NI-9211 and sbRIO-9211 Specifications

2025-03-10

Contents

NI-9211 and sbRIO-9211 Specifications

Terminology & Naming Conventions

In these specifications, the NI-9211 and sbRIO-9211 are referred to inclusively as the NI-9211.

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.

Related information:

- Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT

Conditions

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

Accuracy within typical use can vary based on chassis, mounting parameters, other modules present in the system, and installed accessories.

NI-9211 Pinout

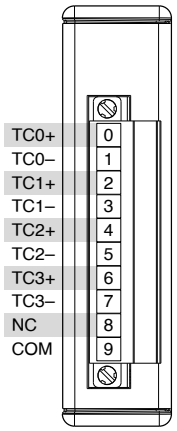


Table 1. Signal Descriptions

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

Input Characteristics

Number of channels	4 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	±80 mV
Temperature measurement ranges	Works over temperature ranges defined by NIST (J, K, T, E, N, B, R, S thermocouple types)
Conversion time	70 ms per channel; 420 ms total for all channels including the autozero and cold-junction channels
Common-mode voltage range	
Channel-to-COM	±1.5 V
COM-to-earth ground	±250 V
Common-mode rejection ratio (0 Hz to 60 Hz)	
Channel-to-COM	95 dB
COM-to-earth ground	>170 dB
Input bandwidth (-3 dB)	15 Hz
Noise rejection (at 50 Hz and 60 Hz)	85 dB minimum
Overvoltage protection	±30 V between any input and COM
Differential input	20 MΩ

impedance	
Input current	50 nA
Input noise	1 µV RMS
Gain error (at -40 °C to 70 °C)	0.06% typical, 0.1% maximum
Offset error (with autozero channel on)	±15 µV typical, ±20 µV maximum
Gain error from source impedance	Add 0.05 ppm per Ω when source impedance >50 Ω
Offset error from source impedance	Add ±0.05 µV typical, ±0.07 µV maximum per Ω when source impedance >50 Ω
Cold-junction compensation sensor accuracy	
0 °C to 70 °C	±0.6 °C typical, ±1.3 °C maximum
-40 °C to 70 °C	±1.7 °C maximum
MTBF	633,012 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

Temperature Measurement Accuracy

Measurement sensitivity[1]	
With autozero channel on	
Types J, K, T, E, N	<0.07 °C
Type B	<0.25 °C
Types R, S	<0.60 °C
With autozero channel off	
Types J, K, T, E, N	<0.05 °C
Type B	<0.20 °C
Types R, S	<0.45 °C

The following figures show the typical and maximum errors for each thermocouple type when used with the NI-9211 over the full temperature range and autozero on. The figures account for gain errors, offset errors, differential and integral nonlinearity, quantization errors, noise errors, and isothermal errors. The figures do not account for the accuracy of the thermocouple itself.

1. Measurement sensitivity represents the smallest change in 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.

Figure 1. Thermocouple Type J and N Errors

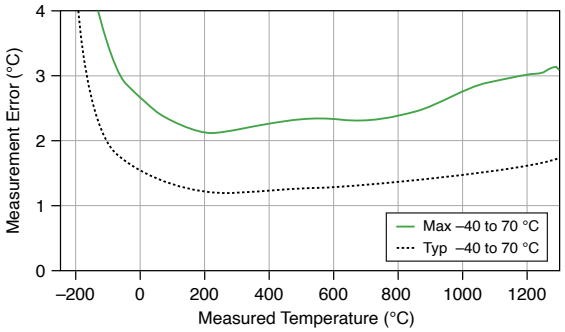


Figure 1. Thermocouple Type K Errors

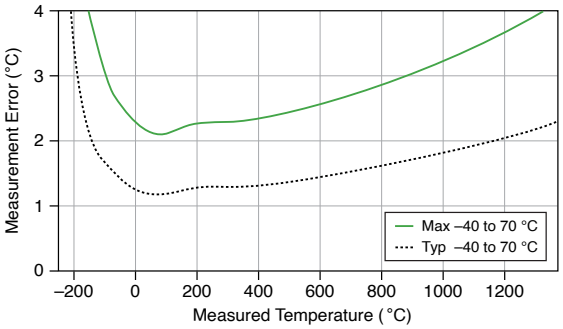


Figure 1. Thermocouple Type T and E Errors

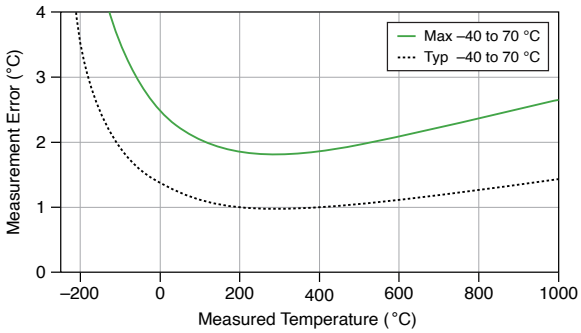


Figure 1. Thermocouple Type B Errors

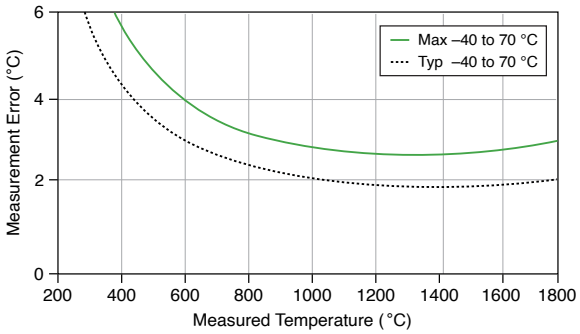
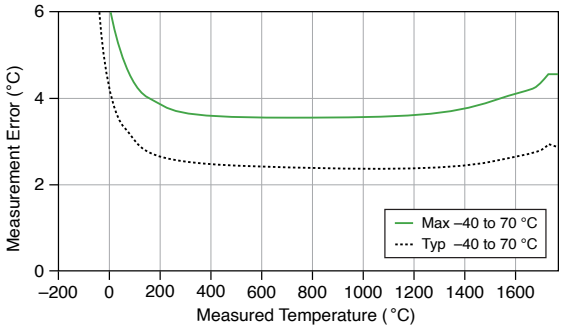


Figure 1. Thermocouple Type R and S Errors



Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±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

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	170 mW maximum
Sleep mode	4 mW maximum
Thermal dissipation (at 70 °C)	
Active mode	170 mW maximum
Sleep mode	4 mW maximum

Physical Characteristics

Screw-terminal wiring	
Gauge	0.25 mm^2 to 2.5 mm^2 (24 AWG to 12 AWG) copper conductor wire
Wire strip length	7 mm (0.28 in.) of insulation stripped from the end

Temperature rating	90 °C, minimum
Torque for screw terminals	0.3 N · m (2.66 lb · in.)
Wires per screw terminal	One wire per screw terminal
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)
Dimensions	Visit ni.com/dimensions and search by module number.
Weight	150 g (5.3 oz)

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9211 at ni.com/calibration.

Calibration interval	1 year