NI-9237 Specifications

2025-03-10

Contents

NI-9237 Specifications

NI-9237 Specifications

These specifications apply to the NI-9237.

Revision History

Version	Date changed	Description
378964B-01	February 2025	Updated accuracy table.
378964A-01	March 2023	Initial release.

Looking For Something Else?

For information not found in the specifications for your product, such as operating instructions, browse ***Related Information***.

Related information:

- NI-9237 Getting Started
- Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT
- NI-9237 Calibration Procedure
- Calibration Services
- Software and Driver Downloads
- Dimensional Drawings
- Product Certifications
- Letter of Volatility
- Discussion Forums
- NI Learning Center

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.

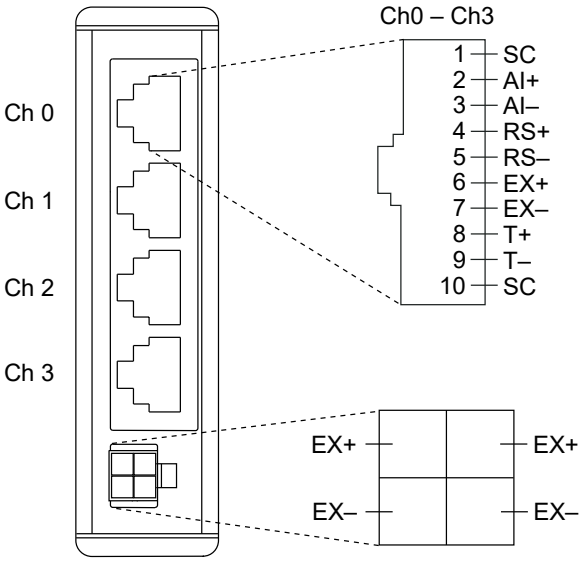
Connector Types

The NI-9237 has more than one connector type: NI-9237 with RJ-50 and NI-9237 with DSUB. Unless the connector type is specified, NI-9237 refers to both connector types.

NI-9237 Pinout

The NI-9237 provides connections for four half or full bridges, and an external excitation voltage source.

NI-9237 with RJ-50 Pinout



Caution Do not use RJ-45 cables with the NI-9237 with RJ-50. RJ-45 cables damage the RJ-50 connector, permanently disabling the shunt calibration, regardless of which connector you use.

Table 1. NI-9237 with RJ-50 Signal Descriptions

Signal Name	Description
AI+	Positive analog input signal connection
AI-	Negative analog input signal connection
RS+	Positive remote sensing connection
RS-	Negative remote sensing connection
EX+	Positive sensor excitation connection
EX-	Negative sensor excitation connection
T+	TEDS data connection
T-	TEDS return connection
SC	Shunt calibration connection

NI-9237 with DSUB Pinout

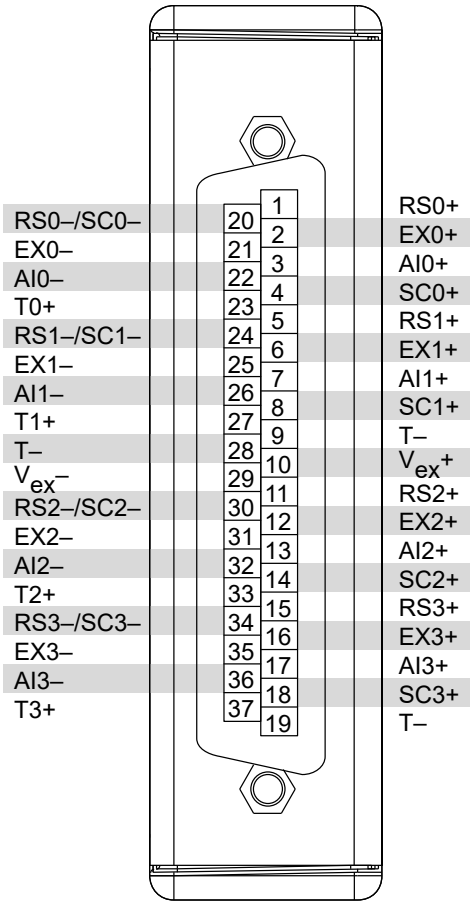


Table 2. NI-9237 with DSUB Signal Descriptions

Signal Name	Description
AI+	Positive analog input signal connection
AI-	Negative analog input signal connection
RS+	Positive remote sensing connection
RS-	Negative remote sensing connection
EX+	Positive sensor excitation connection
EX-	Negative sensor excitation connection
T+	TEDS data connection
T-	TEDS return connection
SC	Shunt calibration connection

Input Characteristics

Number of channels	4 analog input channels

Table 3. 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. Refer to IEEE 1451.4 TEDS Sensor Templates Overview for more information.

Table 4. Internal Master Timebase (f_M)

Frequency	12.8 MHz
Accuracy	±100 ppm maximum

Table 5. Data rate range (f_S) using internal master timebase

Minimum	1.613 kS/s
Maximum	50 kS/s

Table 6. 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 7. Accuracy

Measurement Conditions[1]		Within 1 Year of Calibration		Within 10 Years of Calibration	
		Percent of Reading (Gain Error[2])	Percent of Range[3] (Offset Error)	Percent of Reading (Gain Error[4])	Percent of Range[5] (Offset Error)
Calibrated	Typical (25 °C, ±5 °C)	0.05%	0.05%	0.10%	0.07%
	Maximum (-40° C to 70 °C)	0.20%	0.25%	0.30%	0.28%
Uncalibrated[6]	Typical (25 °C, ±5 °C)	0.20%	0.10%	0.28%	0.19%
	Maximum (-40 °C to 70 °C)	0.55%	0.35%	0.59%	0.37%

Note NI recommends a calibration interval of 1 year and only provides calibration services referencing the 1-year specification limits. If you choose to calibrate less often, the 10-year column provides predicted performance over this extended interval. Choose an appropriate interval based on your application requirements. Longer calibration intervals are more likely to result in As-Found calibration failures when the device is sent back for

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. Applies at a data rate of 50 kS/s. Lower data rates can have up to 0.20% of reading additional gain error.
5. Range equals 25 mV/V.
6. 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.

calibration and compared against the 1-year specification limits.

Gain drift	10 ppm/°C maximum

Table 8. 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

Table 9. Half-Bridge Completion

Tolerance	±1,200 µV/V maximum
Drift	1.5 µV/V per °C

Table 10. Channel-to-Channel Matching (Calibrated)

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

Table 11. 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

Table 12. Passband

Frequency	$0.45 \cdot f_s$
Flatness	0.1 dB maximum

Table 13. Stopband

Frequency	$0.55 \cdot f_S$
Rejection	100 dB

Alias-free bandwidth	$0.45 \cdot f_S$
Oversample rate	$64 \cdot f_S$

Table 14. Rejection at oversample rate

f_S = 10 kS/s	60 dB @ 640 kHz
f_S = 50 kS/s	90 dB @ 3.2 MHz

Note Rejection by analog prefilter of signal frequencies at oversample rate.

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

Table 15. Common-Mode Rejection Ratio (CMRR)

Relative to earth ground[7] (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

Table 16. Total Harmonic Distortion (THD)

1 kHz, –20 dBFS	–95 dB
8 kHz, –20 dBFS	–95 dB

7. 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.

Table 17. 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

Table 18. Crosstalk (Not Including Cable Effects)

f_{in} = 1 kHz	-110 dB
f_{in} = 10 kHz	-100 dB

Table 19. 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

Table 20. Shunt Calibration

Resistance		100 kΩ
Resistor accuracy	25 °C	±110 Ω
	– 40 °C to 70 °C	±200 Ω

Table 21. 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.

Recommended calibration interval	1 year