NI-9210 Specifications

2024-07-30

Contents

NI-9210 Specifications

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.

Connector Types

The NI-9210 has more than one connector type: NI-9210 with mini-TC and NI-9210 with spring terminal. Unless the connector type is specified, NI-9210 refers to both connector types.

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	
NI-9210 with mini-TC	60 V RMS
NI-9210 with spring terminal	250 V RMS

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	
Between any input and COM	±30 V
Between any two inputs	±30 V
Differential input impedance	20 MΩ
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	±15 µV typical

channel on)	±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	
NI-9210 with mini-TC	
23 °C, ±5 °C	0.35 °C typical
-40 °C to 70 °C	0.55 °C typical 0.95 °C maximum
NI-9210 with spring terminal	
23 °C ± 5 °C	0.55 °C typical
-40 °C to 70 °C	0.75 °C typical 1.5 °C maximum

Temperature Measurement Accuracy

Notice The input terminals of this device are not protected from electromagnetic interference. As a result, this device may experience reduced measurement accuracy or other temporary performance degradation when connected cables are routed in an environment with radiated or conducted

> radio frequency electromagnetic interference. To limit radiated emissions and to ensure that this device functions within specifications in its operational electromagnetic environment, take precautions when designing, selecting, and installing measurement probes and cables.

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-9210 over the full temperature range and autozero on as well as the typical errors at 23 °C, ±5 °C without autozero. 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.

Figure 1. NI-9210 with Mini-TC Thermocouple Type J and N Errors

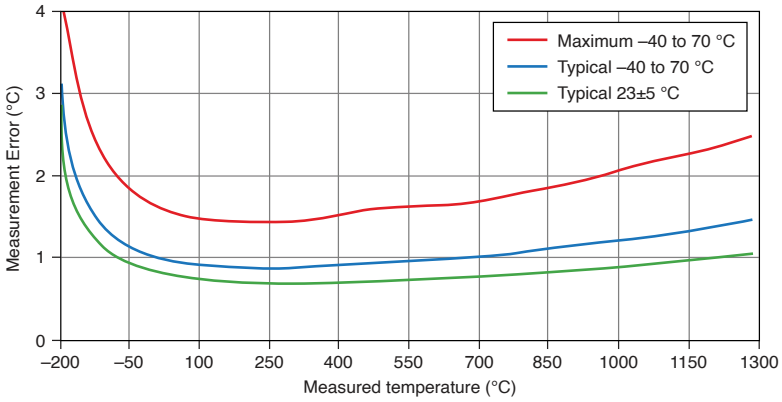


Figure 2. NI-9210 with Spring Terminal Thermocouple Type J and N Errors

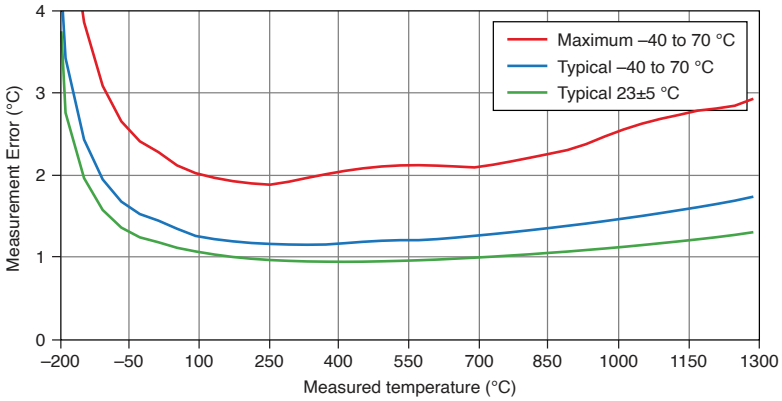


Figure 3. NI-9210 with Mini-TC Thermocouple Type K Errors

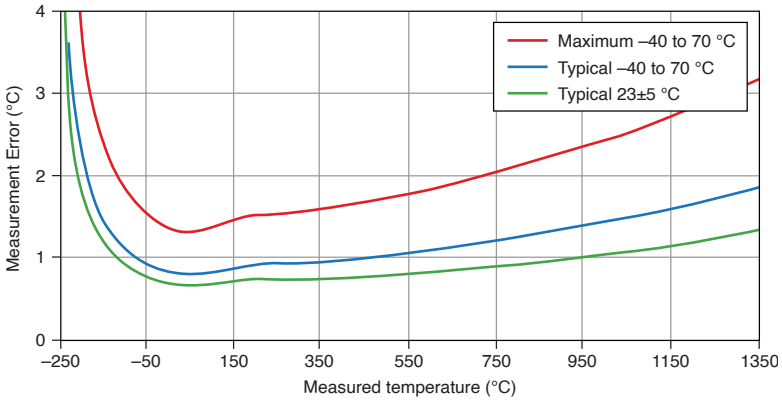


Figure 4. NI-9210 with Spring Terminal Thermocouple Type K Errors

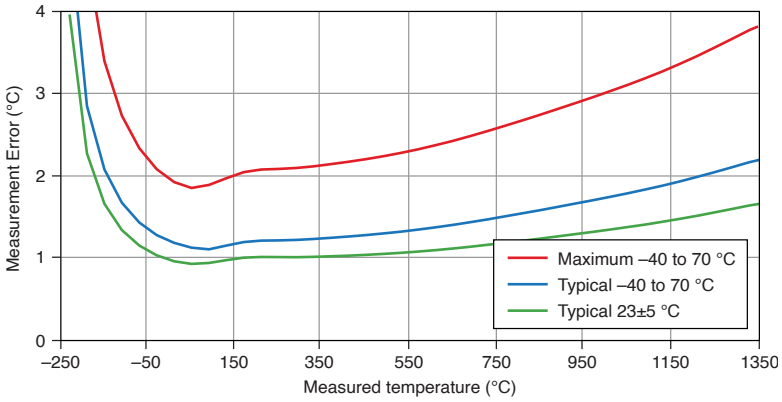


Figure 5. NI-9210 with Mini-TC Thermocouple Type T and E Errors

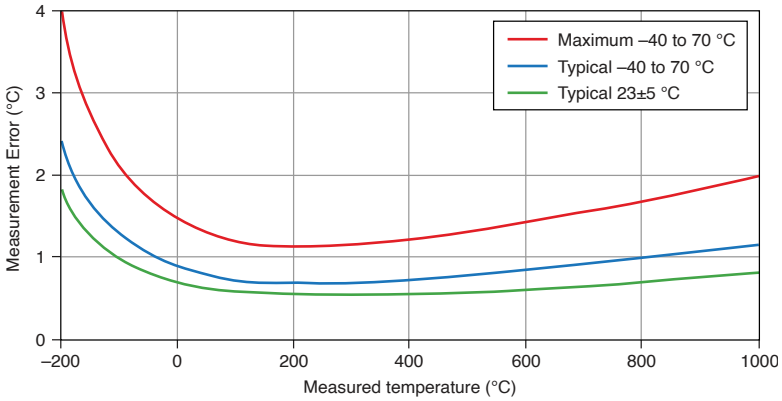


Figure 6. NI-9210 with Spring Terminal Thermocouple Type T and E Errors

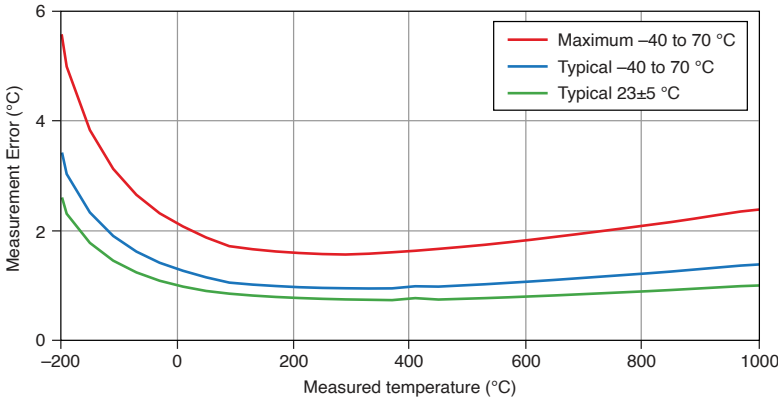


Figure 7. NI-9210 with Mini-TC Thermocouple Type B Errors

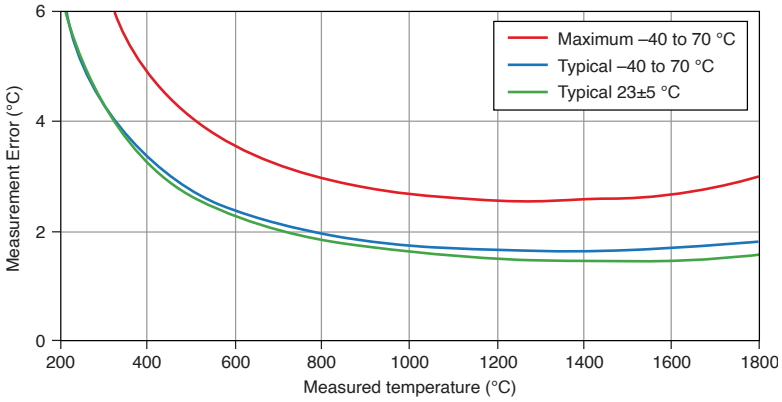


Figure 8. NI-9210 with Spring Terminal Thermocouple Type B Errors

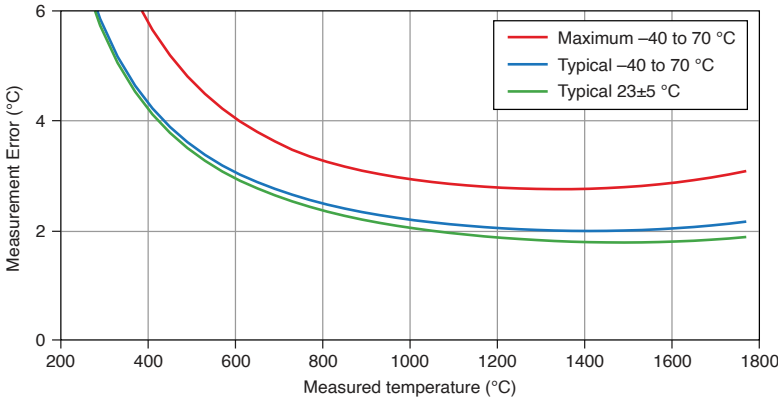


Figure 9. NI-9210 with Mini-TC Thermocouple Type R and S Errors

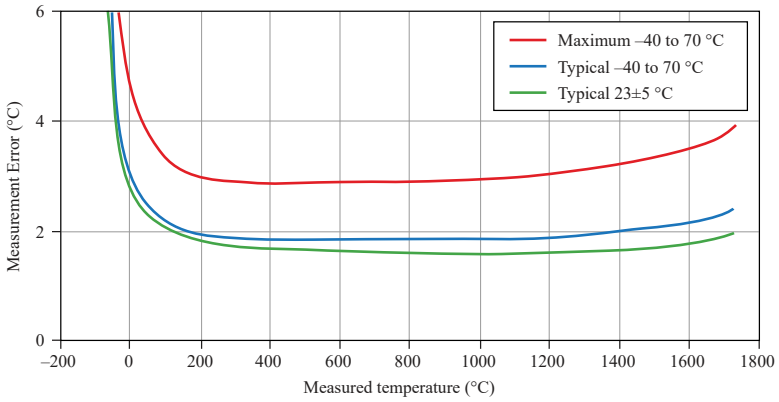
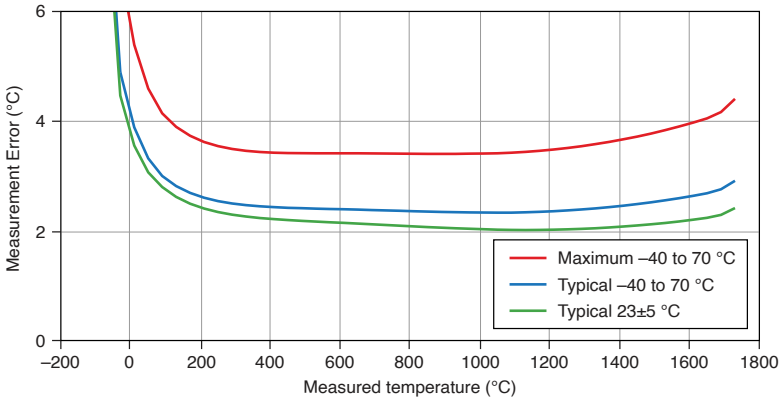


Figure 10. NI-9210 with Spring Terminal Thermocouple Type R and S Errors



NI-9210 with Mini-TC Safety Voltages

Connect only voltages that are within the following limits:

Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test

Measurement Category I

Warning 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.

NI-9210 with Spring Terminal Safety Voltages

Connect only voltages that are within the following limits:

Isolation

Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand	3,000 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 (with COM plug mated)	IP40
Pollution Degree	2

Maximum altitude	
NI-9210 with mini-TC	5,000 m
NI-9210 with spring terminal	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

Power Requirements

Power consumption from chassis	
Active mode	200 mW maximum

Sleep mode	10 mW maximum
Thermal dissipation (at 70 °C)	
Active mode	200 mW maximum
Sleep mode	10 mW maximum

Physical Characteristics

NI-9210 with Mini-TC

Input connection	
Miniature Thermocouple Jack	
Type	Universal
COM connection	
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	Two wires per spring terminal using a 2-wire ferrule
Connector securement	

Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m to 0.25 N · m (1.77 lb · in. to 2.21 lb · in.)
Weight	153 g (5.40 oz)

NI-9210 with Spring Terminal

Spring terminal wiring	
Gauge	0.2 mm^2 to 1.5 mm^2 (24 AWG to 16 AWG) thermocouple wire
Wire strip length	8 mm of insulation stripped from the end
Temperature rating	90 °C, minimum
Wires per spring terminal	One wire per spring terminal
Ferrules	
Single ferrule, uninsulated	0.2 mm^2 to 1 mm^2 (26 AWG to 18 AWG)
Single ferrule, insulated	0.2 mm^2 to 0.75 mm^2 (26 AWG to 18 AWG)
Connector securement	
Securement type	Screw flanges provided

Torque for screw flanges	0.2 N · m (1.80 lb · in.)
Weight	162 g (5.71 oz)

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

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9210 at ni.com/calibration.

Calibration interval	1 year