NI-9237 Specifications

2023-04-11

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NI-9237 Specifications

NI-9237 Nomenclature

In this article, the NI-9237 with RJ-50 and NI-9237 with DSUB are referred to inclusively as the NI-9237.

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.

Input Characteristics

Number of channels	4 analog input channels

Bridge completion	
Half and Full	Internal
Quarter	External
ADC resolution	24 bits
Type of ADC	Delta-Sigma (with analog prefiltering)
Sampling mode	Simultaneous
TEDS support	IEEE 1451.4 TEDS Class II (Interface)

Note The NI 9237 also has TEDS circuitry. For more information about TEDS, visit ni.com/info and enter the Info Code rdteds.

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	391 S/s
Maximum	51.36 kS/s

Data rates (f_S)	(f_M ÷ 256) ÷ n, where n = 1, 2, …, 31
Typical input range	±25 mV/V
Scaling coefficient	2.9802 nV/V per LSB
Overvoltage protection between any two pins	±30 V

Table 1. Accuracy

Measurement Conditions[1]		Percent of Reading (Gain Error[2])	Percent of Range[3] (Offset Error)
Calibrated	Typical (25 °C, ±5 °C)	0.05%	0.05%
	Maximum (– 40 to 70 °C)	0.20%	0.25%
Uncalibrated[4]	Typical (25 °C, ±5 °C)	0.20%	0.10%
	Maximum (– 40 to 70 °C)	0.55%	0.35%

Gain drift	10 ppm/°C maximum
Offset drift	
2.5 V excitation	0.6 µV/V per °C
3.3 V excitation	0.5 µV/V per °C
5 V excitation	0.3 µV/V per °C
10 V excitation	0.2 µV/V per °C
Half-bridge completion	
Tolerance	±1200 µV/V maximum
Drift	1.5 µV/V per °C

Table 2. Channel-to-Channel Matching (Calibrated)

Input Signal Frequency (f_{in})	Gain		Phase
	Typical	Maximum	Maximum
0 to 1 kHz	0.15%	0.3%	0.125°/kHz · f_{in}
1 to 20 kHz	0.4%	1.1%	

Phase nonlinearity	
f_{in} = 0 to 1 kHz	<0.001°
f_{in} = 0 to 20 kHz	±0.1°
Input delay	(40 + 5/512)/f_s + 4.5 µs
Passband	
Frequency	0.45 · f_s
Flatness	0.1 dB maximum
Stopband	
Frequency	0.55 · f_s
Rejection	100 dB
Alias-free bandwidth	0.45 · f_s
Oversample rate	64 · f_s
Rejection at oversample rate[5]	
f_s = 10 kS/s	60 dB @ 640 kHz
f_s = 50 kS/s	90 dB @ 3.2 MHz

Common-mode voltage, all signals to earth ground	±60 VDC
Common-mode voltage range, with respect to EX-	±1 V from the midpoint of the excitation voltage
CMRR	
Relative to earth ground[6] (f_{in} = 0 to 60 Hz)	140 dB
Relative to EX– (f_{in} = 0 to 1 kHz)	85 dB
SFDR (1 kHz, –60 dBFS)	115 dB
Total Harmonic Distortion (THD)	
1 kHz, –20 dBFS	–95 dB
8 kHz, –20 dBFS	–95 dB

Table 3. Input Noise

Excitation Voltage	Density, (nV/V_{rms} per $\sqrt{1\ Hz}$)	Total, f_{in} = 0 to 1 kHz (nV/V_{rms}) (signal sampled at 50 kHz)	Total, f_{in} = 0 to 25 kHz ($\mu V/V_{rms}$)	
	Full Bridge	Full Bridge	Full Bridge	Half Bridge
2.5 V	8	250	1.3	1.6
3.3 V	6	190	1.0	1.2
5 V	4	130	0.6	0.8
10 V	2	65	0.3	0.5

Excitation noise	100 µVrms
Crosstalk (not including cable effects)	
f_{in} = 1 kHz	-110 dB

f_{in} = 10 kHz	-100 dB
Excitation	
Internal voltage	2.5 V, 3.3 V, 5.0 V, 10.0 V
Internal power	150 mW maximum
External voltage	2 V to 10 V
Shunt calibration	
Resistance	100 kΩ
Resistor accuracy	
25 °C	±110 Ω
– 40 °C to 70 °C	±200 Ω
MTBF	
NI-9237 with RJ-50	603,359 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method
NI-9237 with DSUB	704,148 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

Power Requirements

Power consumption from chassis	
Active mode	740 mW maximum
Sleep mode	25 µW maximum
Thermal dissipation (at 70 °C)	

Active mode	740 mW maximum
Sleep mode	25 µW maximum

Physical Characteristics

Dimensions	Visit ni.com/dimensions and search by module number.
Weight	
NI-9237 with RJ-50	152 g (5.4 oz)
NI-9237 with DSUB	149 g (5.25 oz)

Safety Voltages

Connect only voltages that are within the following limits.

Between any two pins	±30 V maximum
Isolation, channel-to-channel	None
Isolation, channel-to-earth ground	
Up to 3,000 m	
Continuous	60 VDC, Measurement Category I
Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test
Up to 5,000 m	
Continuous	60 VDC, Measurement Category I

Withstand	860 Vrms, 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	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.

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9237 at ni.com/calibration.

Calibration interval	1 year

[1] Before offset null or shunt calibration.

[2] Applies at a data rate of 50 kS/s. Lower data rates can have up to 0.20% of reading additional gain error.

[3] Range equals 25 mV/V.

[4] Uncalibrated accuracy refers to the accuracy achieved when acquiring data in raw or unscaled modes and in which calibration constants that are stored in the module are not applied to the data.

[5] Rejection by analog prefilter of signal frequencies at oversample rate.

[6] Measured with a balanced cable on the NI-9237 with RJ-50 and with no cable on the NI-9237 with DSUB. Shielded cables that are not twisted-pair may be significantly unbalanced, which can impact CMRR performance. To improve the balance of shielded cables, NI recommends twisting together the AI+/AI– pair, the RS+/RS– pair, and the EX+/EX– pair.