NI-9775
Specifications

Contents

NI-9775 Specifications

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.

Input Characteristics

Number of channels	4 (simultaneously sampled)
Input type	Referenced single-ended
Input impedance	1 MΩ

| Input capacitance	24 pF
Input coupling	DC
Input range	±10 V, nominal ±11.3 V, typical ±10.04 V, minimum
ADC resolution	14 bits
Overvoltage protection	±30 V DC, safe operating area

Figure 1. Safe Operating Area
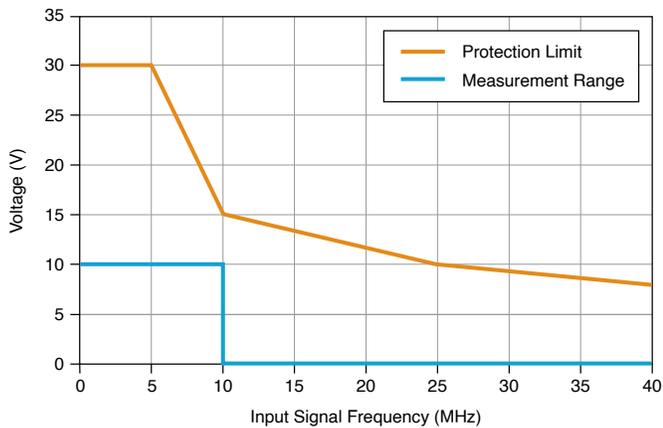
Table 1. DC Accuracy

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range[1] (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	±1.7%	±0.49%
	Typical (25 °C,	±0.32%	±0.08%

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range[1] (Offset Error)
	±5 °C)		
Uncalibrated[2]	Maximum (-40 °C to 70 °C)	±4.0%	±4.0%
	Typical (25 °C, ±5 °C)	±1.7%	±1.8%

DC gain drift	±140 ppm/°C
DC offset drift	±0.34 mV/°C
AC amplitude accuracy	±0.25 dB at 50 kHz
AC amplitude drift	±172 ppm/°C
Channel-to-channel crosstalk	< -90 dB at 5 MHz
Timing modes (software-selectable)	High-speed High-resolution
Analog filter (software-selectable)	6th order low-pass Bessel

Analog filter -3 dB bandwidth

High-speed mode with analog filter disabled	13.9 MHz

High-speed mode with analog filter enabled	4.7 MHz
High-resolution mode	2.36 MHz
Alias rejection in high-resolution mode	45 dB at 5 MS/s only

Figure 2. Frequency Response in High-Speed Mode with Analog Filter Disabled
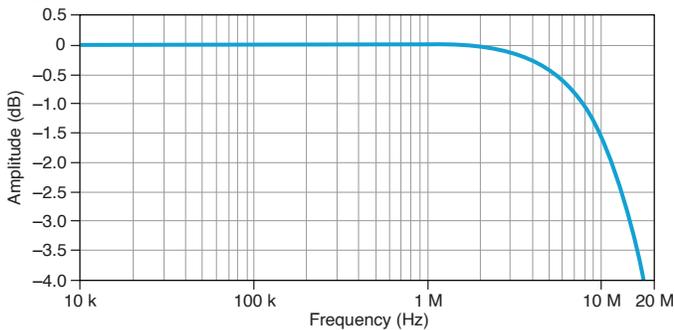

**Figure 3.** Frequency Response in High-Speed Mode with Analog Filter Enabled
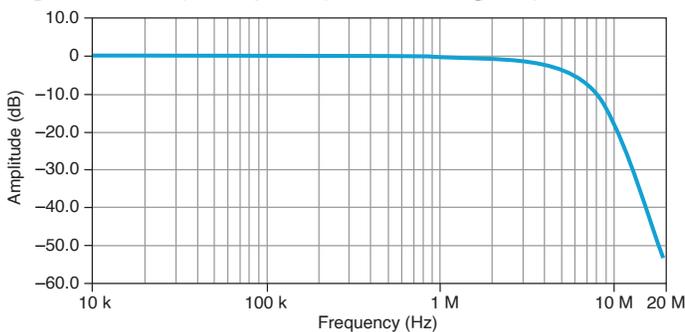
**Figure 4.** Frequency Response in High-Resolution Mode
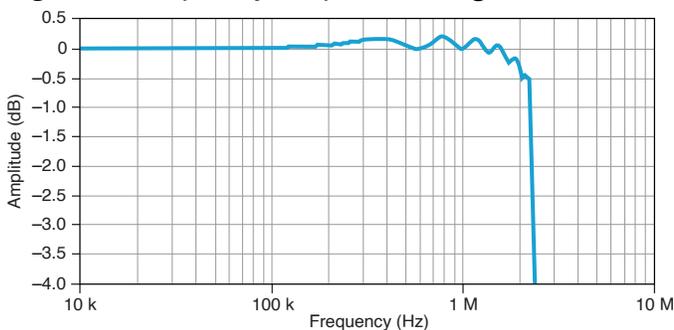
**Figure 5.** Idle Channel FFT in High-Speed Mode with Analog Filter Disabled (20 MS/s, 32,768 point

FFT)
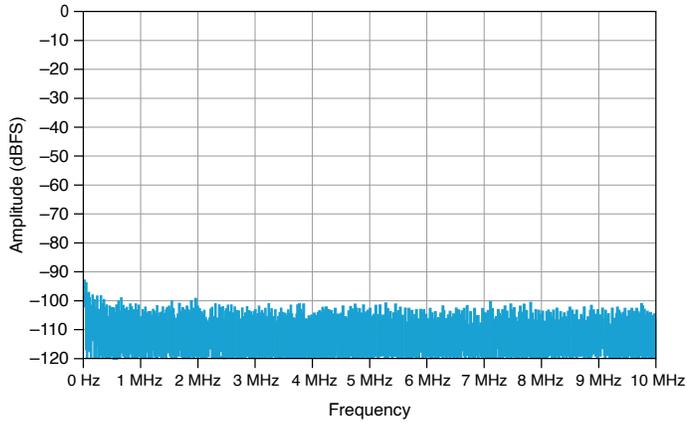
Figure 6. Idle Channel FFT in High-Resolution Mode (1 MS/s, 32,768 point FFT)
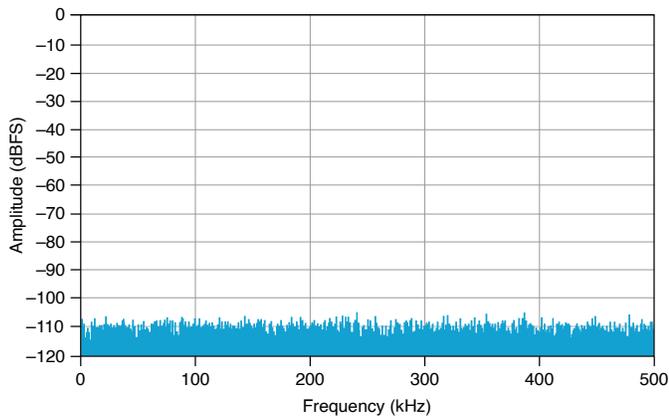

Figure 7. Step Response
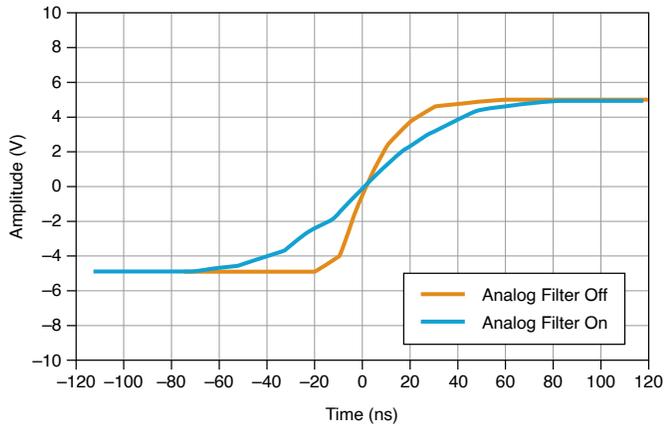
Figure 8. Single-Tone Spectrum at (-1 dB FS, 2.45 MHz)
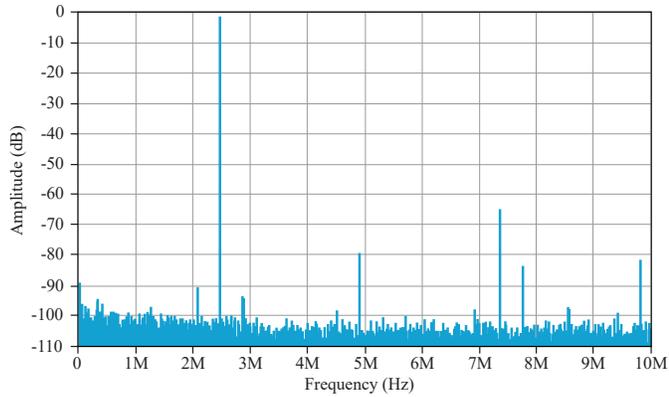
Spurious free dynamic range (-60 dB FS input)	
High-speed mode at 2.45 MHz	89 dB FS
High-resolution mode at 100 kHz	94 dB FS
Input to trigger delay	
High-speed mode with analog filter disabled	863 ns
High-speed mode with analog filter enabled	950 ns
High-resolution mode	4.62 µs
Input delay (Continuous Mode)	
High-speed mode with analog filter disabled	913 ns
High-speed mode with analog filter enabled	999 ns
High-resolution mode	4.67 µs

Noise	
High-speed mode	2.8 mV RMS
High-resolution mode	1.4 mV RMS

Effective number of bits	
High-speed mode	11 bits
High-resolution mode	12 bits

Signal-to-Noise ratio	
High-speed mode	68 dB at 2.45 MHz
High-resolution mode	74 dB at 100 kHz

Total harmonic distortion at -1 dB FS input	
High-speed mode with analog filter disabled at 2.45 MHz	-62 dB FS
High-speed mode with analog filter enabled at 1 MHz	-69 dB FS
High-resolution mode at 100 kHz and	-75 dB FS

Channel-to-channel skew	
Analog filter disabled	1.5 ns

Analog filter enabled	12.7 ns
LSB weight	1.385 mV/LSB

Horizontal

Sample clock source	20 MHz PLL
Maximum sample rate in record mode	
High-speed mode	20 MS/s
High-resolution mode	5 MS/s

Figure 9. Phase Noise
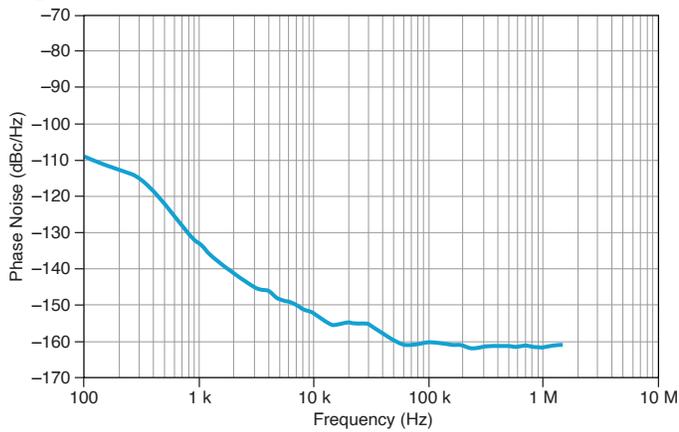
Timebase frequency	20 MHz
Timebase accuracy	±50 ppm
PLL reference clock source	

Internal master timebase	12.8 MHz
Chassis OCLK	12.8 MHz

Data Rate in Record Mode

$$\frac{20\ MS/s}{N}$$

Where

- $N \in$ {1, 2, 3, 4, 5, …, 65,535} for high-speed mode
- $N \in$ {4, 8, 12, 16, 20, …, 65,532} for high-resolution mode

Data Rate in Continuous Mode

$$\frac{20\ MS/s}{M}$$

Where

- $M \in$ {5, 6, 7, 8, 9, …, 65,535} with one channel enabled for high-speed mode
- $M \in$ {8, 12, 16, 20, 24, …, 65,532} with one channel enabled for high-resolution mode
- $M \in$ {10, 11, 12, 13, 14, …, 65,535} with two channels enabled for high-speed mode
- $M \in$ {12, 16, 20, 24, 28, …, 65,532} with two channels enabled for high-resolution mode
- $M \in$ {15, 16, 17, 18, 19, …, 65,535} with three channels enabled for high-speed mode
- $M \in$ {16, 20, 24, 28, 32, …, 65,532} with three channels enabled for high-resolution mode
- $M \in$ {20, 21, 22, 23, 24, …, 65,535} with four channels enabled for high-speed mode
- $M \in$ {20, 24, 28, 32, 36, …, 65,532} with four channels enabled for high-resolution mode

Trigger

Supported trigger modes	Start Reference
Trigger types	Analog edge Digital edge Software
Trigger sources	AI0 to AI3 Chassis backplane
Dead time	0 samples

Analog Edge Trigger

Trigger sources	AI0 to AI3
Settings	Level Slope Hysteresis
Trigger uncertainty	≤ 1 sample
Rearm time	1 sample minimum

Waveform Specifications

Onboard memory size	128 Mibits	
Minimum record length	16 samples	
Minimum number of pre-trigger samples		
CompactRIO		1
CompactDAQ		2
Minimum number of post-trigger samples		
CompactRIO		1
CompactDAQ		2
Maximum number of records	32 records	
Maximum number of samples per record		
CompactDAQ	$\dfrac{2 \times \left[\left(\dfrac{2^{22}}{Number\ of records}\right) - 1\right]}{Number\ of channels}$	
CompactRIO	$\dfrac{2 \times \left[\left(\dfrac{2^{22}}{Number\ of records}\right) - 1\right]}{Number\ of channels} - 8 \times \text{Number of channels}$	

Record data transfer rate	4.7 MS/s, maximum[3] 4 MS/s, typical

Safety Voltages

Connect only voltages that are within Measurement Category O.

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

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 consumed from chassis	
Active mode	0.9 W maximum
Sleep mode	52.5 µW maximum
Thermal dissipation (at 70 °C)	

Active mode	1.06 W maximum
Sleep mode	3.65 mW maximum

Physical Characteristics

Dimensions	Visit ni.com/dimensions and search by module number.
Weight	172 g

Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9775 at ni.com/calibration.

Calibration interval	1 year