NI-9234 Specifications

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Contents

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These specifications apply to the NI-9234.

Revision History

Version	Date changed	Description
377849B-01	February 2025	Updated accuracy table.
377849A-01	June 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-9234 Getting Started
- Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT
- NI-9234 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.

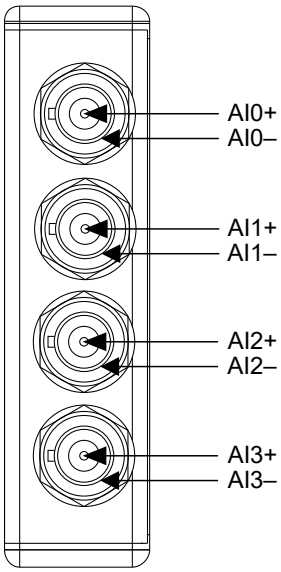
Conditions

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

NI-9234 Pinout

The NI-9234 provides connections to four simultaneously sampled analog input channels.

Figure 1. NI-9234 Pinout



Tip To minimize ground noise, prevent the metal shells of the BNC connectors from coming in contact with each other, the modules, or the

chassis.

Table 1. Signal Descriptions

Signal	Signal Description
AI+	Provides DC excitation (when enabled) and positive input signal connection
AI-	Provides excitation return path and signal ground reference

Input Characteristics

Number of channels	4 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-Sigma (with analog prefiltering)
Sampling mode	Simultaneous
Type of TEDS supported	IEEE 1451.4 TEDS Class I

Table 2. Internal master timebase (f_M)

Frequency	13.1072 MHz
Accuracy	±50 ppm

Table 3. Data Rate Range (f_s)

Timebase Used	Minimum	Maximum
Internal Master Timebase	1.652 kS/s	51.2 kS/s

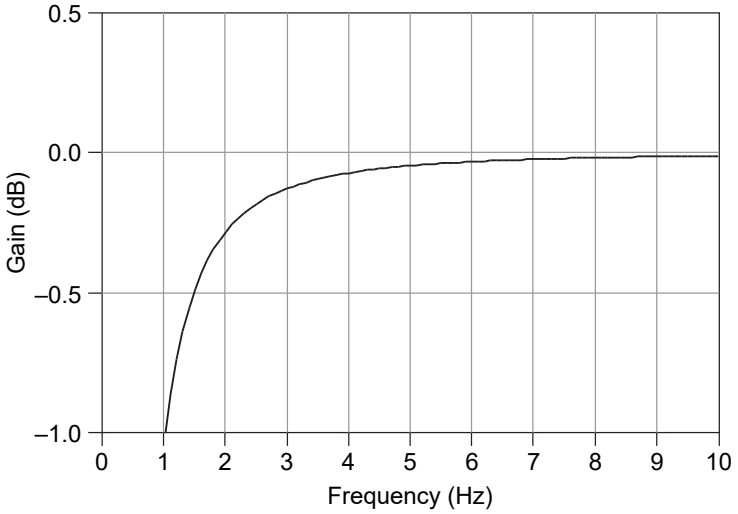
Timebase Used	Minimum	Maximum
External Master Timebase	0.391 kS/s	52.734 kS/s

Data rates [1] (f_S)	(f_M ÷ 256)/n, n = 1, 2, ..., 31
Input coupling	AC/DC (software-selectable)

Table 4. AC cutoff frequency

-3 dB	0.5 Hz
-0.1 dB	4.6 Hz maximum

Figure 2. AC Cutoff Frequency Response



Input range	±5 V

Table 5. AC voltage full-scale range

Minimum	±5 Vpk
Typical	±5.1 Vpk

1. The data rate must remain within the appropriate data range.

Maximum	±5.2 Vpk

Common-mode voltage range (AI- to earth ground)	±2 V maximum

Table 6. IEPE excitation current (software-selectable on/off)

Minimum	2.0 mA
Typical	2.1 mA

Power-on glitch	90 µA for 10 µs
IEPE compliance voltage	19 V maximum

If you are using an IEPE sensor, use the following equation to make sure your configuration meets the IEPE compliance voltage range.

- $(V_{common\text{-}mode} + V_{bias} \pm V_{full\text{-}scale})$ must be 0 to 19

Where

- $V_{common\text{-}mode}$ is the common-mode voltage applied to the NI 9234
- V_{bias} is the bias voltage of the IEPE sensor
- $V_{full\text{-}scale}$ is the full-scale voltage of the IEPE sensor

Table 7. Overvoltage protection (with respect to chassis ground)

For a signal source connected to AI+ and AI-	±30 V
For a low-impedance source connected to AI+ and AI-	-6 V to 30 V

Input delay	$(40 + 13/512)/f_S + 2.6\ \mu s$

Table 8. Accuracy

Measurement Conditions		Percent of Reading (Gain Error)		Percent of Range[2] (Offset Error)	
		Within 1 Year of Calibration	Within 10 Years of Calibration	Within 1 Year of Calibration	Within 10 Years of Calibration
Calibrated	Maximum (-40 °C to 70 °C)	0.34%, ±0.03 dB	0.56%, ±0.05 dB	±0.14%, 7.1 mV	±0.19%, 9.5 mV
	Typical (25 °C±5 °C)	0.05%, ±0.005 dB	0.12%, ±0.01 dB	±0.006%, 0.3 mV	±0.009%, 0.5 mV
Uncalibrated[3]	Maximum (-40 °C to 70 °C)	1.9%, ±0.16 dB	2.12%, ±0.18 dB	±0.27%, 13.9 mV	±0.32%, 16.3 mV
	Typical (25 °C±5 °C)	0.48%, ±0.04 dB	0.55%, ±(0.05 dB)	±0.04%, 2.3 mV	±0.05%, 2.5 mV

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 calibration and compared against the 1-year specification limits.

Table 9. Gain drift

Typical	0.14 mdB/°C (16 ppm/°C)
Maximum	0.45 mdB/°C (52 ppm/°C)

2. Range = 5.1 Vpk
3. 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.

Table 10. Offset drift

Typical	19.2 µV/°C
Maximum	118 µV/°C

Table 11. Channel-to-channel matching

Phase (f_{in} in kHz)	(f_{in} * 0.045° + 0.04 maximum)	
Gain	Typical	0.01 dB
	Maximum	0.04 dB

Table 12. Passband

Frequency	0.45 * f_s
Flatness (f_s = 51.2 kS/s)	40 mdB (pk-to-pk maximum)

Phase nonlinearity (f_s = 51.2 kS/s)	±0.45° maximum

Table 13. Stopband

Frequency	0.55 * f_s
Rejection	100 dB

Alias-free bandwidth	0.45 * f_s
Oversample rate	64 * f_s
Crosstalk (1 kHz)	-110 dB

Table 14. CMRR (f_{in} ≤ 1 kHz)

Minimum	40 dB

Typical	47 dB

SFDR (f_{in} = 1 kHz, -60 dBFS)	120 dB

Table 15. Idle Channel Noise and Noise Density

Idle Channel	51.2 kS/s	25.6 kS/s	2.048 kS/s
Noise	97 dBFS	99 dBFS	103 dBFS
	50 µVrms	40 µVrms	25 µVrms
Noise density	310 nV/√Hz	350 nV/√Hz	780 nV/√Hz

Table 16. Input impedance

Differential	305 kΩ
AI- (shield) to chassis ground	50 Ω

Table 17. Total Harmonic Distortion (THD)

Input Amplitude	1 kHz	8 kHz
-1 dBFS	-95 dB	-87 dB
-20 dBFS	-95 dB	-80 dB

Table 18. Intermodulation distortion (-1 dBFS)

DIN 250 Hz/8 kHz 4:1 amplitude ratio	-80 dB
CCIF 11 kHz/12 kHz 1:1 amplitude ratio	-93 dB

MTBF	390,362 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

Power Requirements

Power consumption from chassis

Active mode	900 mW maximum
Sleep mode	25 µW maximum
Thermal dissipation (at 70 °C)	
Active mode	930 mW maximum
Sleep mode	25 µW maximum

Physical Characteristics

Dimensions	Visit ni.com/dimensions and search by module number.
Weight	173 g (6.1 oz)

Safety Voltages

Connect only voltages that are within the following limits:

Channel-to-earth ground	±30 V maximum, Measurement Category I
Isolation	
Channel-to-channel	None
Channel-to-earth ground	None

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-9234 at ni.com/calibration.

Recommended calibration interval	1 year