
NI-9232

Specifications

2025-02-28



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NI-9232 Specifications

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These specifications apply to the NI-9232.

Revision History

Version	Date changed	Description
378863B-01	February 2025	Updated the analog input accuracy table.
378863A-01	December 2022	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-9232 Getting Started](#)
- [Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT](#)
- [NI-9230/9232 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.

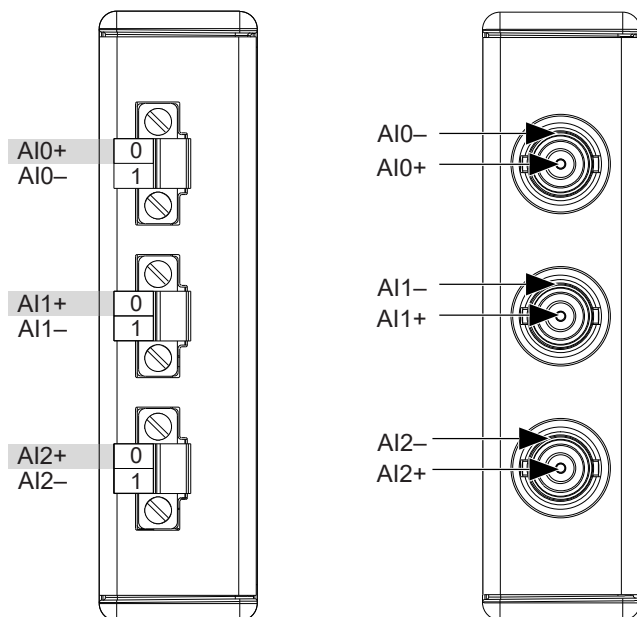
Conditions

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

Connector Types

The NI-9232 has more than one connector type: NI-9232 with screw terminal and NI-9232 with BNC. Unless the connector type is specified, NI-9232 refers to both connector types.

NI-9232 Pinout





Note You must use 2-wire ferrules to create a secure connection when connecting more than one wire to a single terminal on the NI-9232 with screw terminal.

Each channel has a terminal to which you can connect a signal source. The AI+ terminal of the connector provides the DC excitation, when enabled, and the positive input signal connection. The AI- terminal provides the excitation return path and the signal ground reference.

Table 1. Signal Descriptions

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

Input Characteristics

Number of channels	3 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
TEDS capacitive drive	3,000 pF

Table 2. Internal master timebase (f_M)

Frequency	13.1072 MHz
Accuracy	± 100 ppm

Table 3. Data rate range (f_s) using internal master timebase

Minimum	0.985 kS/s
Maximum	102.4 kS/s

Table 4. Data rate range (f_s) using external master timebase

Minimum	0.977 kS/s
Maximum	102.73 kS/s

Figure 1. Data Rates (f_s)

$$\frac{f_M}{2 \times m \times n}$$

$$m = 64, 128, 256n = 1, 2, \dots, 26$$

Input coupling	AC/DC (software-selectable)
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Table 5. AC cutoff frequency

-3 dB	0.1 Hz
-0.1 dB	0.87 Hz maximum

Figure 2. AC Cutoff Frequency Response

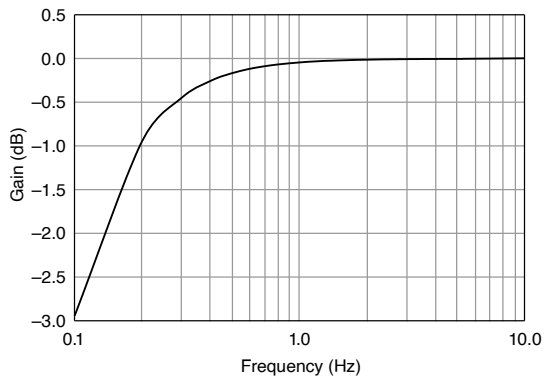


Table 6. DC voltage input range

Minimum	± 30.87 V
Typical	± 31.5 V
Maximum	± 32.13 V

Table 7. AC voltage full-scale range¹

Minimum	± 30.87 V peak
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1. The DC + AC voltage must be below the overvoltage protection of the NI-9232.

Typical	±31.5 V peak
Maximum	±32.13 V peak

Channel-to-channel common-mode voltage range (AI- to AI-)	±1 V maximum
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Table 8. IEPE excitation current (software-selectable on/off)

Minimum	4 mA
Typical	4.25 mA

IEPE excitation noise	100 nA rms
IEPE compliance voltage	22 V minimum

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

Figure 3. IEPE Compliance Voltage Range

$$(0.67 \times V_{\text{common-mode}} + V_{\text{bias}} \pm V_{\text{full-scale}})$$

where

- $V_{\text{common-mode}}$ is the channel-to-channel common-mode voltage across two or more channels
- V_{bias} is the bias voltage of the IEPE sensor
- $V_{\text{full-scale}}$ is the full-scale voltage of the IEPE sensor



Note This equation must resolve to 0 V to 22 V.

Table 9. IEPE fault detection²

Short circuit	$V_{\text{AI}} < 1.5 \text{ V}$
Open loop	$V_{\text{AI}} > 24 \text{ V}$

2. Refer to the software help for information on reading the IEPE fault detection status.

Overvoltage protection	± 45 V for a low impedance source connected between any two terminals
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Table 10. Input delay

64x decimation	$30/f_s + 3.0 \mu s$
128x decimation	$29/f_s + 3.0 \mu s$
256x decimation	$28/f_s + 3.0 \mu s$

Table 11. Accuracy

	Measurement Conditions	Within 1 Year of Calibration		Within 10 Years of Calibration	
		Percent of Reading Gain Error	Offset ³ (Percent of Range) ⁴	Percent of Reading Gain Error	Offset ⁵ (Percent of Range) ⁶
Calibrated	Typical (23 °C, ± 5 °C)	0.10%	0.023%	0.31%	0.148%
	Maximum (-40 °C to 70 °C)	0.60%	0.230%	0.67%	0.269%
Uncalibrated ⁷	Typical (23 °C, ± 5 °C)	0.40%	0.120%	0.61%	0.245%
	Maximum (-40 °C to 70 °C)	1.50%	0.590%	1.57%	0.629%



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

3. DC coupled

4. Range equals 31.5 V

5. DC coupled

6. Range equals 31.5 V

7. 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.

Table 12. Stability

Gain drift	± 25 ppm/ $^{\circ}\text{C}$
Offset drift (DC coupled)	± 320 $\mu\text{V}/^{\circ}\text{C}$

Table 13. Gain Matching (Calibrated)

Frequency Band	20 Hz to 40.96 kHz	
	Typical	Maximum
Channel-to-channel	25 mdB	120 mdB

Table 14. Phase Matching (Maximum)

Frequency Band	20 Hz to 40.96 kHz
Channel-to-channel	$(0.022^{\circ}/\text{kHz} \times f_{\text{in}}) + 0.045^{\circ}$
Module-to-module	$(0.022^{\circ}/\text{kHz} \times f_{\text{in}}) + 0.045^{\circ} + (360^{\circ} \times f_{\text{in}}/f_{\text{M}})$

Passband frequency	$0.4 \cdot f_{\text{s}}$
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Table 15. Flatness (Peak-to-Peak)

Frequency Band	20 Hz to 20.48 kHz	20 Hz to 40.96 kHz
Typical	70 mdB	75 mdB
Maximum	75 mdB ⁸	100 mdB ⁹

Table 16. Phase Nonlinearity (Maximum)

Frequency Band	20 Hz to 20.48 kHz	20 Hz to 40.96 kHz
AC Coupled	0.31°	0.31°
DC Coupled	0.025°	0.19°

8. For conformal coated version, the maximum flatness for 20 Hz to 20.48 kHz is 76 mdB.

9. For conformal coated version, the maximum flatness for 20 Hz to 40.96 kHz is 102 mdB.

Table 17. Stopband

Frequency	$0.5 \cdot f_s$
Rejection	120 dB

Alias-free bandwidth	$0.4 \cdot f_s$
Oversample rate	$64 \cdot f_s$, $128 \cdot f_s$, and $256 \cdot f_s$

Table 18. Rejection at oversample rate¹⁰

$f_s = 10.24 \text{ kS/s}$	95 dB at 1.311 MHz
$f_s = 102.4 \text{ kS/s}$	120 dB at 6.554 MHz

Crosstalk ($f_{in} = 1 \text{ kHz}$)	-125 dB
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Table 19. CMRR

Channel-to-channel ($f_{in} \leq 1 \text{ kHz}$) ¹¹	56 dB
Channel-to-earth ($f_{in} = 60 \text{ Hz}$)	107 dB

Table 20. SFDR ($f_{in} = 1 \text{ kHz}$, -60 dBFS)

$f_s = 102.4 \text{ kS/s}$	120 dBFS
$f_s = 51.2 \text{ kS/s}$	123 dBFS
$f_s = 25.6 \text{ kS/s}$	126 dBFS

Table 21. Input Noise

Data Rate	102.4 kS/s	51.2 kS/s	25.6 kS/s
AC coupled	251 $\mu\text{V RMS}$	171 $\mu\text{V RMS}$	127 $\mu\text{V RMS}$
DC coupled	223 $\mu\text{V RMS}$	150 $\mu\text{V RMS}$	112 $\mu\text{V RMS}$

10. Rejection of analog prefilter at oversample rate.

11. For conformal coated version, channel-to-channel CMRR ($f_{in} \leq 1 \text{ kHz}$) is 54 dB.

Table 22. Dynamic range ($f_{in} = 1$ kHz, -60 dBFS)

Data Rate	102.4 kS/s	51.2 kS/s	25.6 kS/s
AC coupled	99 dBFS	102 dBFS	105 dBFS
DC coupled	100 dBFS	103 dBFS	106 dBFS

Table 23. Input impedance

Differential	324 k Ω
AI- to isolated ground	50 Ω

Table 24. Total Harmonic Distortion (THD)

Input Amplitude	1 kHz	10 kHz
-10.5424 dBFS	-95 dB	-85 dB
-20 dBFS	-95 dB	-85 dB

Table 25. Intermodulation distortion (-10.5424 dBFS)

DIN 250 Hz/8 kHz4:1 amplitude ratio	-80 dB
CCIF 11 kHz/12 kHz1:1 amplitude ratio	-100 dB

Safety Voltages

Connect only voltages that are within the following limits.

Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I

Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test
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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.

Power Requirements

Power consumption from chassis	
Active mode	1 W maximum
Sleep mode	25 μ W maximum
Thermal dissipation (at 70 °C)	
Active mode	1 W maximum
Active mode (BNC variant)	1.5 W maximum
Sleep mode	25 μ 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	
Connector securement		
Securement type		Screw flanges provided
Torque for screw flanges		0.2 N · m (1.80 lb · in.)
Dimensions	Visit ni.com/dimensions and search by module number.	
Weight		
NI-9232 with screw terminal		142 g (5.0 oz)
NI-9232 with BNC		159 g (5.6 oz)

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9232 at ni.com/calibration.

Recommended calibration interval	1 year
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