NI-9202 Specifications

2023-05-29

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NI-9202 Datasheet

- DSUB or push-in spring terminal connectivity
- 250 V RMS, CAT II, channel-to-earth isolation (spring terminal); 60 V DC, CAT I, channel-to-earth isolation (DSUB)
- -40 °C to 70 °C operating, 5 g vibration, 50 g shock

Note In this document, the NI-9202 with spring terminal and the NI-9202 with DSUB are referred to inclusively as the NI 9202.

The NI-9202 is an analog input module for CompactDAQ and CompactRIO systems. Each channel provides a ±10 V measurement range at a 24-bit resolution. The NI-9202 has a maximum sample rate of 10 kS/s and features programmable hardware filters. By choosing one of the 5 different filter responses, a trade-off of fast settling time for increased noise rejection can be attained.

Kit Contents	• NI 9202 • NI 9202 Getting Started Guide
Accessories	• NI 9940 Backshell Connector Kit (Spring Terminal) • NI 9923 Screw-Terminal Block (DSUB)

NI C Series Overview

NI provides more than 100 C Series modules for measurement, control, and communication applications. C Series modules can connect to any sensor or bus and allow for high-accuracy measurements that meet the demands of advanced data acquisition and control applications.

- Measurement-specific signal conditioning that connects to an array of sensors and signals
- Isolation options such as bank-to-bank, channel-to-channel, and channel-to-earth ground
- -40 °C to 70 °C temperature range to meet a variety of application and environmental needs
- Hot-swappable

The majority of C Series modules are supported in both CompactRIO and CompactDAQ platforms and you can move modules from one platform to the other with no modification.

CompactRIO

CompactRIO combines an open-embedded architecture with small size, extreme ruggedness, and C Series modules in a platform powered by the NI LabVIEW reconfigurable I/O (RIO) architecture. Each system contains an FPGA for custom timing, triggering, and processing with a wide array of available modular I/O to meet any embedded application requirement.

CompactDAQ

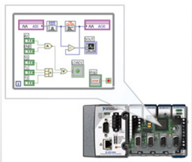
CompactDAQ is a portable, rugged data acquisition platform that integrates connectivity, data acquisition, and signal conditioning into modular I/O for directly interfacing to any sensor or signal. Using CompactDAQ with LabVIEW, you can easily customize how you acquire, analyze, visualize, and manage your measurement data.

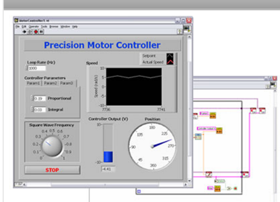
Software

LabVIEW Professional Development System for Windows

- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects

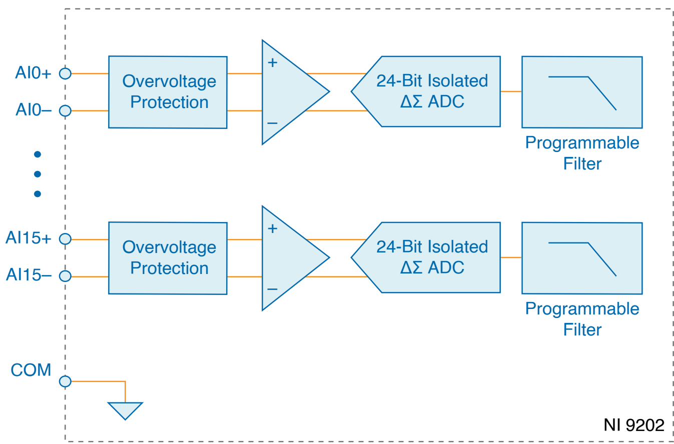
LabVIEW Professional Development System for Windows	
	▪ Build DLLs, executables, and MSI installers

NI LabVIEW FPGA Module	
	▪ Design FPGA applications for NI RIO hardware ▪ Program with the same graphical environment used for desktop and real-time applications ▪ Execute control algorithms with loop rates up to 300 MHz ▪ Implement custom timing and triggering logic, digital protocols, and DSP algorithms ▪ Incorporate existing HDL code and third-party IP including Xilinx IP generator functions ▪ Purchase as part of the LabVIEW Embedded Control and Monitoring Suite

NI LabVIEW Real-Time Module	
	▪ Design deterministic real-time applications with LabVIEW graphical programming ▪ Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O ▪ Take advantage of built-in PID control, signal processing, and analysis functions ▪ Automatically take advantage of multicore CPUs or set processor affinity manually

NI LabVIEW Real-Time Module	
	▪ Take advantage of real-time OS, development and debugging support, and board support ▪ Purchase individually or as part of a LabVIEW suite

NI-9202 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.

NI-9202 Filtering

The NI-9202 uses a combination of analog and digital filtering to provide an accurate representation of in-band signals while rejecting out-of-band signals. The filters discriminate between signals based on the frequency range, or bandwidth, of the signal.

The NI-9202 represents signals within the passband, as quantified primarily by passband flatness and phase linearity.

The NI-9202 has a comb frequency response, characterized by deep, evenly spaced notches and an overall roll-off towards higher frequencies. The NI-9202 provides five available filter options for every data rate. The different options provide a trade-off of noise rejection (refer to Idle Channel Noise table) for filter settling time (refer to Settling Time equation) and latency (refer to Input Delay equation). To control the response of the programmable comb filter, you can select to have the first notch at 1, 1/2, 1/4, 1/8 or 1/16 of the sampling frequency. The following figures show the overall filter response with different filter settings.

Figure 13. Filter Response for Filter Decimation Rate 2

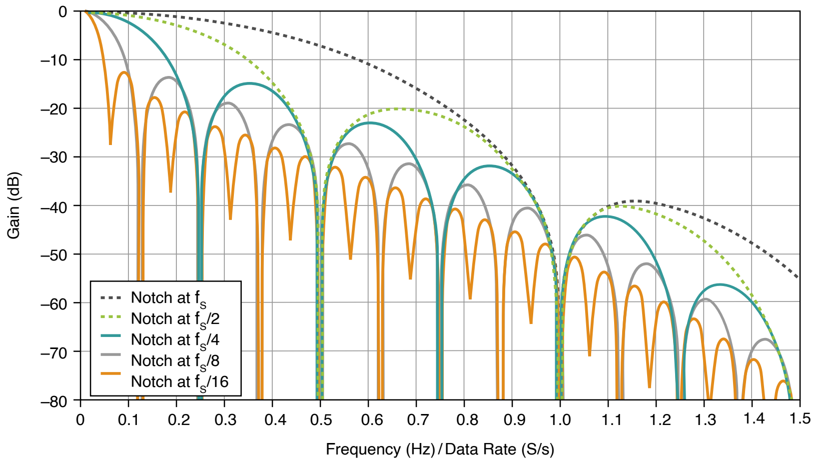


Figure 14. Filter Response for Filter Decimation Rate 4

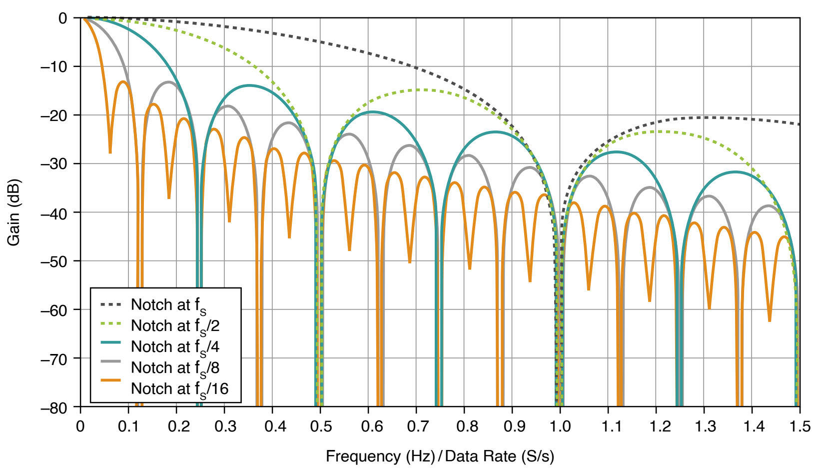


Figure 15. Filter Response for Filter Decimation Rate 5

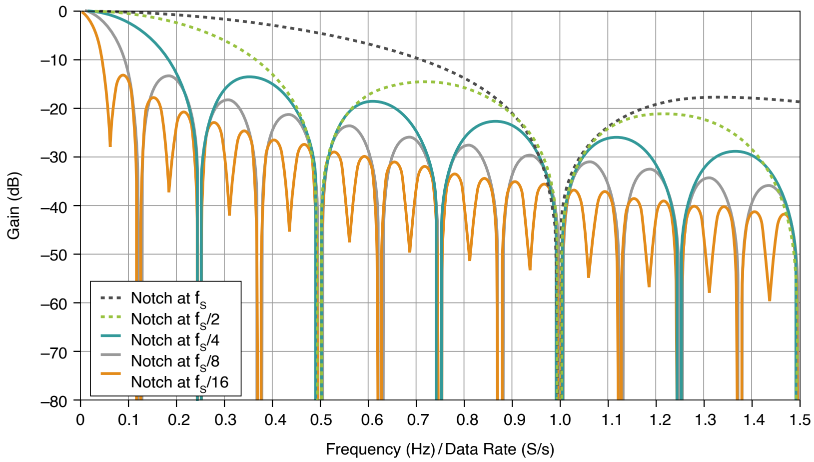
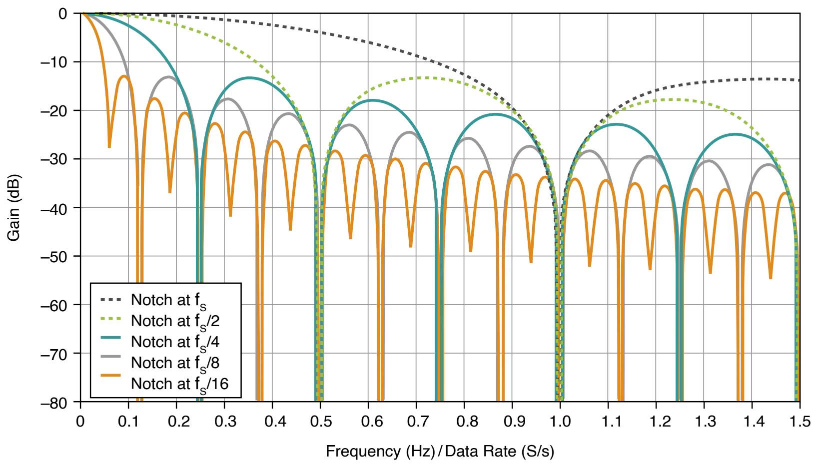


Figure 16. Filter Response for Filter Decimation Rate ≥ 8



NI-9202 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 programmable comb filters of the NI-9202 adjust the frequency range of the passband to match the data rate and filter setting. Therefore, the amount of gain or attenuation at a given frequency depends on the data rate and filter setting.

Figure 17. Typical Flatness for Filter Decimation Rate 2

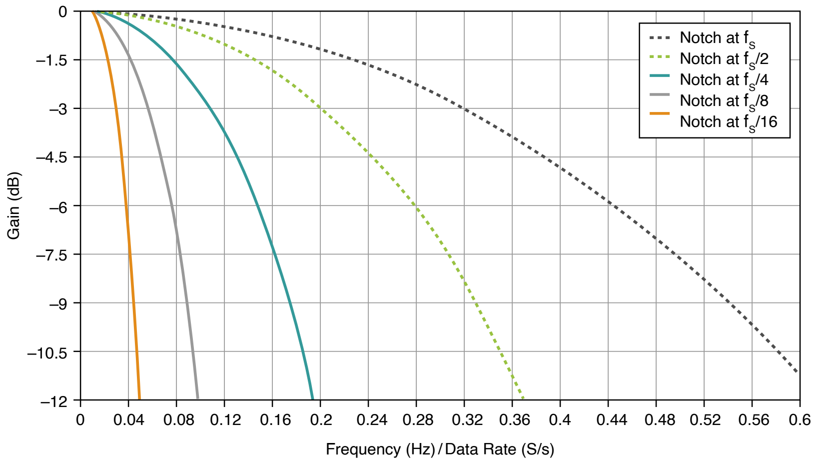


Figure 18. Typical Flatness for Filter Decimation Rate 4

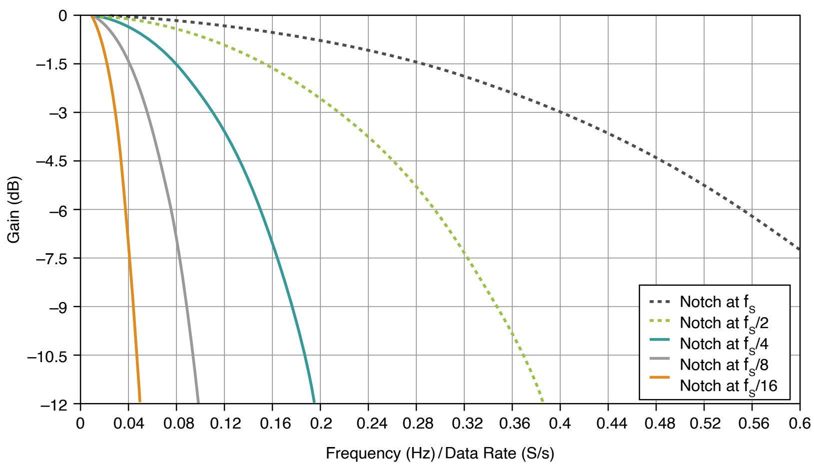


Figure 19. Typical Flatness for Filter Decimation Rate 5

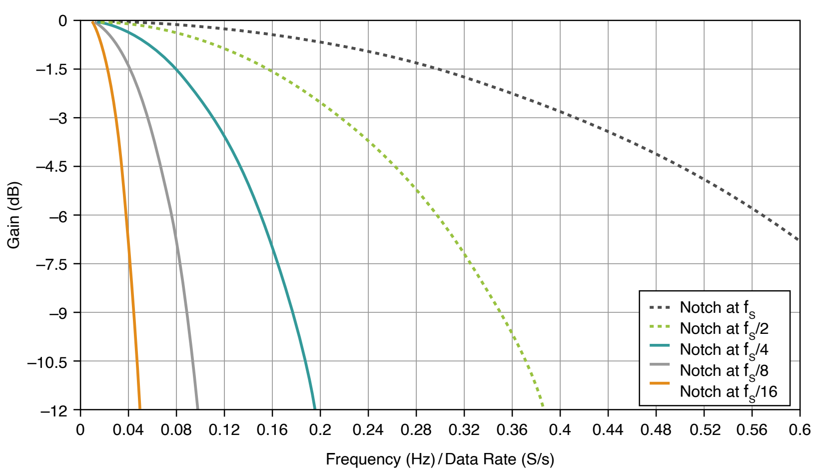
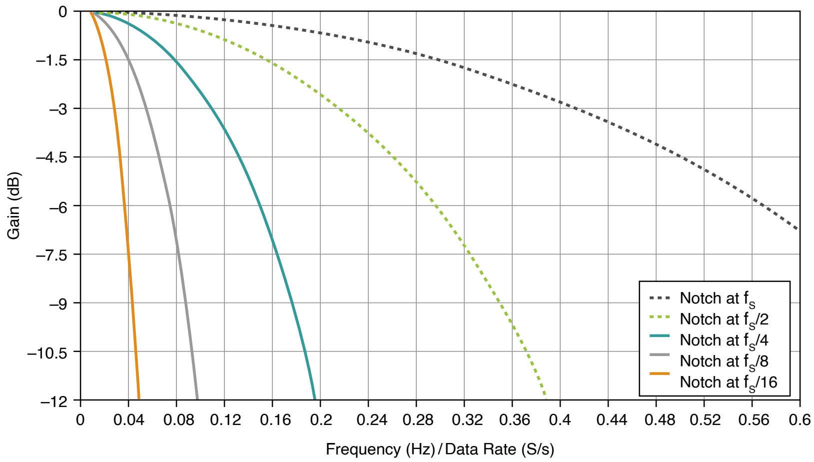
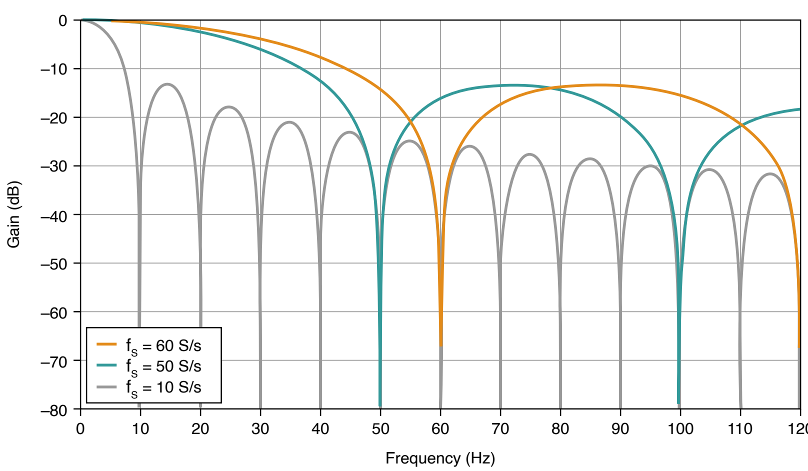


Figure 20. Typical Flatness for Filter Decimation Rate ≥ 8



The NI-9202 also supports power line frequency rejection. The 60 S/s data rate rejects 60 Hz noise and all harmonics of 60 Hz. The 50 S/s data rate rejects 50 Hz noise and all harmonics. The 10 S/s data rate rejects 50 Hz and 60 Hz noise and all harmonics. The following figure shows the typical frequency response for these three data rates. Refer to **Input Characteristics** in the **NI-9202 Specifications** for the minimum NMRR.

Figure 21. Typical Frequency Response at 60 S/s, 50 S/s, and 10 S/s



The -3 dB bandwidth will also be a function of data rate and filter setting, as shown in the following figures.

Figure 22. Typical -3 dB Bandwidth/Data Rate vs Data Rate and Filter Settings

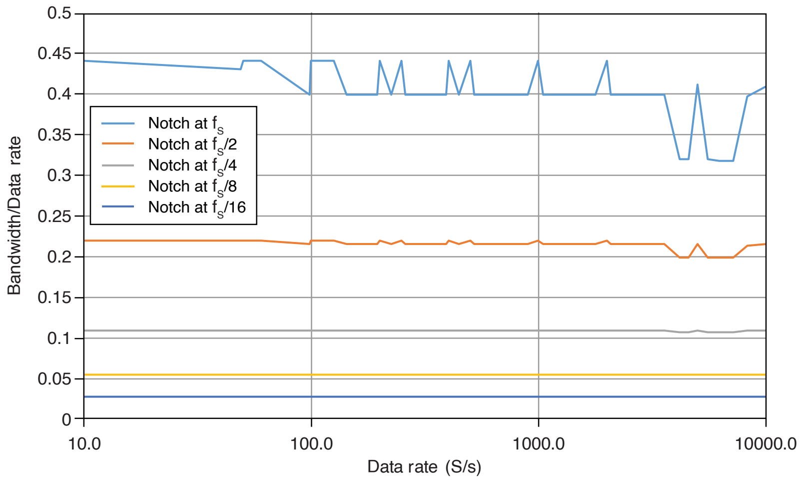
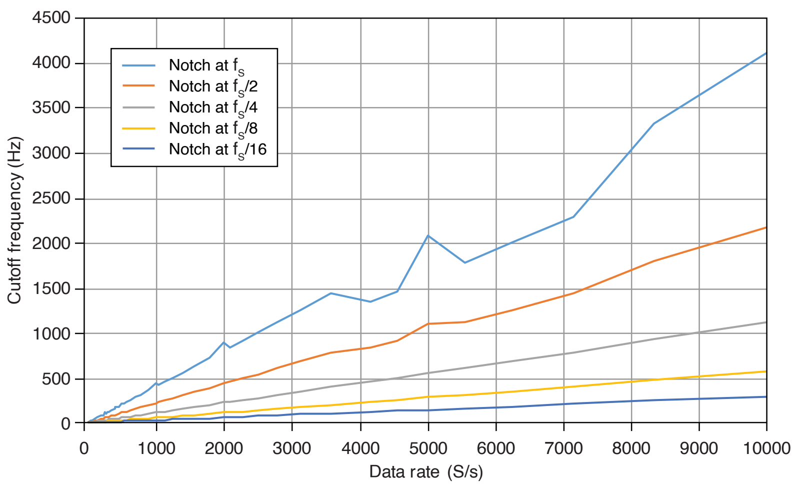


Figure 23. Typical -3 dB Bandwidth vs Data Rate and Filter Settings



NI-9202 Data Rates

The frequency of a master timebase (f_M) controls the data rate (f_s) of the NI-9202. The NI-9202 includes an internal master timebase with a frequency of 12.8 MHz. Using the internal master timebase of 12.8 MHz results in data rates of 10 kS/s, 8333.3 S/s, 7142.9 S/s, 6250 S/s, and so on down to 10 S/s, depending on the decimation rates and the values of the clock dividers. However, the data rate must remain within the appropriate data rate range. Power line frequency rejection is supported through the data rates of 60 S/s, 50 S/s and 10 S/s when using the internal master timebase or when using an external master timebase of 13.1072 MHz or 12.8 MHz.

The following equation provides the available data rates of the NI-9202:

$$f_s = \frac{f_M}{a \times b \times c \times d}$$

where

- a is the ADC Decimation Rate (32, 64, 128, 256, 512, 1024)
- b is the Timebase Clock Divider (integer between 1 and 11)
- c is the ADC Clock Divider (4 or 8)
- d is the Filter Decimation Rate (2, 4, 5, 8, 25, 64, 71, 119, 125)

Note f_M/b must be greater than or equal to 1 MHz and less than 6.575 MHz.

The following table lists available data rates with the internal master timebase.

Table 5. Available Data Rates with the Internal Master Timebase

f_s (S/s)	ADC Decimation Rate	Timebase Clock Divider	ADC Clock Divider	Filter Decimation Rate
10000.0	32	2	4	5
8333.3	32	3	4	4
7142.9	32	7	4	2
6250.0	128	1	8	2
5555.6	32	9	4	2
5000.0	64	2	4	5
4545.5	32	11	4	2
4166.7	128	3	4	2
3571.4	32	7	4	4
3125.0	128	1	8	4
2777.8	32	9	4	4
2500.0	64	5	4	4

f_S (S/s)	ADC Decimation Rate	Timebase Clock Divider	ADC Clock Divider	Filter Decimation Rate
2272.7	32	11	4	4
2083.3	128	3	4	4
2000.0	32	2	4	25
1785.7	64	7	4	4
1562.5	256	1	8	4
1388.9	64	9	4	4
1250.0	128	5	4	4
1136.4	64	11	4	4
1041.7	256	3	4	4
1000.0	64	2	4	25
892.9	128	7	4	4
781.3	512	1	8	4
694.4	128	9	4	4
625.0	256	5	4	4
568.2	128	11	4	4
520.8	512	3	4	4
500.0	128	2	4	25
446.4	256	7	4	4
400.0	32	2	4	125
390.6	1024	1	8	4
347.2	256	9	4	4
312.5	512	5	4	4
284.1	256	11	4	4
260.4	1024	3	4	4
250.0	256	2	4	25
223.2	512	7	4	4
200.0	64	2	4	125
195.3	1024	4	4	4
142.0	512	11	4	4
125.0	512	2	4	25
100.0	128	2	4	125

f_S (S/s)	ADC Decimation Rate	Timebase Clock Divider	ADC Clock Divider	Filter Decimation Rate
97.7	1024	8	4	4
60.0	64 or 256	7 or 3	4	119 or 71
50.0	512 or 1024	5 or 8	4	25 or 8
10.0	512 or 1024	5	4	125 or 64

The NI-9202 can also accept an external master timebase or export its own master timebase. To synchronize the data rate of an NI-9202 with other modules that use master timebases to control sampling, all of the modules must share a single master timebase source. When using an external timebase with a frequency other than 12.8 MHz, the available data rates (with the exception of 60 S/s, 50 S/s and 10 S/s) of the NI-9202 shift by the ratio of the external timebase frequency to the internal timebase frequency. Refer to the software help for information about configuring the master timebase source for the NI-9202.

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

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.

Related information:

- Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT

Conditions

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

NI-9202 Nomenclature

In this article, the NI-9202 with spring terminal and NI-9202 with DSUB are referred to inclusively as the NI-9202.

Input Characteristics

Number of channels	16 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-Sigma with analog prefiltering
Sampling mode	Simultaneous
Internal master timebase (f_M)	
Frequency	12.8 MHz
Accuracy	±50 ppm maximum
Data rate range (f_s)	
Using internal master timebase	
Minimum	10 S/s
Maximum	10 kS/s
Using external master timebase	
Minimum	3.81 S/s
Maximum	10.273 kS/s
Data rate	$f_s = \frac{f_M}{a \times b \times c \times d}$
Overvoltage protection	±30 V

Input resistance (AIx to COM)	>10 GΩ
Input voltage range (Differential)	
Minimum	10.50 V
Typical	10.58 V
Scaling coefficients	
10 kS/s, 5 kS/s	2,017,990 pV/LSB
60 S/s	1,356,632 pV/LSB
2 kS/s, 1 kS/s, 500 S/s, 250 S/s, 125 S/s, 50 S/s	1,614,392 pV/LSB
400 S/s, 200 S/s, 100 S/s, 10 S/s	1,291,513 pV/LSB
60 S/s	2,273,791 pV/LSB
All other data rates	1,261,244 pV/LSB
Maximum input voltage (AIx to COM)	±10.5 V
Input delay	$\frac{(A+B)}{f_S} + C$
Settling time	$\frac{2(A+B)}{f_S} + C$

Table 2. Input Delay

Variable	Value
A	0.8 for f_S = 10 to 60, 100, 125, 200, 250, 400, 500, 1000, 2000

Variable	Value
	1.4 for f_S = 97.7 to 2083.3, 2500, 3125, 5000, 10000
	1.8 for f_S = 2272.7 to 4166.7, 6250, 8333.3
	2.6 for f_S = 4545.5, 5555.6, 7142.9
B	0 for filter notch at f_S
	0.5 for filter notch at $f_S/2$
	1.5 for filter notch at $f_S/4$
	3.5 for filter notch at $f_S/8$
	7.5 for filter notch at $f_S/16$
C	8.5 µs

Table 3. DC Accuracy

Measurement Conditions	Percent of Reading (Gain Error)	Percent of Range (Offset Error)
Maximum (-40 °C to 70 °C)	±0.25%	±0.17%
Typical (23 °C, ±5 °C)	±0.06%	±0.04%

Non-linearity	5 ppm
Stability of Accuracy	
Gain drift	5.3 ppm/°C
Offset drift	34.5 µV/°C
Passband, -3 dB	Refer to the -3 dB graphs in the Passband section
Phase linearity (f_{in} ≤ 4.9 kHz)	0.07° maximum
Channel-to-channel mismatch (f_{in} ≤ 4.9 kHz)	
Gain	0.2 dB maximum
Phase	0.24°/kHz maximum

Module-to-module mismatch ($f_{in} \leq 4.9$ kHz)	
Phase	$0.24°/kHz + 360°f_{in}/f_M$
Attenuation @ 2 x oversample rate (23° C)	
f_s = 10000.0 S/s	95 dB @ 581.818 kHz
f_s = 4545.5 S/s	85 dB @ 3.2 MHz

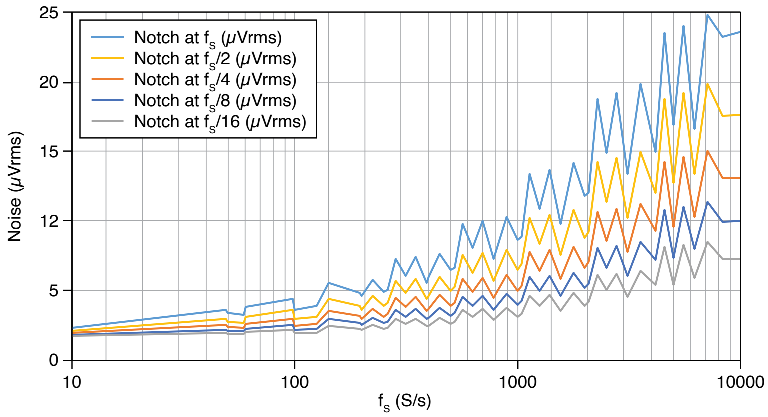
Table 4. Idle Channel Noise

f_s (S/s)	ADC Decimation Rate	Filter Notch at f_s (µVrms)	Filter Notch at $f_s/2$ (µVrms)	Filter Notch at $f_s/4$ (µVrms)	Filter Notch at $f_s/8$ (µVrms)	Filter Notch at $f_s/$16(µVrms)
10000.0	32	23.5	17.6	13.0	9.9	7.2
5000.0	64	16.8	12.7	9.5	7.3	5.4
6250.0	128	16.6	13.3	10.2	7.9	5.8
1562.5	256	9.7	7.5	5.8	4.6	3.5
781.3	512	7.2	5.6	4.4	3.6	2.8
390.6	1,024	5.5	4.3	3.5	2.9	2.4

Note The noise specifications assume the NI-9202 is using the internal master timebase frequency of 12.8 MHz.

Note The noise is dominated by the ADC Decimation Rate.

Figure 12. Idle Channel Noise vs Data Rate and Filter Settings.



Crosstalk (CH to CH)	
NI-9202 with spring terminal	
$f_{in} \leq 100$ Hz	100 dB
$f_{in} \leq 1$ kHz	80 dB
$f_{in} \leq 3$ kHz	70 dB
NI-9202 with DSUB	
$f_{in} \leq 100$ Hz	105 dB
$f_{in} \leq 1$ kHz	85 dB
$f_{in} \leq 3$ kHz	75 dB
Common mode rejection ratio (CMRR) to COM	
$f_{in} \leq 60$ Hz	72 dB typical, 67 dB minimum
Common mode rejection ratio (CMRR) to Earth Ground	
$f_{in} \leq 60$ Hz	125 dB minimum
Normal mode rejection ratio (NMRR) using internal or external master timebase of 12.8 MHz	

60 S/s, f_{in} = 60 Hz ± 1 Hz	35 dB minimum
50 S/s, f_{in} = 50 Hz ± 1 Hz	33 dB minimum
10 S/s, f_{in} = 50 Hz/60 Hz ± 1 Hz	34 dB minimum
Normal mode rejection ratio (NMRR) using external master timebase of 13.1072 MHz	
60 S/s, f_{in} = 60 Hz ± 1 Hz	34 dB minimum
50 S/s, f_{in} = 50 Hz ± 1 Hz	33 dB minimum
10 S/s, f_{in} = 50 Hz/60 Hz ± 1 Hz	33 dB minimum

Related concepts:

- NI-9202 Filtering

NI-9202 Filtering

The NI-9202 uses a combination of analog and digital filtering to provide an accurate representation of in-band signals while rejecting out-of-band signals. The filters discriminate between signals based on the frequency range, or bandwidth, of the signal.

The NI-9202 represents signals within the passband, as quantified primarily by passband flatness and phase linearity.

The NI-9202 has a comb frequency response, characterized by deep, evenly spaced notches and an overall roll-off towards higher frequencies. The NI-9202 provides five available filter options for every data rate. The different options provide a trade-off of noise rejection (refer to Idle Channel Noise table) for filter settling time (refer to Settling Time equation) and latency (refer to Input Delay equation). To control the response of the programmable comb filter, you can select to have the first notch at 1, 1/2, 1/4, 1/8 or 1/16 of the sampling frequency. The following figures show the overall filter response with different filter settings.

Figure 13. Filter Response for Filter Decimation Rate 2

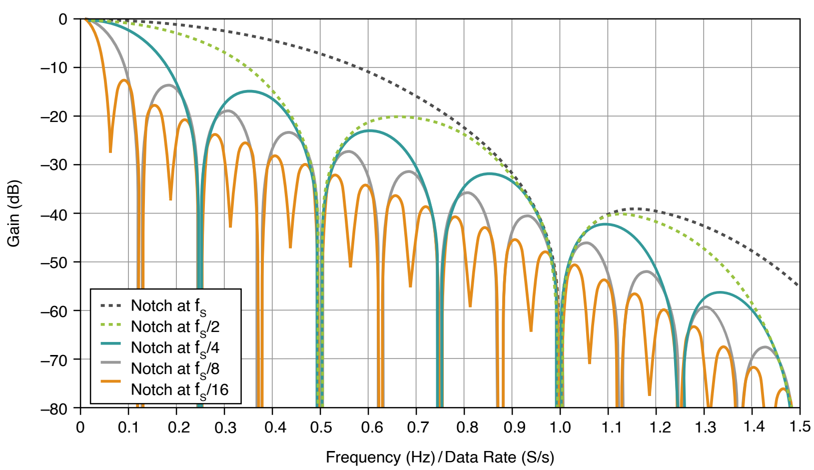


Figure 14. Filter Response for Filter Decimation Rate 4

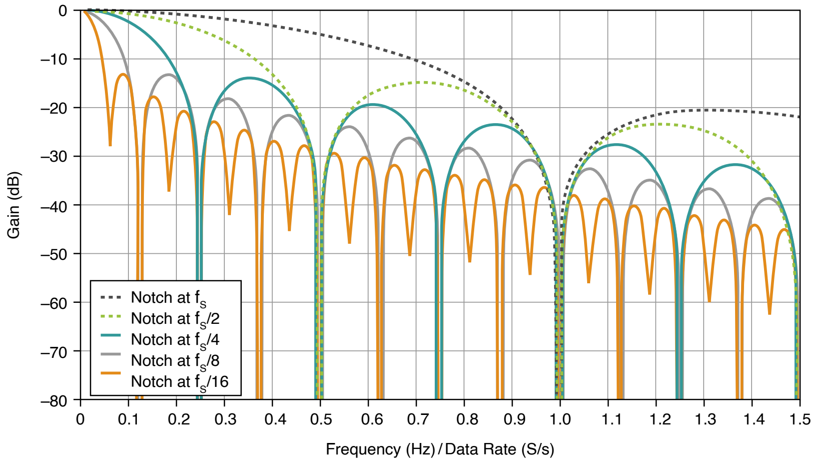


Figure 15. Filter Response for Filter Decimation Rate 5

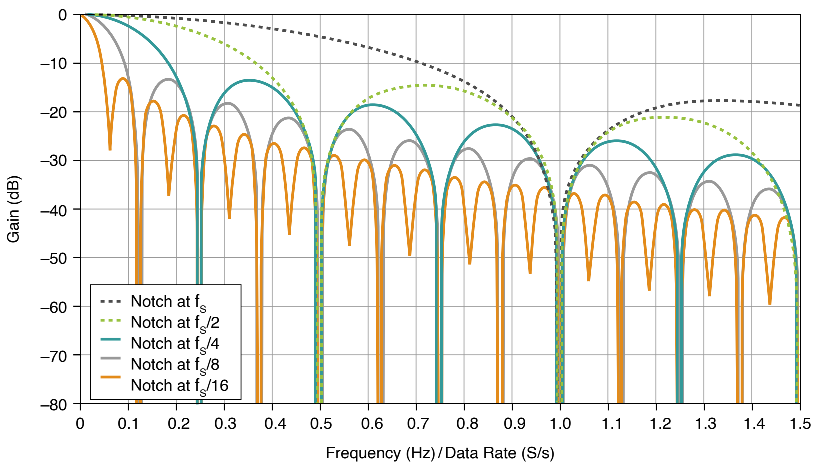
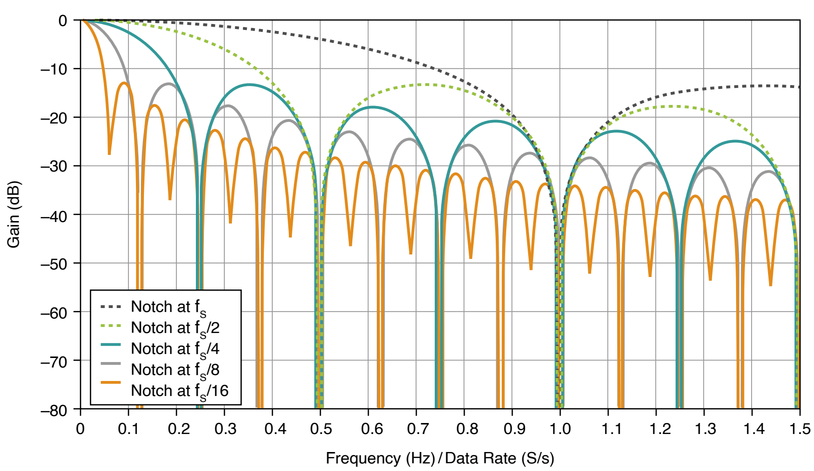


Figure 16. Filter Response for Filter Decimation Rate ≥ 8



Related concepts:

- NI-9202 Data Rates

Related reference:

- Input Characteristics

NI-9202 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 programmable comb filters of the NI-9202 adjust the frequency range of the passband to match the data rate and filter setting. Therefore, the amount of gain or attenuation at a given frequency depends on the data rate and filter setting.

Figure 17. Typical Flatness for Filter Decimation Rate 2

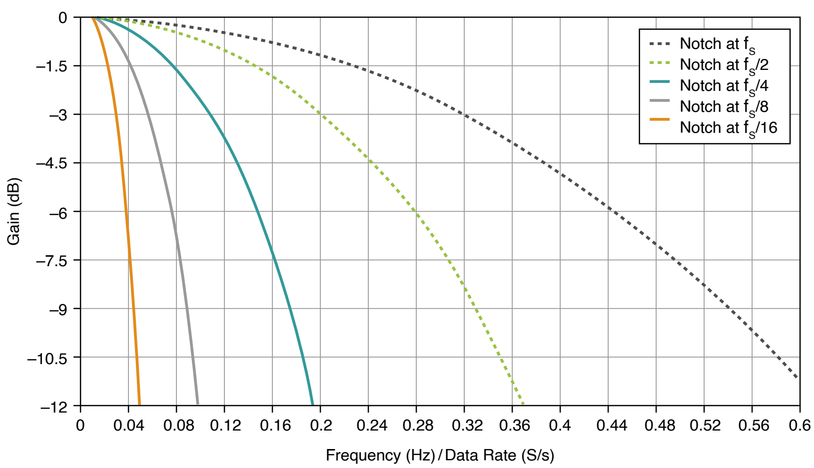
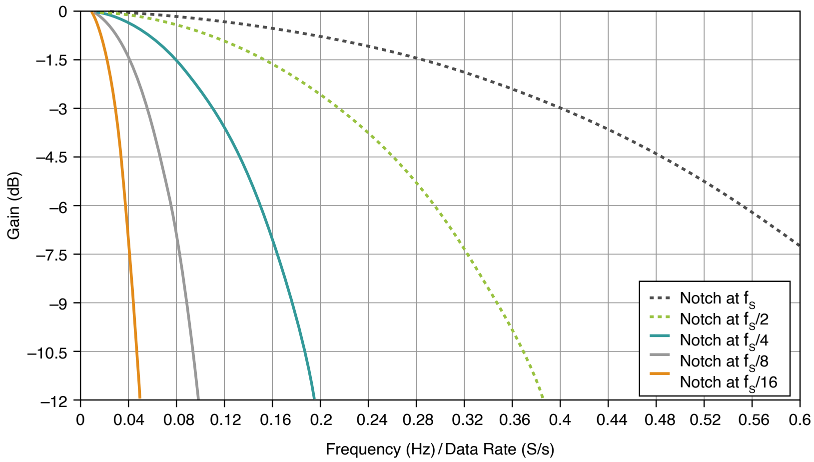


Figure 18. Typical Flatness for Filter Decimation Rate 4



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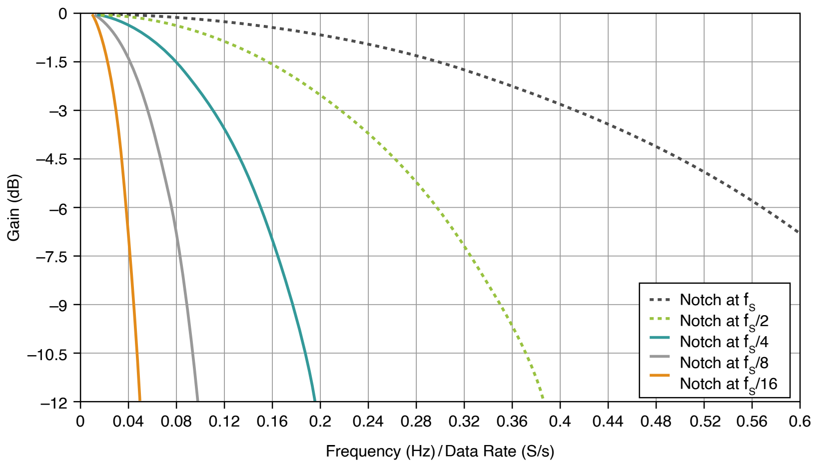
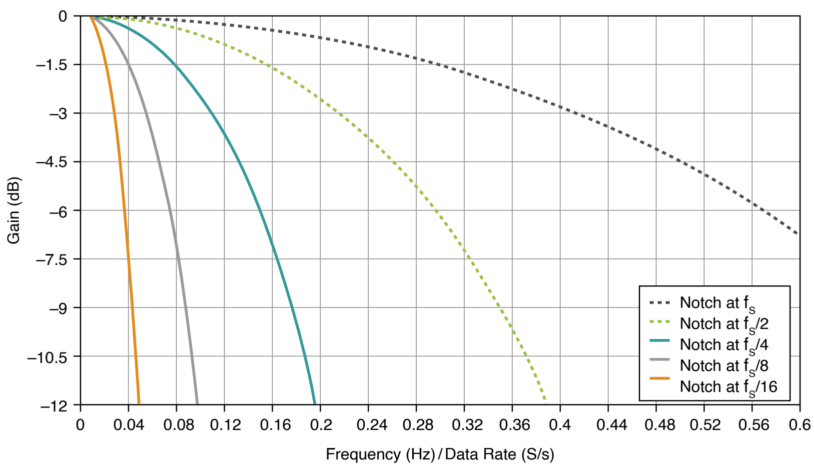
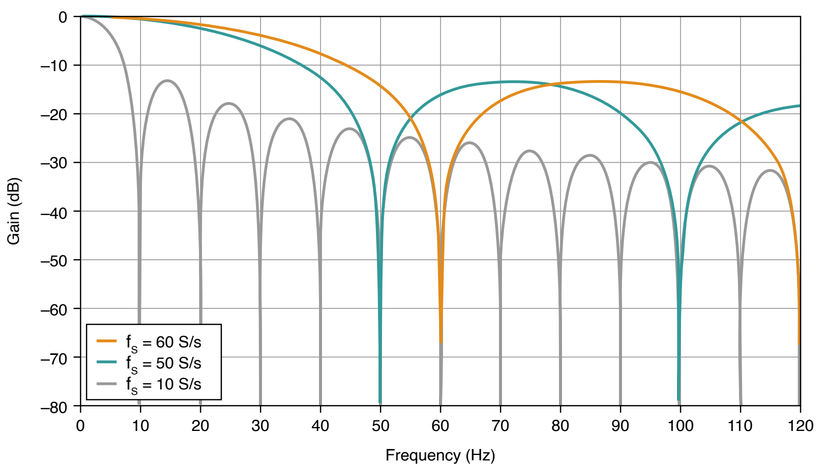


Figure 20. Typical Flatness for Filter Decimation Rate ≥ 8



The NI-9202 also supports power line frequency rejection. The 60 S/s data rate rejects 60 Hz noise and all harmonics of 60 Hz. The 50 S/s data rate rejects 50 Hz noise and all harmonics. The 10 S/s data rate rejects 50 Hz and 60 Hz noise and all harmonics. The following figure shows the typical frequency response for these three data rates. Refer to **Input Characteristics** in the **NI-9202 Specifications** for the minimum NMRR.

Figure 21. Typical Frequency Response at 60 S/s, 50 S/s, and 10 S/s



The -3 dB bandwidth will also be a function of data rate and filter setting, as shown in the following figures.

Figure 22. Typical -3 dB Bandwidth/Data Rate vs Data Rate and Filter Settings

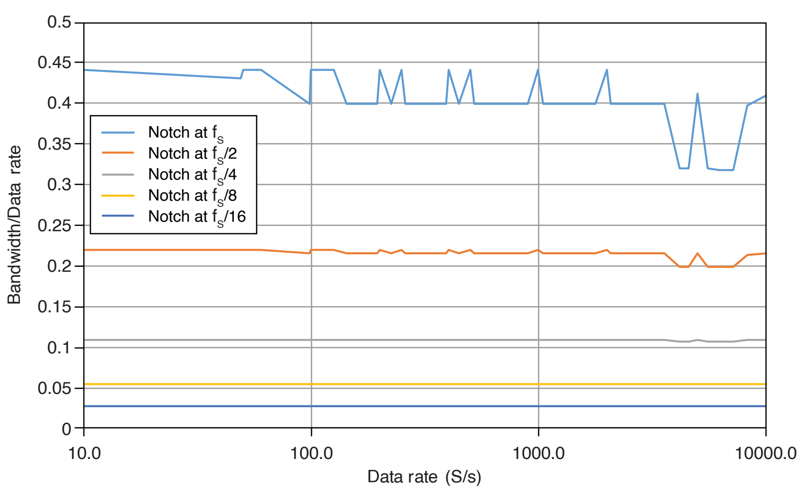
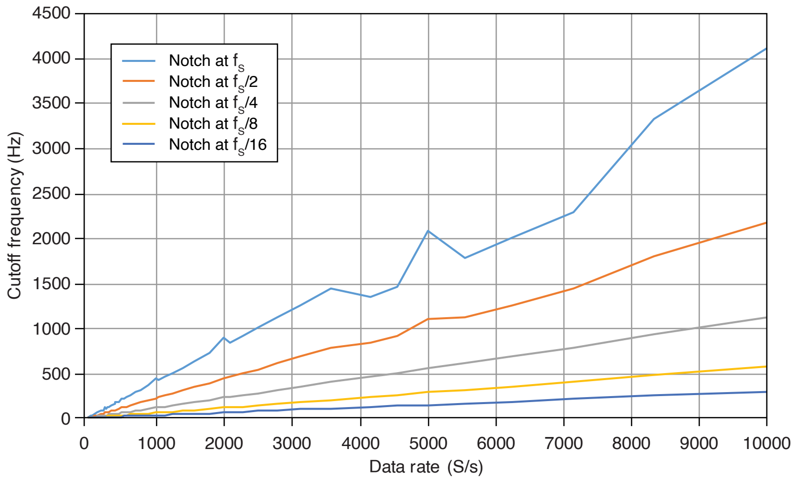


Figure 23. Typical -3 dB Bandwidth vs Data Rate and Filter Settings



NI-9202 Data Rates

The frequency of a master timebase (f_M) controls the data rate (f_s) of the NI-9202. The NI-9202 includes an internal master timebase with a frequency of 12.8 MHz. Using the internal master timebase of 12.8 MHz results in data rates of 10 kS/s, 8333.3 S/s, 7142.9 S/s, 6250 S/s, and so on down to 10 S/s, depending on the decimation rates and the values of the clock dividers. However, the data rate must remain within the appropriate data rate range. Power line frequency rejection is supported through the data rates of 60 S/s, 50 S/s and 10 S/s when using the internal master timebase or when using an external master timebase of 13.1072 MHz or 12.8 MHz.

The following equation provides the available data rates of the NI-9202:

$$f_s = \frac{f_M}{a \times b \times c \times d}$$

where

- a is the ADC Decimation Rate (32, 64, 128, 256, 512, 1024)
- b is the Timebase Clock Divider (integer between 1 and 11)
- c is the ADC Clock Divider (4 or 8)
- d is the Filter Decimation Rate (2, 4, 5, 8, 25, 64, 71, 119, 125)

Note f_M/b must be greater than or equal to 1 MHz and less than 6.575 MHz.

The following table lists available data rates with the internal master timebase.

Table 5. Available Data Rates with the Internal Master Timebase

f_s (S/s)	ADC Decimation Rate	Timebase Clock Divider	ADC Clock Divider	Filter Decimation Rate
10000.0	32	2	4	5
8333.3	32	3	4	4
7142.9	32	7	4	2
6250.0	128	1	8	2

f_S (S/s)	ADC Decimation Rate	Timebase Clock Divider	ADC Clock Divider	Filter Decimation Rate
5555.6	32	9	4	2
5000.0	64	2	4	5
4545.5	32	11	4	2
4166.7	128	3	4	2
3571.4	32	7	4	4
3125.0	128	1	8	4
2777.8	32	9	4	4
2500.0	64	5	4	4
2272.7	32	11	4	4
2083.3	128	3	4	4
2000.0	32	2	4	25
1785.7	64	7	4	4
1562.5	256	1	8	4
1388.9	64	9	4	4
1250.0	128	5	4	4
1136.4	64	11	4	4
1041.7	256	3	4	4
1000.0	64	2	4	25
892.9	128	7	4	4
781.3	512	1	8	4
694.4	128	9	4	4
625.0	256	5	4	4
568.2	128	11	4	4
520.8	512	3	4	4
500.0	128	2	4	25
446.4	256	7	4	4
400.0	32	2	4	125
390.6	1024	1	8	4
347.2	256	9	4	4
312.5	512	5	4	4
284.1	256	11	4	4

f_s (S/s)	ADC Decimation Rate	Timebase Clock Divider	ADC Clock Divider	Filter Decimation Rate
260.4	1024	3	4	4
250.0	256	2	4	25
223.2	512	7	4	4
200.0	64	2	4	125
195.3	1024	4	4	4
142.0	512	11	4	4
125.0	512	2	4	25
100.0	128	2	4	125
97.7	1024	8	4	4
60.0	64 or 256	7 or 3	4	119 or 71
50.0	512 or 1024	5 or 8	4	25 or 8
10.0	512 or 1024	5	4	125 or 64

The NI-9202 can also accept an external master timebase or export its own master timebase. To synchronize the data rate of an NI-9202 with other modules that use master timebases to control sampling, all of the modules must share a single master timebase source. When using an external timebase with a frequency other than 12.8 MHz, the available data rates (with the exception of 60 S/s, 50 S/s and 10 S/s) of the NI-9202 shift by the ratio of the external timebase frequency to the internal timebase frequency. Refer to the software help for information about configuring the master timebase source for the NI-9202.

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

Related concepts:

- NI-9202 Filtering

Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage	
Channel-to-COM	±30 V DC maximum, up to 6 channels at a time

NI-9202 with Spring Terminal Isolation Voltages

Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand (up to 5,000 m)	3,000 V RMS, verified by a 5 s dielectric withstand test

Measurement Category II

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

Attention Ne pas connecter le produit à des signaux dans les catégories de mesure III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.

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.

NI-9202 with DSUB Isolation Voltages

Channel-to-channel	None
Channel-to-earth ground	

Continuous	60 V DC, Measurement Category I
Withstand	
up to 2,000 m	1,000 V RMS, verified by a 5 s dielectric withstand test
up to 5,000 m	500 V RMS

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	0.95 W maximum
Sleep mode	53 µW maximum
Thermal dissipation	
Active mode	1.30 W maximum
Sleep mode	0.64 W maximum

Physical Characteristics

Spring terminal wiring	
Gauge	0.14 mm to 1.5 mm (26 AWG to 16 AWG) copper conductor wire
Wire strip length	10 mm (0.394 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Wires per spring terminal	One wire per spring terminal; two wires per spring terminal using a 2-wire ferrule
Ferrules	
Single ferrule, uninsulated	0.14 mm to 1.5 mm (26 AWG to 16 AWG) 10 mm barrel length
Single ferrule, insulated	0.14 mm to 1.0 mm (26 AWG to 18 AWG) 12 mm barrel length
Two-wire ferrule, insulated	2× 0.34 mm (2× 22 AWG) 12 mm barrel length
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-9202 with spring terminal	138.6 g (4.9 oz)
NI-9202 with DSUB	149.0 g (5.3 oz)