NI-9252

Specifications

Provided by:

Test & Measurement Automation

Embedded Control & Monitoring

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Authorized Distributor

Integration Partner

Contents

NI-9252 Specifications

Connector Types

The NI-9252 has more than one connector type: NI-9252 with screw terminal and NI-9252 with DSUB. Unless the connector type is specified, NI-9252 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.

Related information:

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

NI-9252 Pinout

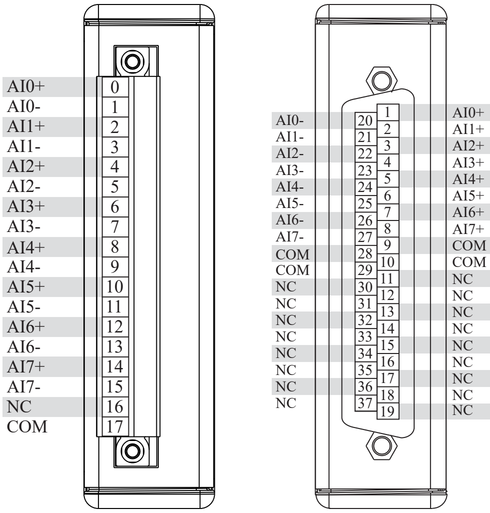


Table 1. Signal Descriptions

Signal	Description
AI+	Positive analog input signal connection
AI-	Negative analog input signal connection
COM	Common reference connection to isolated ground
NC	No connection

Conditions

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

NI-9252 with DSUB Isolation Voltages

Channel-to-channel	None
Channel-to-earth ground isolation	
Up to 3,000 m altitude	
Continuous	60 V DC, Measurement Category I

Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test
Up to 5,000 m altitude	
Continuous	60 V DC, Measurement Category I
Withstand	860 V RMS

Caution Do not connect the NI-9252 with DSUB to signals or use for measurements within Measurement Categories II, III, or IV.

Attention Ne connectez pas le NI-9252 with DSUB à des signaux et ne l'utilisez pas pour effectuer des mesures dans les catégories de mesure II, III ou IV.

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.

Input Characteristics

Number of channels	8 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
CompactRIO & CompactDAQ chassis data rate range (f_s)	
Using internal master timebase	
Minimum	10 S/s
Maximum	50 kS/s
Using external master timebase	
Minimum	0.78 S/s
Maximum	51.367 kS/s
R Series Expansion chassis data rate range (f_s)	
Using internal master timebase	
Minimum	10 S/s
Maximum	25 kS/s
Data rate[1]	$f_s = \frac{f_M}{128 \times a}$
Overvoltage protection[2]	±30 V

1. Refer to ***Available Data Rates with the Internal Master Timebase*** for the value of the decimation rate, a

Input resistance (AIx to COM)	>10 GΩ
Input voltage range (Differential)	
Minimum	10.50 V
Typical	10.58 V
Scaling coefficients	1,261,244 pV/LSB
Maximum input voltage (AIx to COM)	±10.5 V
Butterworth filter	
Filter order	2nd or 4th order
Cut-off frequencies[3]	$\frac{f_c \times f_M}{12.8\ MHz}$
Flatness Frequencies[4]	$\frac{f_F \times f_M}{12.8\ MHz}$
Input delay[5]	$\left(t_D - 2.17\ \mu s\right) \times \left(\frac{12.8\ MHz}{f_M}\right) + 2.17\ \mu s$
Input delay tolerance	$\pm 100\ ns + \left(\frac{1}{f_M}\right)$ maximum

2. Up to 4 channels simultaneously
3. Refer to ***Butterworth Filter Cut-off Frequencies and Flatness*** for the values of f_c and f_M.

Table 2. Butterworth Filter Cut-off Frequencies and Flatness

Master Timebase Clock (f_M)	Cut-off Frequencies (f_c)	2nd Order		4th Order	
		0.1% or 0.0087 dB Flatness Frequencies(f_F)	1% or 0.087 dB Flatness Frequencies(f_F)	0.1% or 0.0087 dB Flatness Frequencies(f_F)	1% or 0.087 dB Flatness Frequencies(f_F)
12.8 MHz	4000 Hz	740 Hz	1445 Hz	1125 Hz	2295 Hz
	2000 Hz	415 Hz	750 Hz	875 Hz	1210 Hz
	1000 Hz	215 Hz	380 Hz	430 Hz	615 Hz
	500 Hz	105 Hz	190 Hz	225 Hz	305 Hz
	250 Hz	55 Hz	95 Hz	115 Hz	155 Hz
	125 Hz	25 Hz	45 Hz	60 Hz	75 Hz

Note The specifications in ***Butterworth Filter Cut-off Frequencies and Flatness*** scale linearly with the master timebase frequency as indicated by the formulas shown in the ***Butterworth filter*** section. For example, on a 2nd Order Butterworth filter, for a master timebase clock of 13.1072 MHz, the cut-off frequency is 4096 Hz and 757.7 Hz of 0.1% Flatness instead of the cut-off frequency of 4000 Hz and 740 Hz of 0.1% Flatness at the 12.8 MHz default internal master timebase clock.

Table 3. Butterworth Filter Input Delay

Master Timebase Clock (f_M)	Cut-off Frequencies (f_c)	2nd Order		4th Order	
		DC Delay (t_D)	Maximum Delay (t_D)	DC Delay (t_D)	Maximum Delay (t_D)
12.8 MHz	4000 Hz	98.0 µs	104.6 µs	136.1 µs	158.0 µs
	2000 Hz	153.4 µs	166.9 µs	238.7 µs	282.6 µs
	1000 Hz	266.2 µs	292.9 µs	449.1 µs	538.8 µs
	500 Hz	491.2 µs	544.4 µs	861.5 µs	1038.0 µs
	250 Hz	941.3 µs	1047.7 µs	1700.2 µs	2059.7 µs

4. Refer to ***Butterworth Filter Cut-off Frequencies and Flatness*** for the values of f_F and f_M.
5. Refer to ***Butterworth Filter Input Delay*** for the values of t_D and f_M.

Master Timebase Clock (f_M)	Cut-off Frequencies (f_c)	2nd Order		4th Order	
		DC Delay (t_D)	Maximum Delay (t_D)	DC Delay (t_D)	Maximum Delay (t_D)
	125 Hz	1841.5 µs	2054.2 µs	3346.9 µs	4055.4 µs

Note The specifications in ***Butterworth Filter Input Delay*** scale with the master timebase frequency as indicated by the formulas shown in the ***Butterworth filter*** section. For example, for a master timebase clock of 13.1072 MHz, the 2nd order Butterworth filter with a 4096 Hz cut-off will have a 95.754 µs input DC delay.

Figure 1. Butterworth Filter Input Delay (4th Order, with 12.8 MHz Timebase, 4000 Hz, 2000 Hz, 1000 Hz)

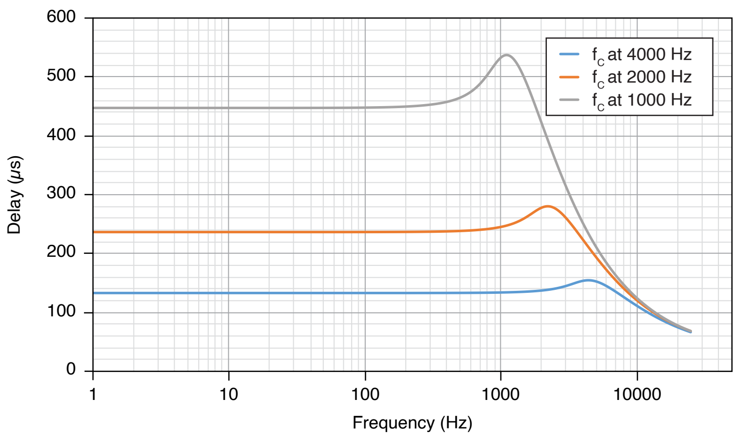


Figure 1. Butterworth Filter Input Delay (4th Order, with 12.8 MHz Timebase, 500 Hz, 250 Hz, 125 Hz)

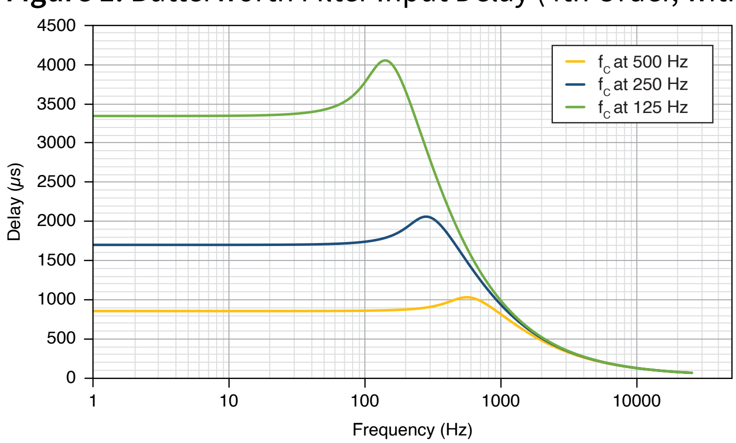


Figure 1. Butterworth Filter Input Delay (2nd Order, with 12.8 MHz Timebase, 4000 Hz, 2000 Hz, 1000

Hz)

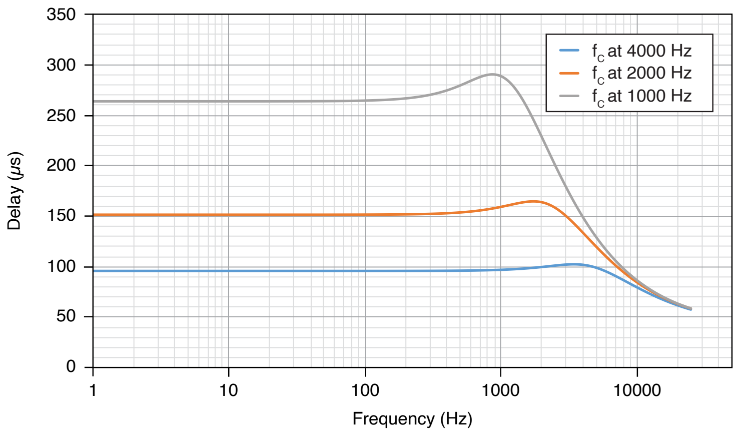
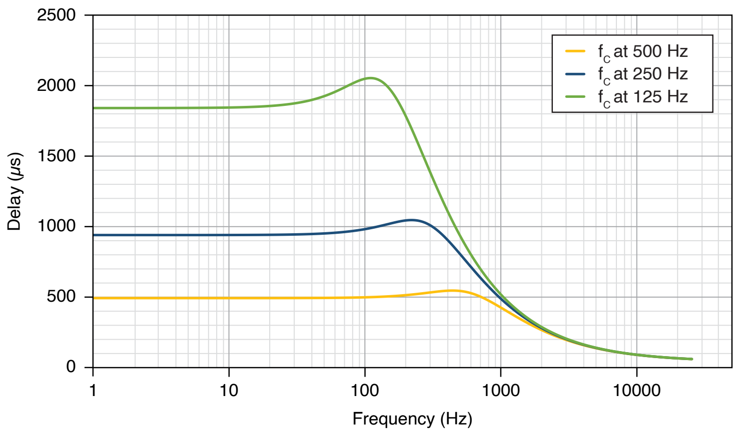


Figure 1. Butterworth Filter Input Delay (2nd Order, with 12.8 MHz Timebase, 500 Hz, 250 Hz, 125 Hz)



Comb filter[6]	
Programmable first notch	f_S, $f_S/2$, $f_S/4$, $f_S/8$, $f_S/16$
Input delay[7]	$\frac{(A+B)}{f_s} + 2.17\ \mu s$
Input delay tolerance	$\pm 100\ ns + \left(\frac{1}{f_M}\right)$ maximum
Settling time	$\frac{2(A+B)}{f_s} + 2.17\ \mu s$

Table 4. Input Delay with Comb Filter

Variable	Value
A	2.4 for f_S = 50000
	1.8 for f_S = 14285.71 to 33333.33
	1 for f_S = 2777.78 to 12500
	0.6 for f_S = all other output data rates
B	0 for filter first notch at f_S
	0.5 for filter first notch at $f_S/2$
	1.5 for filter first notch at $f_S/4$
	3.5 for filter first notch at $f_S/8$
	7.5 for filter first notch at $f_S/16$

Table 5. DC Accuracy

Measurement Conditions	Percent of ReadingGUID-A160F7D8-1EEE-44C0-934C-E55C58C3248A.html#GUID-A160F7D8-1EEE-44C0-934C-E55C58C3248A__CMRR[8] (Gain Error)	Percent of Range[9] (Offset Error)
Maximum (-40 °C to 70 °C)	±0.22%	±0.08%
Typical (23 °C, ±5 °C)	±0.06%	±0.01%

Non-linearity	5 ppm
Stability of Accuracy	
Gain driftGUID-A160F7D8-1EEE-44C0-934C-E55C58C3248A.html#GUID-	7.2

6. See the subsequent ***Input Delay with Comb Filter*** table for the values of A and B.
7. Refer to ***Input Delay with Comb Filter*** for the values of A and B.
8. Includes the expected difference in measurement between using single-ended and differential sources due to finite CMRR
9. Range equals 10.58 V

A160F7D8-1EEE-44C0-934C-E55C58C3248A__CMRR	ppm/°C
Offset drift	6.4 µV/°C
Passband, -3 dB	Refer to the -3 dB graphs in the ***Filtering*** section
Delay linearity (f_{in} ≤ 24.9 kHz)	11.16 ns maximum
Channel-to-channel mismatch (f_{in} ≤ 24.9 kHz)	
Gain	0.2 dB maximum
Delay	166.67 ns maximum
Module-to-module mismatch (f_{in} ≤ 24.9 kHz)	
Delay	$166.67\ ns + \frac{1}{f_M}$ maximum
Attenuation @ 2 x oversample rate (23° C)	110 dB
Idle Channel Noise	
Comb filter with first notch at f_s	
f_s = 50 kS/s	27.2 µVRMS
f_s = 10 kS/s	14.7 µVRMS

$f_s = 1$ kS/s	5.5 µVRMS
$f_s \leq 250$ S/s	3.7 µVRMS
Butterworth filter, $f_s = 50$ kS/s	
$f_c = 4$ kHz	14.5 µVRMS
$f_c = 1$ kHz	7.9 µVRMS
$f_c = 125$ Hz	3.7 µVRMS

Note The noise specifications assume the NI-9252 is using the internal master timebase frequency of 12.8 MHz.

Crosstalk (CH to CH)	
NI-9252 with screw terminal	
$f_{in} \leq 1$ kHz	120 dB
$f_{in} \leq 5$ kHz	105 dB
$f_{in} \leq 20$ kHz	80 dB
NI-9252 with DSUB	
$f_{in} \leq 1$ kHz	115 dB

$f_{in} \leq 5$ kHz	100 dB
$f_{in} \leq 20$ kHz	80 dB
Common mode rejection ratio (CMRR) to COM	
$f_{in} \leq 60$ Hz	74 dB typical, 69 dB minimum
Common mode rejection ratio (CMRR) to Earth Ground	
$f_{in} \leq 60$ Hz	120 dB minimum
Normal mode rejection ratio (NMRR) using internal or external master timebase of 12.8 MHzGUID-A160F7D8-1EEE-44C0-934C-E55C58C3248A.html#GUID-A160F7D8-1EEE-44C0-934C-E55C58C3248A__COMB[10]	
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	33 dB minimum
Normal mode rejection ratio (NMRR) using external master timebase of 13.1072 MHzGUID-A160F7D8-1EEE-44C0-934C-E55C58C3248A.html#GUID-A160F7D8-1EEE-44C0-934C-E55C58C3248A__COMB	
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. Only applicable for comb filter.

10 S/s, f_{in} = 50 Hz/60 Hz ± 1 Hz	33 dB minimum

NI-9252 with Screw Terminal Safety Voltages

Connect only voltages that are within the following limits:

Channel-to-channel isolation	None
Channel-to-earth ground isolation	
Up to 3,000 m altitude	
Continuous	250 V RMS, Measurement Category II
Withstand	3,000 V RMS, verified by a 5 s dielectric withstand test
Up to 5,000 m altitude	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test
Overvoltage protection	±30 V, between any two pins of the connector[11]

Caution When using the NI-9252 with screw terminal above 3,000 m or in explosive atmospheres, do not connect the NI-9252 with screw terminal to signals or use for measurements within Measurement Categories II, III, or IV.

11. Up to 4 channels simultaneously.

> **Attention** Lorsque vous utilisez le NI-9252 with screw terminal à une altitude supérieure à 3 000 m ou dans des atmosphères explosibles, ne le connectez pas à des signaux et ne l'utilisez pas pour effectuer des mesures dans les catégories de mesure II, III ou IV.

> **Caution** Do not connect the NI-9252 with screw terminal to signals or use for measurements within Measurement Categories III or IV.

> **Attention** Ne connectez pas le NI-9252 with screw terminal à des signaux et ne l'utilisez pas pour effectuer des mesures dans les catégories de mesure III ou 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.

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-9252 with screw terminal	5,000 m
NI-9252 with DSUB	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	91 µW maximum
Thermal dissipation (at 70 °C)	

Active mode	1.4 W maximum
Sleep mode	673 mW maximum

Physical Characteristics

Screw-terminal wiring

Gauge	0.05 mm^2 to 0.82 mm^2 (30 AWG to 18 AWG) copper conductor wire
Wire strip length	5 mm to 6 mm (0.20 in. to 0.24 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Torque for screw terminals	0.20 N · m to 0.25 N · m (1.8 lb · in. to 2.2 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 1.0 mm^2
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.3 N · m to 0.4 N · m (2.7 lb · in. to 3.5 lb · in.)

Weight	
NI-9252 with screw terminal	134 g (4.7 oz)
NI-9252 with DSUB	149 g (5.3 oz)

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9252 at ni.com/calibration.

Calibration interval	2 years