
NI-9219

Specifications

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NI-9219 Specifications

Connector Types

The NI-9219 is available in two types: push-in spring terminal and spring terminal. The push-in type spring terminal connector is black and orange. The spring terminal connector is black. NI-9219 refers to both types unless the two types are specified. Differences between the two types of spring terminal connectors are noted by the connector color.

Related information:

- [Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT](#)

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

Characteristics describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- **Typical** specifications describe the performance met by a majority of models.
- **Nominal** specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are **Typical** unless otherwise noted.

Conditions

Specifications are valid for the range -40 °C to 70 °C unless otherwise noted.

NI-9219 Safety Voltages (Black Connector)

Connect only voltages that are within the following limits.

| Channel-to-channel | |
|--|---|
| Continuous | 250 V AC, Measurement Category II |
| Withstand | 1,390 V AC, verified by a 5 s dielectric withstand test |
| Channel-to-earth ground | |
| Continuous | 250 V AC, Measurement Category II |
| Withstand | 2,300 V AC, verified by a 5 s dielectric withstand test |
| Zone 2 hazardous locations applications in Europe | |
| Channel-to-channel and channel-to-earth ground | 60 V DC, Measurement Category I |

NI-9219 Safety Voltages (Black/Orange Connector)

Connect only voltages that are within the following limits.

| Isolation | |
|--------------------------------|---|
| Channel-to-channel | |
| Continuous | 250 V AC, Measurement Category II |
| Withstand | 1,500 V AC, verified by a 5 s dielectric withstand test |
| Channel-to-earth ground | |
| Continuous | 250 V AC, Measurement Category II |

| | |
|--|---|
| Withstand | 3,000 V AC, verified by a 5 s dielectric withstand test |
| Zone 2 hazardous locations applications | |
| Channel-to-channel and channel-to-earth ground | 60 V DC, Measurement Category I |

Measurement Category

Measurement Category I



Caution When using the NI-9219 above 2,000 m or in explosive atmospheres, do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.



Attention Lorsque vous utilisez le NI-9219 à une altitude supérieure à 2 000 m ou dans des atmosphères explosibles, ne le connectez pas à des signaux et ne l'utilisez pas pour effectuer des mesures dans les catégories de mesure II, III ou IV.

Warning When using the NI-9219 above 2,000 m or in explosive atmospheres, do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV, or for measurements on MAINs circuits or on circuits derived from Overvoltage Category II, III, or IV which may have transient overvoltages above what the product can withstand. The product must not be connected to circuits that have a maximum voltage above the continuous working voltage, relative to earth or to other channels, or this could damage and defeat the insulation. The product can only withstand transients up to the transient overvoltage rating without breakdown or damage to the insulation. An analysis of the working voltages, loop impedances,

temporary overvoltages, and transient overvoltages in the system must be conducted prior to making measurements.

Mise en garde Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour des mesures dans ces catégories, ou des mesures sur secteur ou sur des circuits dérivés de surtensions de catégorie II, III ou IV pouvant présenter des surtensions transitoires supérieures à ce que le produit peut supporter. Le produit ne doit pas être raccordé à des circuits ayant une tension maximale supérieure à la tension de fonctionnement continu, par rapport à la terre ou à d'autres voies, sous peine d'endommager et de compromettre l'isolation. Le produit peut tomber en panne et son isolation risque d'être endommagée si les tensions transitoires dépassent la surtension transitoire nominale. Une analyse des tensions de fonctionnement, des impédances de boucle, des surtensions temporaires et des surtensions transitoires dans le système doit être effectuée avant de procéder à des mesures.

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.



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

Measurement Category II



Caution Do not connect the product to signals or use for measurements within Measurement Categories III or IV.



Attention Ne pas connecter le produit à des signaux dans les catégories de mesure III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.

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.

Environmental Characteristics

| Temperature | |
|--------------------|---------------------------------|
| Operating | -40 °C to 70 °C |
| Storage | -40 °C to 85 °C |
| Humidity | |
| Operating | 10% RH to 90% RH, noncondensing |
| Storage | 5% RH to 95% RH, noncondensing |
| Ingress protection | IP40 |
| Pollution Degree | 2 |
| Maximum altitude | 2,000 m |

| Shock and Vibration | |
|----------------------------|---|
| 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 |

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

Power Requirements

| Power consumption from chassis | |
|---------------------------------------|--------------------|
| Active mode | 750 mW maximum |
| Sleep mode | 25 μ W maximum |
| Thermal dissipation (at 70 °C) | |
| Active mode | 625 mW maximum |
| Sleep mode | 25 μ W maximum |

Physical Characteristics

| Weight | |
|----------------------------------|-----------------|
| NI-9219 (black connector) | 156 g (5.5 oz.) |
| NI-9219 (black/orange connector) | 160 g (5.6 oz.) |

| | |
|------------|--|
| Dimensions | Visit ni.com/dimensions and search by module number. |
|------------|--|

NI-9219 with Spring Terminal (Black Connector)

The NI-9219 (black connector) requires a flathead screwdriver with a 2.3 mm × 1.0 mm (0.09 in. × 0.04 in.) blade for signal connection; insert the screwdriver into a spring clamp activation slot to open the corresponding connector terminal, press a wire into the open connector terminal, and then remove the screwdriver from the activation slot to clamp the wire into place.

| Spring terminal wiring | |
|-------------------------------|--|
| Gauge | 0.08 mm to 1.0 mm (28 AWG to 18 AWG) copper conductor wire |
| Wire strip length | 7 mm (0.28 in.) of insulation stripped from the end |
| Temperature rating | 90 °C minimum |
| Wires per spring terminal | One wire per spring terminal |
| Connector securement | |
| Securement type | Screw flanges provided |
| Torque for screw flanges | 0.2 N · m (1.80 lb · in.) |

NI-9219 with Push-in Style Spring Terminal (Black/Orange Connector)

The push-in spring style NI-9219 does not require a tool for signal connection; push the wire into the terminal when using solid wire or stranded wire with a ferrule, or by pressing the push button when using stranded wire without a ferrule.

| Spring terminal wiring | |
|-------------------------------|--|
| Gauge | 0.14 mm to 1.5 mm (26 AWG to 16 AWG) copper conductor wire |
| Wire strip length | 10 mm (0.394 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 |
| Ferrules | |
| Single ferrule, uninsulated | 0.14 mm to 1.5 mm (26 AWG to 16 AWG) 10 mm barrel length |
| Single ferrule, insulated | 0.14 mm to 1.0 mm (26 AWG to 18 AWG) 12 mm barrel length |
| Two-wire ferrule, insulated | 2x 0.34 mm (2x 22 AWG) 12 mm barrel length |
| Connector securement | |
| Securement type | Screw flanges provided |
| Torque for screw flanges | 0.2 N · m (1.80 lb · in.) |

Timing Modes

The NI-9219 supports high-resolution, best 50 Hz rejection, best 60 Hz rejection, and high-speed timing modes. High-resolution timing mode optimizes maximum overall noise rejection and provides rejection of 50 Hz and 60 Hz noise. Best 50 Hz rejection optimizes 50 Hz noise rejection. Best 60 Hz rejection optimizes 60 Hz noise rejection. High-speed timing mode optimizes sample rate.

Input Characteristics

| | |
|------------------------|--|
| Number of channels | 4 analog input channels |
| ADC resolution | 24 bits |
| Type of ADC | Delta-sigma (with analog prefiltering) |
| Sampling mode | Simultaneous |
| Type of TEDS supported | IEEE 1451.4 TEDS Class 2 (Interface) |

Table 1. Input Ranges

| Measurement Type | Nominal Range(s) | Actual Range(s) |
|------------------------------|---|---|
| Voltage | $\pm 60\text{ V}$, $\pm 15\text{ V}$, $\pm 4\text{ V}$, $\pm 1\text{ V}$, $\pm 125\text{ mV}$ | $\pm 60\text{ V}$, $\pm 15\text{ V}$, $\pm 4\text{ V}$, $\pm 1\text{ V}$, $\pm 125\text{ mV}$ |
| Current | $\pm 25\text{ mA}$ | $\pm 25\text{ mA}$ |
| Thermocouple | $\pm 125\text{ mV}$ | $\pm 125\text{ mV}$ |
| 4-Wire and 2-Wire Resistance | 10 k Ω , 1 k Ω | 10.5 k Ω , 1.05 k Ω |
| 4-Wire and 3-Wire RTD | Pt 1000, Pt 100 | 5.05 k Ω , 505 Ω |
| Quarter-Bridge | 350 Ω , 120 Ω | 390 Ω , 150 Ω |
| Half-Bridge | $\pm 500\text{ mV/V}$ | $\pm 500\text{ mV/V}$ |
| Full-Bridge | $\pm 62.5\text{ mV/V}$, $\pm 7.8\text{ mV/V}$ | $\pm 62.5\text{ mV/V}$, $\pm 7.8125\text{ mV/V}$ |
| Digital In | — | 0 V to 60 V |
| Open Contact | — | 1.05 k Ω |

Conversion time, all channels

No channels configured as a thermocouple

| | |
|----------------------|--------|
| High speed | 10 ms |
| Best 60 Hz rejection | 110 ms |
| Best 50 Hz rejection | 130 ms |

| | |
|--|--------|
| High resolution | 500 ms |
| One or more channels configured as a thermocouple | |
| High speed | 20 ms |
| Best 60 Hz rejection | 120 ms |
| Best 50 Hz rejection | 140 ms |
| High resolution | 510 ms |
| Overvoltage protection | |
| Terminals 1 and 2 | ±30 V |
| Terminals 3 through 6, across any combination | ±60 V |
| Input impedance | |
| Voltage and Digital In (±60 V, ±15 V, ±4 V) | 1 MΩ |
| Current | < 40 Ω |
| All other measurement types | >1 GΩ |

Table 2. Accuracy

| Measurement Type | Range | Gain Error (Percent of Reading) | Offset Error (ppm of Range) |
|----------------------|---------|---|-----------------------------|
| | | Typical (25 °C±5 °C), Maximum (-40 °C to 70 °C) | |
| Voltage | ±60 V | ±0.3, ±0.4 | ±20, ±50 |
| | ±15 V | ±0.3, ±0.4 | ±60, ±180 |
| | ±4 V | ±0.3, ±0.4 | ±240, ±720 |
| | ±1 V | ±0.1, ±0.18 | ±15, ±45 |
| Voltage/Thermocouple | ±125 mV | ±0.1, ±0.18 | ±120, ±360 |
| Current | ±25 mA | ±0.1, ±0.6 | ±30, ±100 |

| Measurement Type | Range | Gain Error (Percent of Reading) | Offset Error (ppm of Range) |
|--|------------|---|-----------------------------|
| | | Typical (25 °C±5 °C), Maximum (-40 °C to 70 °C) | |
| 4-Wire and 2-Wire Resistance | 10 kΩ | ±0.1, ±0.5 | ±120, ±320 |
| | 1 kΩ | ±0.1, ±0.5 | ±1200, ±3200 |
| 4-Wire and 3-Wire RTD | Pt 1000 | ±0.1, ±0.5 | ±240, ±640 |
| | Pt 100 | ±0.1, ±0.5 | ±2400, ±6400 |
| Quarter-Bridge | 350 Ω | ±0.1, ±0.5 | ±2400, ±6400 |
| | 120 Ω | ±0.1, ±0.5 | ±2400, ±6400 |
| Half-Bridge | ±500 mV/V | ±0.03, ±0.07 | ±300, ±450 |
| Full-Bridge | ±62.5 mV/V | ±0.03, ±0.08 | ±300, ±1000 |
| | ±7.8 mV/V | ±0.03, ±0.08 | ±2200, ±8000 |
| Cold-junction compensation sensor accuracy | | ±1 °C typical | |

Table 3. Stability

| Measurement Type | Range | Gain Drift (ppm of Reading/°C) | Offset Drift (ppm of Range/°C) |
|------------------------------|------------|--------------------------------|--------------------------------|
| Voltage | ±60 V | ±20 | ±0.2 |
| | ±15 V | ±20 | ±0.8 |
| | ±4 V | ±20 | ±3.2 |
| | ±1 V | ±10 | ±0.2 |
| Voltage/Thermocouple | ±125 mV | ±10 | ±1.6 |
| Current | ±25 mA | ±15 | ±0.4 |
| 4-Wire and 2-Wire Resistance | 10 kΩ | ±15 | ±3 |
| | 1 kΩ | ±15 | ±30 |
| 4-Wire and 3-Wire RTD | Pt 1000 | ±15 | ±6 |
| | Pt 100 | ±15 | ±60 |
| Quarter-Bridge | 350 Ω | ±15 | ±120 |
| | 120 Ω | ±15 | ±240 |
| Half-Bridge | ±500 mV/V | ±3 | ±20 |
| Full-Bridge | ±62.5 mV/V | ±3 | ±20 |
| | ±7.8 mV/V | ±3 | ±20 |

Table 4. Input Noise in ppm of Range_{rms}

| Measurement Type | Range | Timing Mode | | | |
|-------------------------------------|------------|-------------|----------------------|----------------------|-----------------|
| | | High Speed | Best 60 Hz Rejection | Best 50 Hz Rejection | High Resolution |
| Voltage | ±60 V | 7.6 | 1.3 | 1.3 | 0.5 |
| | ±15 V | 10.8 | 1.9 | 1.9 | 0.7 |
| | ±4 V | 10.8 | 2.7 | 2.7 | 1.3 |
| | ±1 V | 7.6 | 1.3 | 1.3 | 0.5 |
| Voltage/ Thermocouple | ±125 mV | 10.8 | 1.9 | 1.9 | 1.0 |
| Current | ±25 mA | 10.8 | 1.9 | 1.9 | 1.0 |
| 4-Wire and 2- Wire Resistance | 10 kΩ | 4.1 | 1.3 | 0.8 | 0.3 |
| | 1 kΩ | 7.1 | 1.8 | 1.2 | 0.7 |
| 4-Wire and 3- Wire RTD | Pt 1000 | 7.6 | 1.7 | 1.1 | 0.4 |
| | Pt 100 | 10.8 | 1.9 | 1.9 | 0.9 |
| Quarter-Bridge | 350 Ω | 5.4 | 1.0 | 1.0 | 0.7 |
| | 120 Ω | 5.4 | 1.0 | 1.0 | 0.7 |
| Half-Bridge | ±500 mV/V | 3.8 | 0.5 | 0.5 | 0.2 |
| Full-Bridge | ±62.5 mV/V | 5.4 | 1.0 | 1.0 | 0.8 |
| | ±7.8 mV/V | 30 | 4.7 | 4.7 | 2.3 |
| Input bias current | | | <1 nA | | |
| INL | | | ±15 ppm | | |
| CMRR ($f_{in} = 60$ Hz) | | | >100 dB | | |
| NMRR | | | | | |
| Best 60 Hz rejection | | | 90 dB at 60 Hz | | |
| Best 50 Hz rejection | | | 80 dB at 50 Hz | | |
| | | | | | |

| | |
|-----------------|--------------------------|
| High resolution | 65 dB at 50 Hz and 60 Hz |
|-----------------|--------------------------|

Table 5. Half-Bridge, Full-Bridge, Quarter-Bridge, Resistance, and RTD Excitation Level

| Measurement Type | Load Resistance (Ω) | Characteristic Excitation Level |
|-------------------------------------|--|---------------------------------|
| Half-Bridge | 700 | 2.5 V |
| | 240 | 2.0 V |
| Full-Bridge | 350 | 2.7 V |
| | 120 | 2.2 V |
| Resistance, RTD, and Quarter-Bridge | 120 | 50 mV |
| | 350 | 150 mV |
| | 1,000 | 430 mV |
| | 10,000 | 2200 mV |
| MTBF | 384,716 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method | |

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9219 at ni.com/calibration.

| | |
|----------------------|--------|
| Calibration interval | 1 year |
|----------------------|--------|