NI-9234 Getting Started

2025-03-21

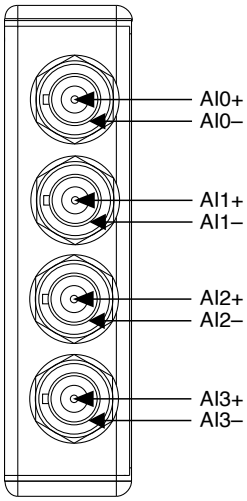
Contents

NI-9234 Getting Started

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.

Signal Descriptions

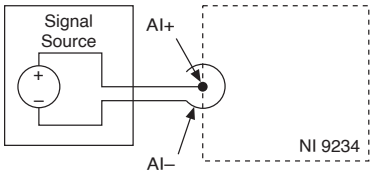
Table 1. Signal Descriptions

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

Connecting Floating Differential Signals

You can connect floating differential signals to the NI-9234.

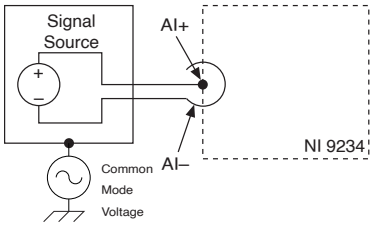
Figure 2. Connecting Floating Differential Signals to the NI-9234



Connecting Grounded Differential Signals

You can connect grounded differential signals to the NI-9234.

Figure 3. Connecting Grounded Differential Signals to the NI-9234

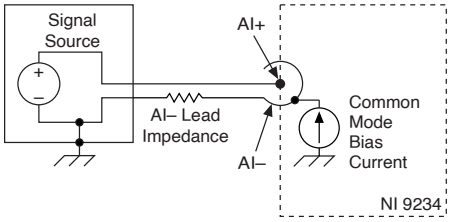


Make sure the voltage on the AI- shell is in the common-mode range to ensure proper operation of the NI-9234. The AI- shell is protected against accidental contact with overvoltages within the overvoltage protection range.

Common-Mode Bias Current

The NI-9234 uses common-mode bias current to bias the current-limiting diodes when IEPE current is turned off. When the NI-9234 is using grounded signal sources, this current causes an error that is dependent on the AI- lead impedance. This error is approximately 50 ppm of range and 15 ppm of reading per ohm of AI- impedance. The common-mode bias current causes an error only with grounded sources and is not an issue with floating signal sources. For best accuracy, use low-impedance leads when connecting grounded signal sources.

Figure 4. Measurement Error Introduced by Common-Mode Bias Current



IEPE Excitation Current

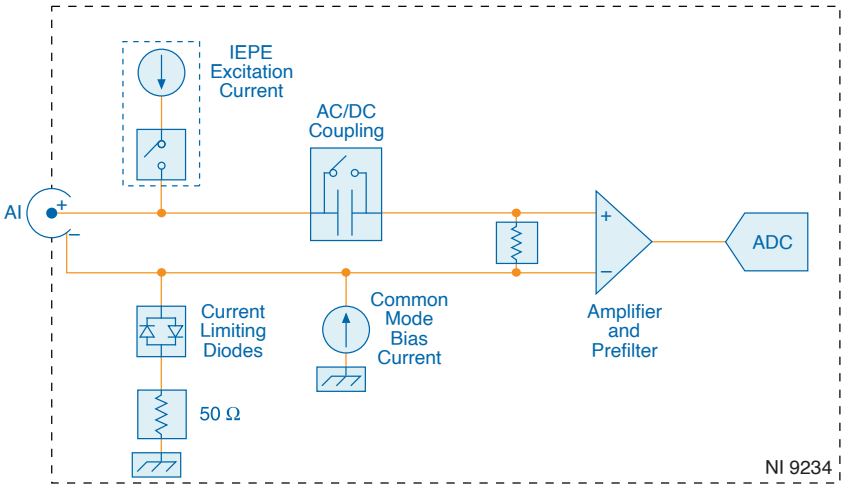
The NI-9234 can also provide an IEPE excitation current for each channel to measure ground-referenced or floating IEPE sensors. Typical IEPE sensors have a case that is electrically isolated from the IEPE electronics, so connecting the sensor to the NI-9234 results in a floating connection even though the case of the sensor is grounded.

You can enable excitation current on a per-channel basis. Refer to your software help for more information about excitation current.

NI-9234 Block Diagram

The input signal on each channel is buffered, conditioned, and then sampled by a 24-bit Delta-Sigma ADC.

Figure 5. NI-9234 Input Circuitry for One Channel



The NI-9234 analog input channels are referenced to chassis ground through a 50 Ω resistor. To minimize ground noise, make sure the chassis ground is connected to earth ground. Each channel is protected from overvoltages.

AC/DC Coupling

You can configure each channel in software for AC or DC coupling. For channels set to AC coupling, you can turn the IEPE excitation current on or off. Refer to your software help for more information about configuring AC/DC coupling and enabling excitation current.

NI-9234 TEDS

The NI-9234 also has TEDS circuitry. For more information about TEDS, visit ni.com/info and enter the Info Code `rdteds`.

Filtering

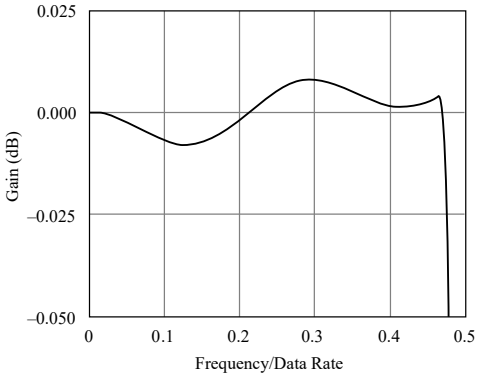
The NI-9234 uses a combination of analog and digital filtering to provide an accurate representation of in-band signals and reject out-of-band signals. The filters discriminate between signals based on the frequency range, or bandwidth, of the signal. The three important bandwidths to consider are the passband, the stopband, and the anti-imaging bandwidth.

The NI-9234 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-9234 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 6. Typical Passband Response for the NI-9234



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-9234. The NI-9234 includes an internal master timebase with a frequency of 13.1072 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-9234 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-9234:

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

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 13.1072 MHz, the result is data rates of 51.2 kS/s, 25.6 kS/s, 17.067 kS/s, and so on down to 1.652 kS/s, depending on the value of n. When using an external timebase with a frequency other than 13.1072 MHz, the NI-9234 has a different set of data rates.

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

Conformal Coating

The NI-9234 is available with conformal coating for additional protection in corrosive and condensing environments, including environments with molds and dust.

In addition to the environmental specifications listed in the ***NI-9234 Safety, Environmental, and Regulatory Information***, the NI-9234 with conformal coating meets the following specification for the device temperature range. To meet this specification, you must follow the appropriate setup requirements for condensing environments. Refer to ***Conformal Coating and NI RIO Products*** for more information about conformal coating and the setup requirements for condensing environments.

Operating humidity (IEC 60068-2-30 Test Db)	80 to 100% RH, condensing

Related information:

- Conformal Coating and NI RIO Products

© 2025 National Instruments Corporation.