NI-9213 Specifications

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Contents

NI-9213 Specifications

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.

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.

Input Characteristics

Number of channels	16 thermocouple channels, 1 internal autozero 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 1. Timing Modes

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

Common-mode voltage range	
Channel-to-COM	±1.2 V minimum
COM-to-earth ground	±250 V

1. If you are using fewer than all channels, the sample rate might be faster. The maximum sample rate = 1/(Conversion Time x 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 autozero and cold-junction channels.

Common-mode rejection ratio	
High-resolution mode (at DC and 50 Hz to 60 Hz)	
Channel-to-COM	100 dB
COM-to-earth ground	>170 dB
High-speed mode (at 0 Hz to 60 Hz)	
Channel-to-COM	70 dB
COM-to-earth ground	>150 dB
Input bandwidth	
High-resolution mode	14.4 Hz
High-speed mode	78 Hz
High-resolution noise rejection (at 50 Hz and 60 Hz)	60 dB
Overvoltage protection	±30 V between any two inputs
Differential input impedance	78 MΩ
Input current	50 nA
Input noise	

High-resolution mode	200 nV RMS
High-speed mode	7 µV RMS
Gain error	
High-resolution mode	
at 25 °C	0.03% typical
at -40 °C to 70 °C	0.07% typical, 0.15% maximum
High-speed mode	
at 25 °C	0.04% typical
at -40 °C to 70 °C	0.08% typical, 0.16% maximum
Offset error	
High-resolution mode	4 µV typical, 6 µV maximum
High-speed mode	14 µV typical, 17 µV maximum
Offset error from source impedance	Add 0.05 µV per Ω, when source impedance >50 Ω
Cold-junction compensation accuracy	
0 °C to 70 °C	0.8 °C typical, 1.7 °C maximum

-40 °C to 70 °C	1.1 °C typical, 2.1 °C maximum
MTBF	852,407 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

Temperature Measurement Accuracy

Measurement sensitivity[3]	
High-resolution mode	
Types J, K, T, E, N	<0.02 °C
Types B, R, S	<0.15 °C
High-speed mode	
Types J, K, T, E	<0.25 °C
Type N	<0.35 °C
Type B	<1.2 °C
Types R, S	<2.8 °C

The following figures show the errors for each thermocouple type when connected to the NI-9213 with the autozero channel on. The figures display the maximum errors over a full temperature range and typical errors at room temperature. The figures

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.

account for gain errors, offset errors, differential and integral nonlinearity, 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

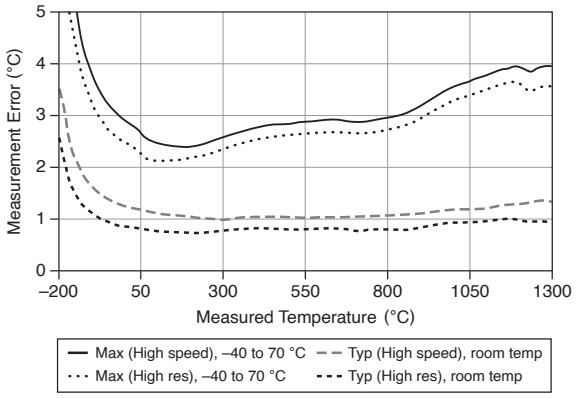


Figure 2. Thermocouple Type K Errors

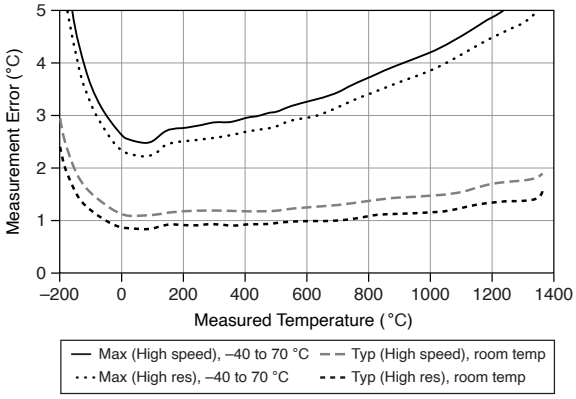


Figure 3. Thermocouple Types T and E Errors

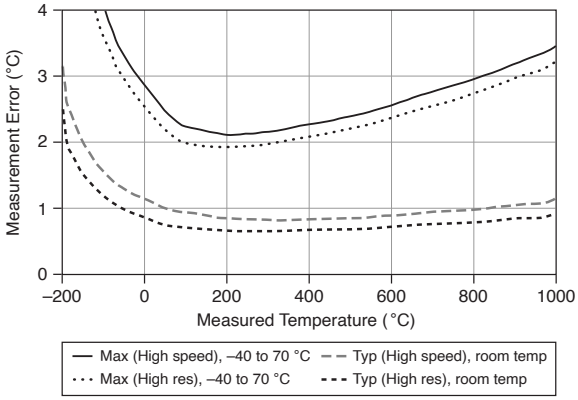


Figure 4. Thermocouple Type B Errors

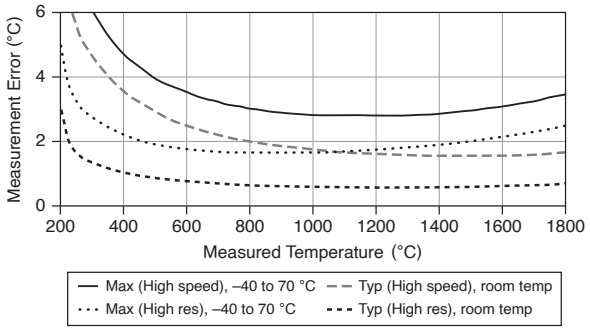
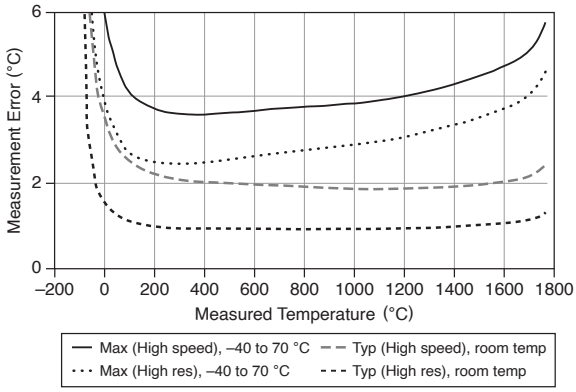


Figure 5. Thermocouple Types R and S Errors



Power Requirements

Power consumption from chassis	
Active mode	490 mW maximum
Sleep mode	25 µW 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

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.

Calibration interval	1 year

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