NI-9238 Specifications

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Contents

NI-9238 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. All voltages are relative to the AI- signal on each channel unless otherwise noted.

NI-9238 Pinout

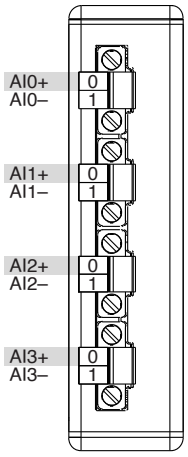

Table 1. Signal Descriptions

Signal	Description
AI+	Positive analog input signal connection
AI-	Negative analog input signal connection

Input Characteristics

Number of channels	4 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-Sigma (with analog prefiltering)
Sampling mode	Simultaneous
Internal master timebase (f_M)	
Frequency	12.8 MHz

Accuracy	±100 ppm maximum
Data rate range (f_S) using internal master timebase	
Minimum	1.613 kS/s
Maximum	50 kS/s
Data rate range (f_S) using external master timebase	
Minimum	390.625 S/s
Maximum	51.36 kS/s
Data rates (f_S)	$\frac{f_M \div 256}{n}$, $n = 1, 2, \ldots, 31$
Input voltage range (AI+ to AI-)	
Nominal	±0.5 V
Minimum	±0.496 V
Typical scaling coefficient	74.506 nV/LSB
Overvoltage protection	±30 V
Input coupling	DC

Input impedance (AI+ to AI-)	>1 GΩ

Table 2. Accuracy

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range[1] (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	±0.20%	±0.06%
	Typical (23 °C ±5 °C)	±0.07%	±0.005%
Uncalibrated[2]	Maximum (-40 °C to 70 °C)	±1.8%	±0.3%
	Typical (23 °C ±5 °C)	±0.7%	±0.1%

Input noise	3.9 µV RMS
Stability	
Gain drift	±7 ppm/°C
Offset drift	1.3 µV/°C
Post calibration gain match (ch-to-ch, 20 kHz)	100 mdB maximum
Phase mismatch (ch-to-ch, 20 kHz)	0.13°/kHz maximum
Phase mismatch (module-to-module, maximum)	$(0.13°/kHz \cdot f_{in}) + (360° \cdot f_{in}/f_M)$

1. Range equals 0.5 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.

Phase nonlinearity (f_S = 50 kS/s)	0.12° maximum
Input delay	$40\frac{5}{512} \Big/ f_s + 3.5\mu s$
Passband	
Frequency	0.453 · f_S
Flatness (f_S = 50 kS/s)	0.11 dB peak-to-peak maximum
Stopband	
Frequency	0.547 · f_S
Rejection	100 dB
Alias-free bandwidth	0.453 · f_S
-3 dB bandwidth (f_S = 50 kS/s)	24.6 kHz
Crosstalk (0 kHz to 24.6 kHz)	-115 dB
CMRR (f_{in} = 60 Hz)	140 dB
Spurious-Free Dynamic Range (SFDR) 1 kHz, -60 dB FS	110 dB

Total Harmonic Distortion (THD) 1 kHz, -1 dB FS	-85 dB

Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-channel isolation	
Up to 2,000 m altitude	
Continuous	250 V RMS, Measurement Category II
Withstand	1,500 V RMS, verified by a 5 s dielectric test
2,001 m to 5,000 m altitude	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V DC
Channel-to-earth ground isolation	
Up to 2,000 m altitude	
Continuous	250 V RMS, Measurement Category II
Withstand	3,000 V RMS, verified by a 5 s dielectric test
2,001 m to 5,000 m altitude	
Continuous	60 V DC, Measurement Category I

Withstand	1,000 V DC
Division 2 and Zone 2 hazardous locations applications (Channel-to-channel and channel-to-earth ground)	60 V DC, Measurement Category I

Measurement Category

Measurement Category I

Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

Attention Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.

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.

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	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

To meet these shock and vibration specifications, you must panel mount the system.

Power Requirements

Power consumption from chassis	
Active mode	730 mW maximum
Sleep mode	50 µW maximum
Thermal dissipation	
Active mode	1.48 W maximum
Sleep mode	0.5 W maximum

Physical Characteristics

Screw-terminal wiring

Gauge	0.05 mm^2 to 1.5 mm^2 (30 AWG to 14 AWG) copper conductor wire
Wire strip length	6 mm (0.24 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Torque for screw terminals	0.22 N · m to 0.25 N · m (1.95 lb · in. to 2.21 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 1.5 mm^2
Weight	146 g (5.15 oz)
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9238 at ni.com/calibration.

Calibration interval	1 year