NI-9216 Specifications

2025-03-10

Contents

NI-9216 Specifications

NI-9216 Specifications

These specifications apply to the NI-9216.

Revision History

Version	Date changed	Description
378945B-01	February 2025	Updated the resistance measurement accuracy tables.
378945A-01	January 2023	Initial release.

Looking For Something Else?

For information not found in the specifications for your product, such as operating instructions, browse ***Related Information***.

Related information:

- NI-9216 Getting Started
- Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT
- NI-9216/9226 Calibration Procedure
- Calibration Services
- Software and Driver Downloads
- Dimensional Drawings
- Product Certifications
- Letter of Volatility
- Discussion Forums
- NI Learning Center

Connector Types

The NI-9216 has more than one connector type: NI-9216 with spring terminal and

NI-9216 with DSUB. Unless the connector type is specified, NI-9216 refers to all connector types.

The NI-9216 with spring terminal 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-9216 with spring terminal 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.

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-9216 with Spring Terminal Pinout

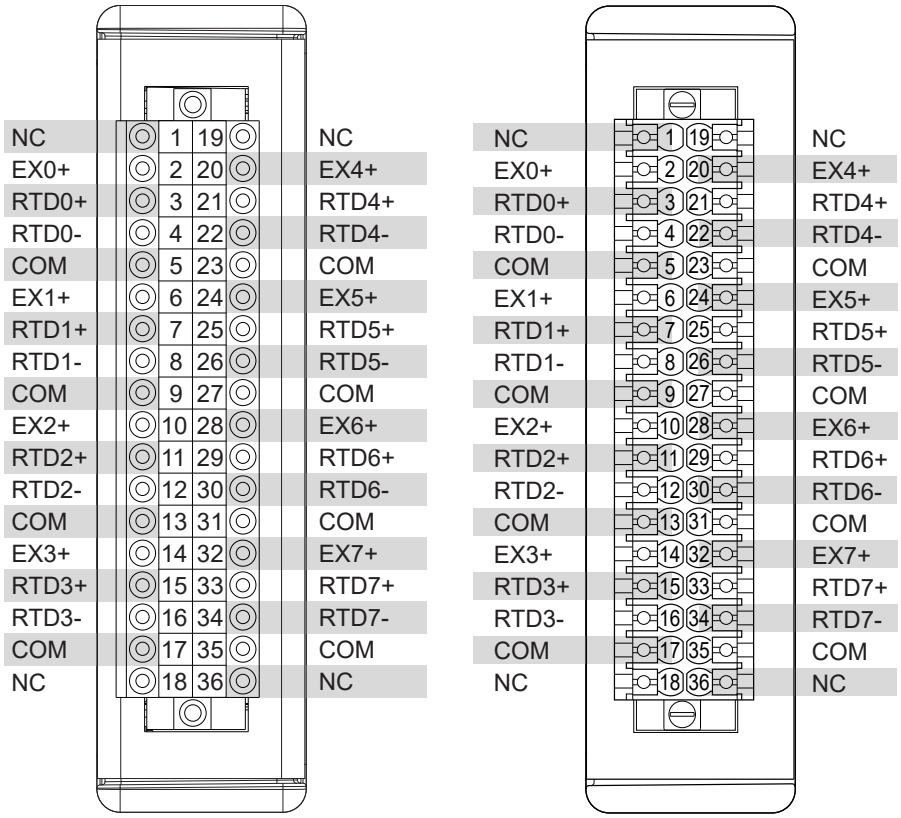


Table 1. Signal Descriptions

Signal	Description
COM	Common reference connection to isolated ground
EX+	Positive sensor excitation connection
NC	No connection
RTD+	Positive resistance temperature detector connection
RTD-	Negative resistance temperature detector connection

NI-9216 with DSUB Pinout

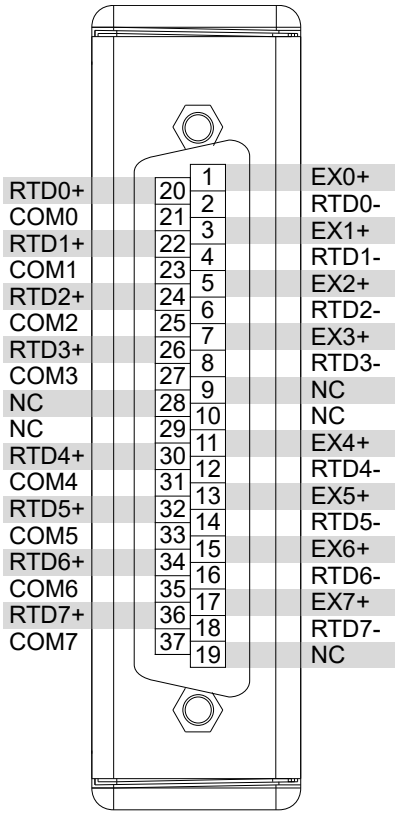


Table 2. Signal Descriptions

Signal	Description
COM	Common reference connection to isolated ground
EX+	Positive sensor excitation connection
NC	No connection
RTD+	Positive resistance temperature detector connection
RTD-	Negative resistance temperature detector connection

Input Characteristics

Number of channels	8 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-sigma

Sampling mode	Scanned

Table 3. Measurement Range

Temperature	-200 °C to 850 °C
Resistance	0 Ω to 400 Ω

Table 4. Conversion Time

High-resolution mode	200 ms per channel, 1,600 ms total for all channels
High-speed mode	2.5 ms per channel, 20 ms total for all channels

Table 5. Temperature Accuracy (Including Noise), 4-Wire Mode

Measured Value	Within 1 Year of Calibration		Within 10 Years of Calibration	
	Typical (25 °C)	Maximum (-40 °C to 70 °C)	Typical (25 °C)	Maximum (-40 °C to 70 °C)
-200 °C to 150 °C	±0.15 °C	±0.4 °C	±0.25 °C	±0.7 °C
150 °C to 850 °C	±0.20 °C	±1.0 °C	±0.4 °C	±2.0 °C

Note For the table above, add 0.1 °C of error for high-speed mode.

Table 6. Temperature Accuracy (Including Noise), 3-Wire Mode

Measured Value	Within 1 Year of Calibration		Within 10 Years of Calibration	
	Typical (25 °C)	Maximum (-40 °C to 70 °C)	Typical (25 °C)	Maximum (-40 °C to 70 °C)
-200 °C to 150 °C	±0.20 °C	±0.5 °C	±0.35 °C	±1.0 °C
150 °C to 850 °C	±0.30 °C	±1.0 °C	±0.6 °C	±2.0 °C

Note For the table above,

- Add 0.1 °C of error for high-speed mode.

- The 3-wire specification assumes equal wire length connecting RTD+ terminal to RTD sensor and COM terminal to RTD sensor. If the lengths are unequal or there is a mismatch between the path resistances, use the following formula to evaluate additional error:
  °C error = $R_{mismatch}$ * 3.42 °C/Ω.

Table 7. Resistance Measurement Accuracy (Including Noise), 4-Wire Mode

Measurement Conditions	Within 1 Year of Calibration		Within 10 Years of Calibration	
	Offset Error	Gain Error	Offset Error	Gain Error
Typical (25 °C)	±0.006 Ω	±0.007%	±0.028 Ω	±0.017%
Maximum (-40 °C to 70 °C)	±0.083 Ω	±0.048%	±0.143 Ω	±0.074%

Note For the table above, add 0.027 Ω of error for high-speed mode.

Note NI recommends a calibration interval of 1 year and only provides calibration services referencing the 1-year specification limits. If you choose to calibrate less often, the 10-year column provides predicted performance over this extended interval. Choose an appropriate interval based on your application requirements. Longer calibration intervals are more likely to result in As-Found calibration failures when the device is sent back for calibration and compared against the 1-year specification limits.

Table 8. Resistance Measurement Accuracy (Including Noise), 3-Wire Mode

Measurement Conditions	Within 1 Year of Calibration		Within 10 Years of Calibration	
	Offset Error	Gain Error	Offset Error	Gain Error
Typical (25 °C)	±0.012 Ω	±0.007%	±0.054 Ω	±0.017%
Maximum (-40 °C to 70 °C)	±0.101 Ω	±0.048%	±0.228 Ω	±0.074%

Note For the table above, add 0.027 Ω of error for high-speed mode.

Table 9. Stability

Mode	Offset Drift	Gain Drift
4-wire	±3 mΩ/°C	±7 ppm/°C
3-wire	±3.3 mΩ/°C	±7 ppm/°C

Table 10. Noise

High-resolution mode	0.001 °C RMS (0.3 mΩ RMS)
High-speed mode	0.02 °C RMS (6 mΩ RMS)

Excitation current	1 mA per channel

Table 11. Noise Rejection, Normal Mode (50/60 Hz)

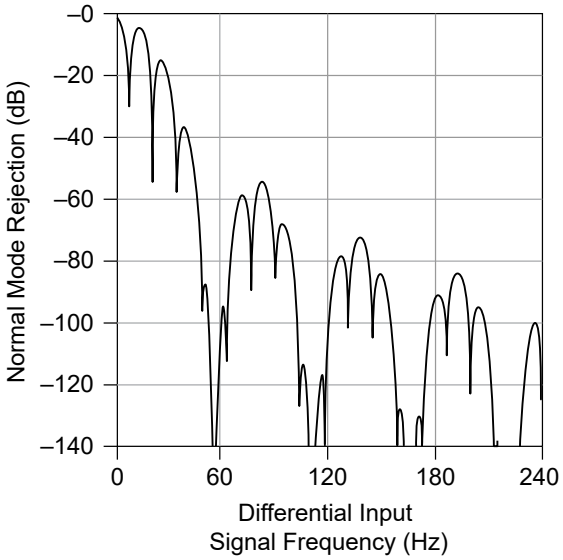
High-resolution mode	85 dB
High-speed mode	None

Table 12. Noise Rejection, Common-Mode Rejection, Channel-to-Earth Ground (50/60 Hz)

High-resolution mode	>170 dB
High-speed mode	122 dB

Input bandwidth (high-resolution mode)	3.3 Hz

Figure 1. High-Resolution Filter Response[1],



Note High-speed filter response has the same characteristics as the high-resolution filter response except that the first notch is at 14 kHz.

Overvoltage protection	±30 V, maximum

NI-9216 with Spring Terminal (Black Connector) Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand	3,000 V RMS, verified by a 5 sdielectric withstand test

1. This image is provided courtesy of Linear Technology Corp.

NI-9216 with Push-In Style Spring Terminal (Black/Orange Connector) Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand up to 5,000 m	3,000 V RMS, verified by a 5 sdielectric withstand test

NI-9216 with DSUB Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand up to 3,000 m	1,000 V RMS, verified by a 5 sdielectric withstand test
Withstand up to 5,000 m	860 V RMS, verified by a 5 sdielectric withstand test

Measurement Category

Measurement Category I

Caution Do not connect the NI-9216 with DSUB to signals or use for measurements within Measurement Categories II, III, or IV.

Attention Ne pas connecter le NI-9216 with DSUB à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.

Warning Do not connect the NI-9216 with DSUB 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 NI-9216 with DSUB 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 NI-9216 with spring terminal to signals or use for measurements within Measurement Categories III or IV.

Attention Ne pas connecter le NI-9216 avec bornier à ressort 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	5,000 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.

Physical Characteristics

Weight

NI-9216 with spring terminal (black connector)	156 g (5.5 oz)
NI-9216 with spring terminal (black/orange connector)	161 g (5.7 oz)
NI-9216 with DSUB	143 g (5.04 oz)
Dimensions	Visit ni.com/dimensions and search by module number.

NI-9216 with Spring Terminal (Black Connector)

The NI-9216 (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^2 to 1.0 mm^2 (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-9216 with Push-In Style Spring Terminal (Black/Orange Connector)

The push-in spring style NI-9216 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^2 to 1.5 mm^2 (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	0.14 mm^2 to 1.5 mm^2
Connector securement	
Securement type	Screw flanges provided

Torque for screw flanges	0.2 N · m (1.80 lb · in.)

Power Requirements

Power consumption from chassis, maximum	
Active mode	517 mW
Sleep mode	90 µW
Thermal dissipation, maximum	
Active mode	1.48 W
Sleep mode	0.76 W

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9216 at ni.com/calibration.

Recommended calibration interval	1 year