

# NI 9203 Datasheet

8-Channel,  $\pm 20$  mA, 16-Bit Analog Input Module



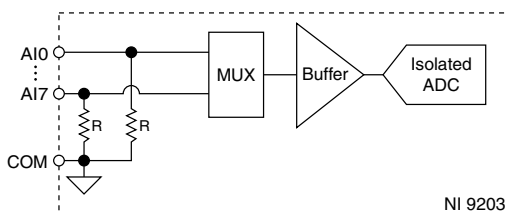
- 8 channels, 200 kS/s current input
- $\pm 20$  mA, 0 mA to 20 mA programmable input ranges; 16-bit resolution
- NIST-traceable calibration
- Screw-terminal or spring-terminal connectivity
- 250 V<sub>rms</sub>, CAT II bank isolation
- -40 °C to 70 °C operating range, 5 g vibration, 50 g shock

The NI 9203 is a C Series DAQ module with 8 analog current input channels for high-performance control and monitoring applications. It features programmable input ranges of  $\pm 20$  mA or 0 mA to 20 mA, 16-bit resolution, and a 200 kS/s maximum sampling rate. To protect against signal transients, the NI 9203 includes a channel-to-earth ground double-isolation barrier (250 V<sub>rms</sub> isolation) for safety and noise immunity.

## Input Circuitry

The input signals are buffered, conditioned, and sampled by a single 16-bit ADC. The module protects each channel from overvoltages. Refer to the Specifications section for information about overvoltage protection.

**Figure 1.** Input Circuitry on the NI 9203



## Specifications

The following specifications are typical for the range -40 °C to 70 °C unless otherwise noted. All voltages are relative to COM unless otherwise noted.

# Input Characteristics

Number of channels.....	8 analog input channels
ADC resolution.....	16 bits
Type of ADC.....	Successive approximation register (SAR)
Nominal input	
Unipolar.....	0 mA to 20 mA
Bipolar.....	±20 mA
Minimum overrange	
Unipolar.....	6.5%
Bipolar.....	5.5%
Overvoltage protection, channel-to-.....	±30 V max on one channel at a time
COM	
Sample rate	
R Series Expansion chassis.....	192 kS/s max
All other chassis.....	200 kS/s max
Conversion time	
R Series Expansion chassis.....	5.2 µs min
All other chassis.....	5 µs min

**Table 1. Unipolar Accuracy**

	Measurement Conditions	Percent of Reading (Gain Error)	Percent of Range <sup>1</sup> (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	±0.18%	±0.06%
	Typical (25 °C, ±5 °C)	±0.04%	±0.02%
Uncalibrated	Maximum (-40 °C to 70 °C)	±0.66%	±0.54%
	Typical (25 °C, ±5 °C)	±0.49%	±0.46%

<sup>1</sup> Range equals 21.5 mA.

**Table 2. Bipolar Accuracy**

	Measurement Conditions	Percent of Reading (Gain Error)	Percent of Range <sup>1</sup> (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	±0.20%	±0.09%
	Typical (25 °C, ±5 °C)	±0.05%	±0.02%
Uncalibrated	Maximum (-40 °C to 70 °C)	±0.74%	±0.66%
	Typical (25 °C, ±5 °C)	±0.54%	±0.55%

Scaling coefficients

Unipolar.....330 nA/LSB typ  
 Bipolar.....660 nA/LSB typ

Unipolar stability

Offset drift.....63 nA/°C  
 Gain drift.....±14 ppm/°C

Bipolar stability

Offset drift.....286 nA/°C  
 Gain drift.....±17 ppm/°C

Input bandwidth (-3 dB).....850 kHz

Input impedance

Resistance.....138 Ω  
 Capacitance.....20 pF

Input noise (code-centered)

RMS.....1 LSB<sub>rms</sub>  
 Peak-to-peak.....7 LSB

No missing codes.....16 bits

INL.....±3 LSB max

Crosstalk (at 1 kHz).....-100 dB

Settling time (to 2 LSB).....5 μs

MTBF.....1,522,814 hours at 25 °C; Bellcore Issue 6,  
 Method 1, Case 3, Limited Part Stress Method

# Power Requirements

## Power consumption from chassis

Active mode.....	399 mW max
Sleep mode.....	5 mW max

## Thermal dissipation (at 70 °C)

Active mode.....	1.22 W max
Sleep mode.....	824 mW max

# Physical Characteristics

## Screw-terminal wiring

Gauge.....	0.2 mm <sup>2</sup> to 2.5 mm <sup>2</sup> (26 AWG to 14 AWG) copper conductor wire
Wire strip length.....	13 mm (0.51 in.) of insulation stripped from the end
Temperature rating.....	90 °C minimum
Torque for screw terminals.....	0.5 N · m to 0.6 N · m (4.4 lb · in. to 5.3 lb · in.)
Wires per screw terminal.....	One wire per screw terminal; two wires per screw terminal using a 2-wire ferrule

## Connector securement

Securement type.....	Screw flanges provided
Torque for screw flanges.....	0.2 N · m (1.80 lb · in.)

# Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM.....	±30 VDC max
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# Isolation Voltages

Channel-to-channel.....	None
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## Channel-to-earth ground

### Continuous

up to 2,000 m altitude.....	250 Vrms, Measurement Category II
up to 5,000 m altitude.....	60 VDC, Measurement Category I

### Withstand

up to 2,000 m altitude.....	2,300 Vrms, verified by a 5 s withstand test
up to 5,000 m altitude.....	1,000 Vrms, verified by a 5 s withstand test

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.



**Caution** Do not connect the NI 9203 to signals or use for measurements within Measurement Categories II, III, or IV.

Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet, for example, 115 V for U.S. or 230 V for Europe.



**Caution** Do not connect the NI 9203 to signals or use for measurements within Measurement Categories III or IV.

## Hazardous Locations

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U.S. (UL).....	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA IIC T4
Canada (C-UL).....	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA IIC T4
Europe (ATEX) and International (IECEX)	Ex nA IIC T4 Gc

## Safety and Hazardous Locations Standards

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This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 5, UL 60079-15; Ed 3
- CSA 60079-0:2011, CSA 60079-15:2012



**Note** For UL and other safety certifications, refer to the product label or the [Online Product Certification](#) section.

# Electromagnetic Compatibility

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This product meets the requirements of the following EMC standards for sensitive electrical equipment for measurement, control, and laboratory use:

- EN 61326-2-1 (IEC 61326-2-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



**Note** In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.



**Note** Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.



**Note** For EMC declarations and certifications, and additional information, refer to the *Online Product Certification* section.

## CE Compliance

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This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 94/9/EC; Potentially Explosive Atmospheres (ATEX)

## Online Product Certification

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Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit [ni.com/certification](https://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

# Shock and Vibration

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To meet these specifications, you must panel mount the system.

## Operating vibration

Random (IEC 60068-2-64).....5 g<sub>rms</sub>, 10 Hz to 500 Hz

Sinusoidal (IEC 60068-2-6).....5 g, 10 Hz to 500 Hz

Operating shock (IEC 60068-2-27).....30 g, 11 ms half sine; 50 g, 3 ms half sine;  
18 shocks at 6 orientations

# Environmental

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Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature.....-40 °C to 70 °C  
(IEC 60068-2-1, IEC 60068-2-2)

Storage temperature.....-40 °C to 85 °C  
(IEC 60068-2-1, IEC 60068-2-2)

Ingress protection.....IP 40  
(with power plug attached)

Operating humidity.....10% RH to 90% RH, noncondensing  
(IEC 60068-2-78)

Storage humidity (IEC 60068-2-78).....5% RH to 95% RH, noncondensing

Pollution Degree.....2

Maximum altitude.....5,000 m

Indoor use only.

# Environmental Management

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NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at [ni.com/environment](http://ni.com/environment). This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

# Waste Electrical and Electronic Equipment (WEEE)

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**EU Customers** At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit [ni.com/environment/weee](http://ni.com/environment/weee).

## 电子信息产品污染控制管理办法（中国 RoHS）

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**中国客户** National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china)。(For information about China RoHS compliance, go to [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china).)

## Calibration

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You can obtain the calibration certificate and information about calibration services for the NI 9203 at [ni.com/calibration](http://ni.com/calibration).

Calibration interval.....1 year

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