NI-9221 Specifications

2024-06-06

Contents

NI-9221 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.

Conditions

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

Connector Types

The NI-9221 has more than one connector type: NI-9221 with screw terminal, NI-9221 with spring terminal, and NI-9221 with DSUB. Unless the connector type is specified, NI-9221 refers to all connector types.

Related information:

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

Input Characteristics

Number of channels	8	
ADC resolution	12 bits	
Type of ADC	Successive approximation register (SAR)	
Maximum Sample Rate (Aggregate)		
R Series Expansion Chassis		475 kS/s
All Other Chassis		800 kS/s
Input range	±60 V	
Measurement voltage, channel-to-COM (V)		
Minimum	±61.4	
Typical	±62.50	
Maximum	±63.8	
Overvoltage protection, channel-to-COM	±100 V	

Table 1. NI-9221 Accuracy (Excludes Noise)

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range[1] (Offset Error)
Calibrated	Typical (25 °C, ±5 °C)	±0.04%	±0.07%
	Maximum (-40 °C to 70 °C)	±0.25%	±0.25%
Uncalibrated[2]	Typical (25 °C, ±5 °C)	±0.26%	±0.43%
	Maximum (-40 °C to 70 °C)	±0.67%	±1.06%

Stability	
Gain drift	±34 ppm/°C
Offset drift	±580 µV/°C
Input bandwidth (-3 dB)	950 kHz min
Input impedance	
Resistance	1 MΩ
Capacitance	5 pF
Input noise, code-centered	
RMS	0.7 LSBrms

1. Range equals 62.50 V
2. Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

Peak-to-peak	5 LSB
No missing codes	12 bits
DNL	-0.9 to 1.5 LSB
INL	±1.5 LSB
Crosstalk, at 10 kHz	-75 dB
Settling time, to 1 LSB	1.25 µs
MTBF	1,092,512 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

Power Requirements

Power consumption from chassis	
Active mode	1 W maximum
Sleep mode	1 mW maximum
Thermal dissipation (at 70 °C)	
Active mode	1 W maximum

Sleep mode	32 mW maximum

Physical Characteristics

Screw-terminal wiring	
Gauge	0.2 mm^2 to 2.5 mm^2 (26 AWG to 14 AWG) copper conductor wire
Wire strip length	13 mm (0.51 in.) of insulation stripped from the end
Temperature rating	90 °C minimum
Torque for screw terminals	0.5 N · m to 0.6 N · m (4.4 lb · in. to 5.3 lb · in.)
Wires per screw terminal	One wire per screw terminal; two wires per screw terminal using a 2-wire ferrule
Ferrules	0.25 mm^2 to 2.5 mm^2
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)
Weight	

NI-9221 with screw terminal	165 g (5.8 oz)
NI-9221 with spring terminal	152 g (5.4 oz)
NI-9221 with DSUB	142 g (5.0 oz)
Dimensions	Visit ***ni.com/dimensions*** and search by module number.

NI-9221 with Screw Terminal and NI-9221 with Spring Terminal Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±60 V DC maximum
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.

NI-9221 with DSUB Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±60 V DC maximum
Channel-to-channel	None
Channel-to-earth	
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.

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.

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9221 at ni.com/calibration.

Calibration interval	1 year