



NI-9223 and sbRIO-9223 Specifications



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NI-9223 and sbRIO-9223 Specifications ± 10 V, 1 MS/s, 16-Bit, Simultaneous Input, 4-Channel C Series Voltage Input Module

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Connector Types

The NI-9223 has more than one connector type: NI-9223 with screw terminal , NI-9223 with snap in terminal, and NI-9223 with BNC. Unless the connector type is specified, NI-9223 refers to all connector types.

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

The following specifications are typical 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.



RELATED INFORMATION

[Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT](#)



Input Characteristics

Number of Channels	4 analog input channels
ADC resolution	16 bits
Type of ADC	Successive approximation register (SAR)
Input voltage ranges ¹ , Measurement Voltage (AI+ to AI-)	
Minimum ²	±10.5 V
Typical	±10.6 V
Maximum	±10.7 V
Overvoltage protection	±30 V
Maximum Sampling Rate	
CompactDAQ (NI-DAQmx)	1 MS/s
CompactRIO	
FPGA User-Controlled I/O Sampling ³	1 MS/s
FPGA I/O Nodes	350 kS/s

Table 1 : Accuracy

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range [†] (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	±0.20%	±0.10%
	Typical (23 °C ±5 °C)	±0.02%	±0.01%
Uncalibrated [‡]	Maximum (-40 °C to 70 °C)	±0.40%	±0.40%
	Typical (23 °C ±5 °C)	±0.20%	±0.10%

[†] Range equals ±10.6 V.

[‡] 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.

¹ Refer to the *Safety Voltages* section for more information about safe operating voltages.

² The minimum measurement voltage range is the largest voltage the NI-9223 is guaranteed to accurately measure.

³ FPGA User-Controlled I/O Sampling provides low level access to sample acquisition and transfer, and higher sample rates. Visit ni.com/r/samplerate for information about FPGA User-Controlled I/O Sampling.

Stability		
Gain drift		6 ppm/°C
Offset drift		29 μ V/°C
CMRR ($f_{in} = 60$ Hz)		100 dB
-3 dB bandwidth ⁴		>1 MHz
Input impedance		>1 G Ω
Noise		0.75 LSB RMS
Total Harmonic Distortion (THD) (20 V peak-to-peak at 1 kHz)		-85 dB
Crosstalk (20 V peak-to-peak at 1 kHz)		-100 dB

Safety Voltages

Connect only voltages that are within the following limits:

Isolation		
Channel-to-channel		
Continuous		60 V DC, Measurement Category I
Withstand		1000 V RMS, verified by a 5 s dielectric withstand test
Channel-to-earth ground		
Continuous		60 V DC, Measurement Category I
Withstand		1000 V RMS, verified by a 5 s dielectric withstand test

⁴ -3 dB bandwidth for input amplitude at 10% of the input range.



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		
NI-9223 with screw terminal		5,000 m
NI-9223 with snap in terminal		5,000 m
NI-9223 with BNC		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		5 mW maximum
Thermal dissipation (at 70 °C)		
Active mode		1.3 W maximum
Sleep mode		430 mW maximum

Physical Characteristics

Dimensions

Visit ni.com/dimensions and search by module number.

Weight		
NI-9223 with screw terminal		138 g (4.9 oz)
NI-9223 with snap in terminal		158.3 g (5.58 oz)
NI-9223 with BNC		165 g (5.8 oz)



Screw terminal wiring	
Gauge	0.05 mm ² to 1.5 mm ² (30 AWG to 16 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
Snap in terminal wiring	
Gauge	0.5 mm ² to 2.5 mm ² (20 AWG to 14 AWG) copper conductor wire
Wire strip length	9 mm ± 1 mm (0.35 in. ± 0.04 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Wires per snap in terminal	One wire per snap in terminal; two wires per snap in terminal using a 2-wire ferrule
Ferrules	0.5 mm ² to 2.5 mm ²
Connector securement	
Securement type	Snap in securement provided

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9223 at ni.com/calibration.

Calibration interval	1 year
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