# NI-9238

## Getting Started

# Contents

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## NI-9238 Specifications

The NI-9238 has more than one connector type: NI-9238 with screw terminals and NI-9238 with snap in terminals. Unless the connector type is specified, NI-9238 refers to both connector types.

## NI-9238 Pinout

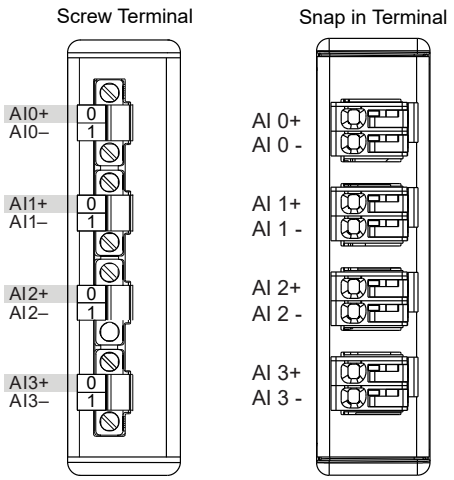
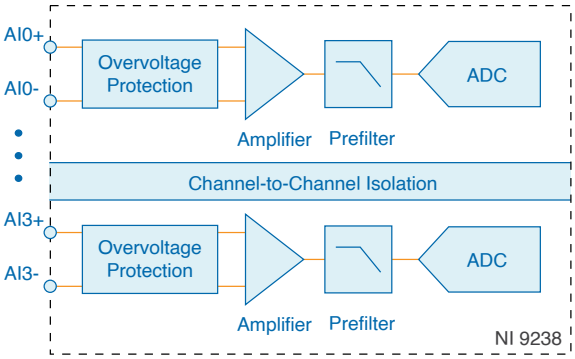



Table 2. Signal Descriptions

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

## NI-9238 Block Diagram




- Input signals on each channel are buffered, conditioned, and then sampled by an ADC.
- Each AI channel provides an independent signal path and ADC, enabling you to sample all channels simultaneously.

# Filtering

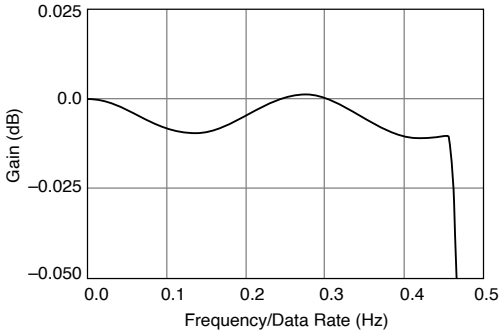
The NI-9238 uses a combination of analog and digital filtering to provide an accurate representation of in-band signals and reject out-of-band signals. The filters discriminate between signals based on the frequency range, or bandwidth, of the signal. The three important bandwidths to consider are the passband, the stopband, and the anti-imaging bandwidth.

The NI-9238 represents signals within the passband, as quantified primarily by passband ripple and phase nonlinearity. All signals that appear in the alias-free bandwidth are either unaliased signals or signals that have been filtered by at least the amount of the stopband rejection.

## Passband

The signals within the passband have frequency-dependent gain or attenuation. The small amount of variation in gain with respect to frequency is called the passband flatness. The digital filters of the NI-9238 adjust the frequency range of the passband to match the data rate. Therefore, the amount of gain or attenuation at a given frequency depends on the data rate.

Figure 1. Typical Passband Response for the NI-9238




## Stopband

The filter significantly attenuates all signals above the stopband frequency. The primary goal of the filter is to prevent aliasing. Therefore, the stopband frequency scales precisely with the data rate. The stopband rejection is the minimum amount of attenuation applied by the filter to all signals with frequencies within the stopband.

## Alias-Free Bandwidth

Any signals that appear in the alias-free bandwidth are not aliased artifacts of signals at a higher frequency. The alias-free bandwidth is defined by the ability of the filter to reject frequencies above the stopband frequency. The alias-free bandwidth is equal to the data rate minus the stopband frequency.

# Data Rates

The frequency of a master timebase ($f_M$) controls the data rate ($f_S$) of the NI-9238. The NI-9238 includes an internal master timebase with a frequency of 12.8 MHz, but the module also can accept an external master timebase or export its own master timebase. To synchronize the data rate of an NI-9238 with other modules that use master timebases to control sampling, all of the modules must share a single master timebase source.

The following equation provides the available data rates of the NI-9238:

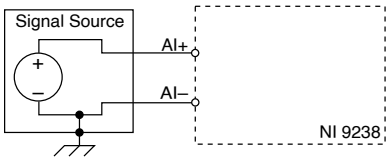
$$f_s = \frac{f_M \div 256}{n}$$

where n is any integer from 1 to 31.

However, the data rate must remain within the appropriate data rate range. When using the internal master timebase of 12.8 MHz, the result is data rates of 50 kS/s, 25 kS/s, 16.667 kS/s, and so on down to 1.613 kS/s depending on the value of n. When using an external timebase with a frequency other than 12.8 MHz, the NI-9238 has a different set of data rates.

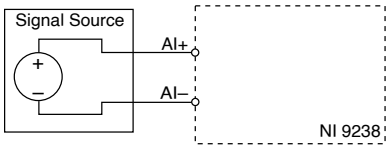
**Note** The NI-9151 R Series Expansion chassis does not support sharing timebases between modules.

## Grounded Connections




Make sure the voltage on the AI+ and AI- connections are in the channel-to-earth safety voltage range to ensure proper operation.

## Floating Connections




## NI-9238 Connection Guidelines

- Make sure that devices you connect to the NI-9238 are compatible with the module specifications.
- You must use 2-wire ferrules to create a secure connection when connecting more than one wire to a single terminal on the NI-9238.

**Related reference:**

- Cable Requirements

## Wiring for High-Vibration Applications

If your application is subject to high vibration, NI recommends that you use the NI 9971 backshell kit to protect connections to the NI-9238 with screw terminals or NI 9990 backshell kit to protect connections to the NI-9238 with snap in terminals.

You must follow these guidelines to meet the shock and vibration performance specifications stated in the device datasheet on `ni.com/manuals`.

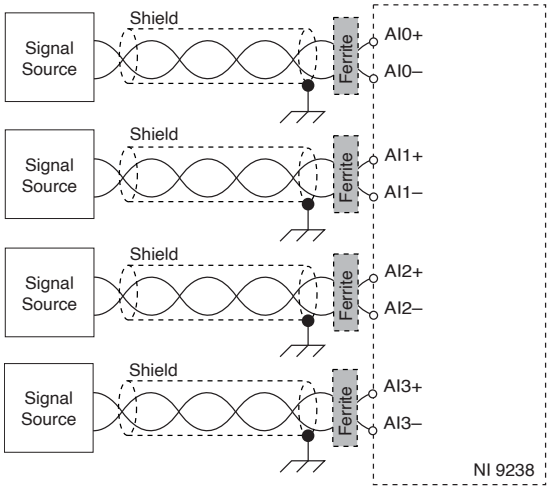
- Panel mount the system.
- Provide strain relief for the module by securing the cabling to a supporting fixture no more than 8 cm (3 in.) away from the opening of the connector backshell.
- Ensure that the supporting fixture for strain relief is stiff and rigidly coupled to the chassis mounting surface.
- Use ferrules to terminate wires to the detachable connector.

# Cable Requirements

Install cables for the NI-9238 in accordance with the following EMC requirements:

- Connect the cable shield to the chassis ground (grounding screw of the chassis).
- Install an EMI Noise-Suppression Ferrite (part number 782802-01) on the input cable for each channel connected to the NI-9238.
- Position the ferrite as close to the module as possible. Placing the ferrite elsewhere decreases its effectiveness.

Figure 2. NI-9238 Cable Connections for EMC Compliance




## Related concepts:

- NI-9238 Connection Guidelines