
NI-9213

Specifications



Mess- und Prüftechnik. Die Experten.

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NI-9213 Specifications

NI-9213 Specifications

These specifications apply to the NI-9213.

Revision History

Version	Date changed	Description
378914C-01	June 2025	Updated the product description.
378914B-01	February 2025	Updated gain error and offset error tables.
378914A-01	June 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-9213 Getting Started](#)
- [Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT](#)
- [NI-9213 Calibration Procedure](#)
- [Calibration Services](#)
- [Software and Driver Downloads](#)
- [Dimensional Drawings](#)
- [Product Certifications](#)
- [Letter of Volatility](#)
- [Discussion Forums](#)
- [NI Learning Center](#)

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 under the following conditions unless otherwise noted.

- Ambient temperature range -40 °C to 70 °C
- 15 minutes of warm-up time

Connector Types

The NI-9213 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-9213 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.

NI-9213 (Black Connector) Pinout

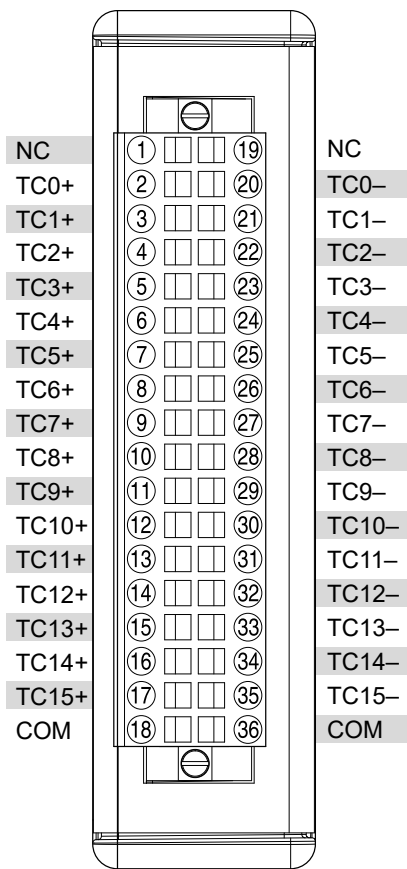


Table 1. Signal Descriptions

Signal	Description
COM	Common reference connection
NC	No connection
TC+	Positive thermocouple connection
TC-	Negative thermocouple connection

NI-9213 (Black/Orange Connector) Pinout

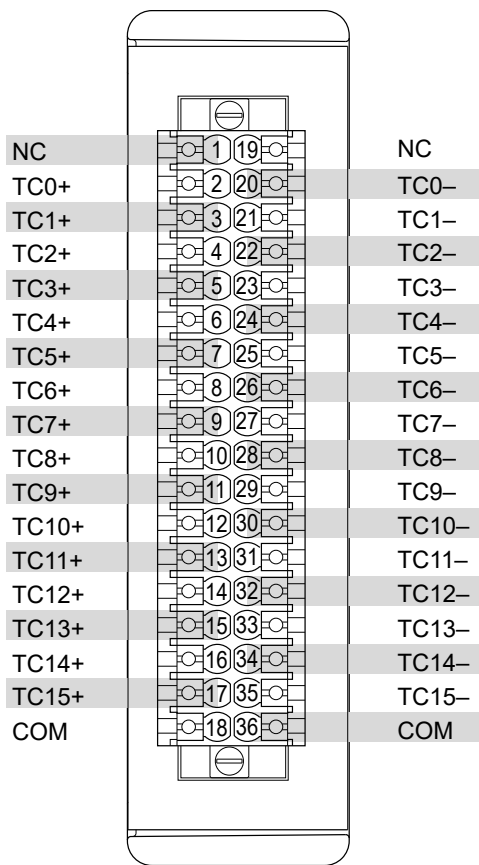


Table 2. Signal Descriptions

Signal	Description
COM	Common reference connection
NC	No connection
TC+	Positive thermocouple connection
TC-	Negative thermocouple connection

Input Characteristics

Number of channels	16 thermocouple channels, 1 internal auto-zero channel, 1 internal cold-junction compensation channel
ADC resolution	24 bits
Type of ADC	Delta-Sigma

Sampling mode	Scanned
Voltage measurement range	± 78.125 mV
Temperature measurement ranges	Works over temperature ranges defined by NIST (J, K, T, E, N, B, R, S thermocouple types)

Table 3. Timing Modes

Timing Mode	Conversion Time (Per Channel)	Sample Rate ¹ (All Channels ²)
High-resolution	55 ms	1 S/s
High-speed	740 μ s	75 S/s

Table 4. Common-Mode Voltage Range

Connection	Common-Mode Voltage Range
Channel-to-COM	± 1.2 V
COM-to-earth ground	± 250 V

Table 5. Common-Mode Rejection Ratio (CMRR)

Timing Mode	Measurement Conditions	Channel	CMRR
High-resolution	DC and 50 Hz to 60 Hz	Channel-to-COM	100 dB
		COM-to-earth ground	>170 dB
High-speed	0 Hz to 60 Hz	Channel-to-COM	70 dB
		COM-to-earth ground	>150 dB

Table 6. Input Bandwidth

Timing Mode	Input Bandwidth
High-resolution	14.4 Hz
High-speed	78 Hz

1. If you are using fewer than all channels, the sample rate might be faster. The maximum sample rate = $1/(\text{Conversion Time} \times \text{Number of Channels})$, or 100 S/s, whichever is smaller. Sampling faster than the maximum sample rate may result in the degradation of accuracy.
2. Including the auto-zero and cold-junction channels.

High-resolution noise rejection (at 50 Hz and 60 Hz)	60 dB
Overvoltage protection	± 30 V between any two inputs
Differential input impedance	78 M Ω
Input current	50 nA

Table 7. Input Noise

Timing Mode	Input Noise
High-resolution	200 nV RMS
High-speed	7 μ V RMS

Table 8. Gain Error

Timing Mode	Measurement Conditions	Within 1 Year of Calibration		Within 10 Years of Calibration	
		Typical	Maximum	Typical	Maximum
High-resolution	25 °C	0.03%	—	0.08%	—
	-40 °C to 70 °C	0.07%	0.15%	0.13%	0.20%
High-speed	25 °C	0.04%	—	0.09%	—
	-40 °C to 70 °C	0.08%	0.16%	0.14%	0.21%



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 9. Offset Error

Timing Mode	Within 1 Year of Calibration		Within 10 Years of Calibration	
	Typical	Maximum	Typical	Maximum
High-resolution	4 μ V	6 μ V	4 μ V	6 μ V

Timing Mode	Within 1 Year of Calibration		Within 10 Years of Calibration	
	Typical	Maximum	Typical	Maximum
High-speed	14 μV	17 μV	14 μV	17 μV

Offset error from source impedance	Add 0.05 μV per Ω , when source impedance $>50 \Omega$
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Table 10. Cold-Junction Compensation Accuracy

Measurement Conditions	Within 1 Year of Calibration		Within 10 Years of Calibration	
	Typical	Maximum	Typical	Maximum
0 °C to 70 °C	0.8 °C	1.7 °C	0.8 °C	1.7 °C
-40 °C to 70 °C	1.1 °C	2.1 °C	1.1 °C	2.1 °C

MTBF	852,407 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method
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Temperature Measurement Accuracy

Table 11. Measurement Sensitivity

Timing Mode	Thermocouple Types	Measurement Sensitivity ³
High-resolution	J, K, T, E, N	<0.02 °C
	B, R, S	<0.15 °C
High-speed	J, K, T, E	<0.25 °C
	N	<0.35 °C
	B	<1.2 °C
	R,S	<2.8 °C

3. *Measurement sensitivity* represents the smallest change in a temperature that a sensor can detect. It is a function of noise. The values assume the full measurement range of the standard thermocouple sensor according to ASTM E230-87.

The following figures show the errors for each thermocouple type when connected to the NI-9213 with the auto-zero channel on. The figures display the maximum errors over a full temperature range and typical errors at room temperature. The figures account for gain errors, offset errors, differential and integral non-linearity, quantization errors, noise errors, 50 Ω lead wire resistance, and cold-junction compensation errors. The figures do not account for the accuracy of the thermocouple itself.

Figure 1. Thermocouple Types J and N Errors

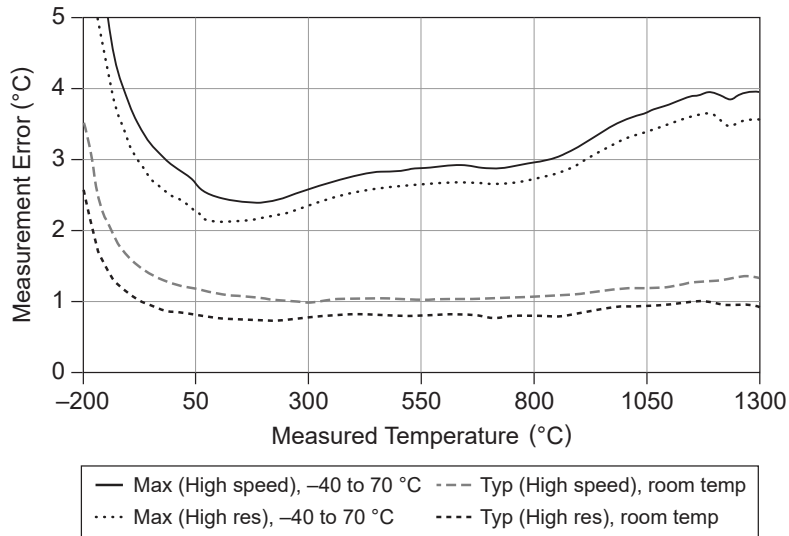


Figure 2. Thermocouple Type K Errors

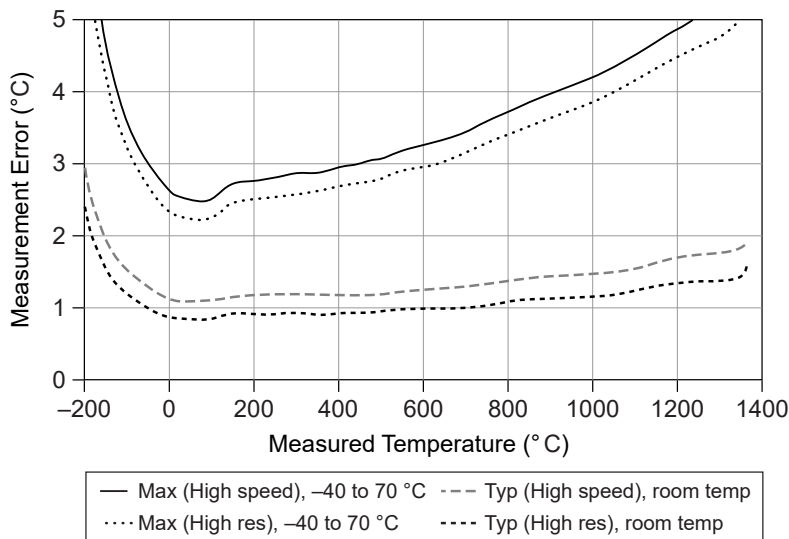


Figure 3. Thermocouple Types T and E Errors

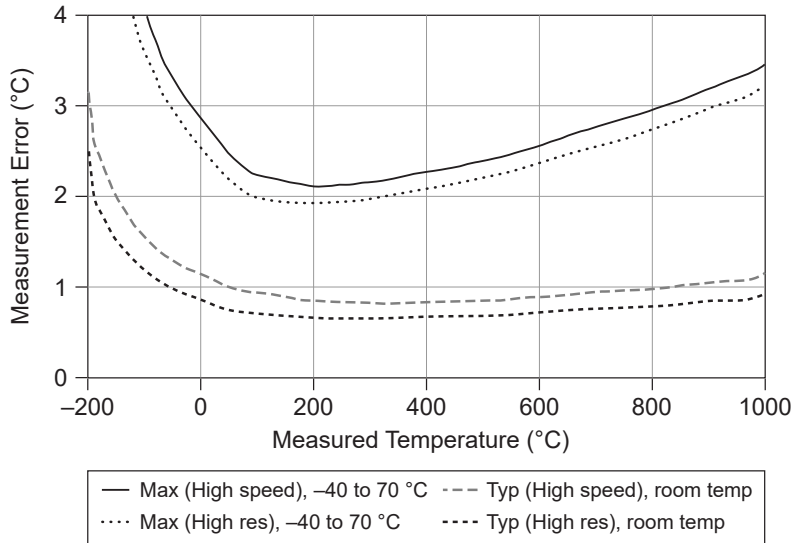


Figure 4. Thermocouple Type B Errors

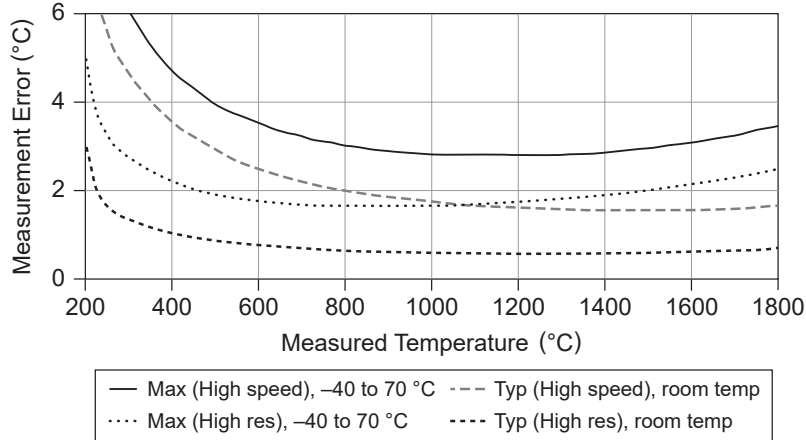
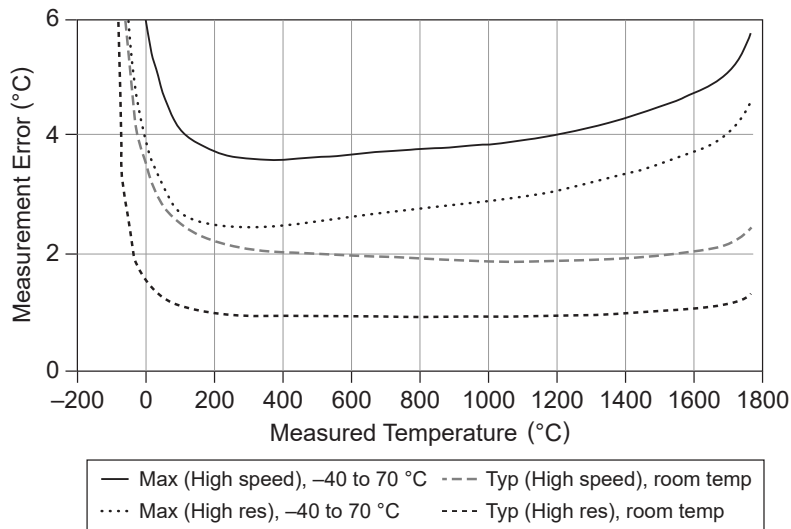


Figure 5. Thermocouple Types R and S Errors



Power Requirements

Power consumption from chassis	
Active mode	490 mW maximum
Sleep mode	25 μ W maximum
Thermal dissipation (at 70 °C)	
Active mode	840 mW maximum
Sleep mode	710 mW maximum

Physical Characteristics

Weight	
NI-9213 (black connector)	159 g (5.6 oz)
NI-9213 (black/orange connector)	164 g (5.8 oz)
Dimensions	Visit ni.com/dimensions and search by module number.

Black Connector

The NI-9213 (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.)

Black/Orange Connector

The push-in spring style NI-9213 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.)

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		
NI-9213 (black connector)		2,000 m
NI-9213 (black/orange connector)		4,000 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.

NI-9213 (Black Connector) Safety Voltages

Connect only voltages that are within the following limits:

Between any two terminals		±30 V maximum
Isolation		
Channel-to-channel		None
Channel-to-earth ground		
Continuous	250 V RMS, Measurement Category II	

Withstand	2,300 V RMS, verified by a 5 s dielectric withstand test
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NI-9213 (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 4,000 m	3,000 V RMS, verified by a 5 s dielectric withstand test

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9213 at ni.com/calibration.

Recommended calibration interval	1 year
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