NI-9218 Specifications

2022-10-07

Contents

NI 9218 Datasheet

- DSUB or LEMO connectivity
- Built-in support for accelerometer, powered-sensor, full-bridge, and voltage measurements
- Support for half-bridge, quarter-bridge, 60 V, and current measurements with adapters
- 60 V DC, CAT I, channel-to-channel isolation

The NI 9218 is a 2-channel, universal C Series module designed for universal measurements in NI CompactDAQ and CompactRIO systems. The measurement type is selectable per channel, allowing you to perform different measurement types on each channel. The NI 9218 is ideal for creating universal test systems for automotive, off-highway, and data-logging systems.

NI 9218 Kit Contents

NI 9218 with DSUB	NI 9218 with LEMO

		
	▪ NI 9218 with DSUB ▪ NI 9218 Getting Started Guide ▪ 2-Position Micro-Fit Plug and Crimp Terminal Kit	▪ NI 9218 with LEMO ▪ NI 9218 Getting Started Guide ▪ Power Connector

NI 9218 Accessories

	NI 9218 with DSUB 	NI 9218 with LEMO 
Screw-Terminal Adapter	NI 9982D (Cabled) NI 9982F (Front-Mounted)	NI 9982L (Cabled)
±20 mA Adapter	NI 9983D (Cabled) NI 9983F (Front-Mounted)	NI 9983L (Cabled)
±60 V Adapter	NI 9987D (Cabled)	NI 9987L (Cabled)

	NI 9987F (Front-Mounted)	
Half-Bridge Adapter	NI 9986D (Cabled) NI 9986F (Front-Mounted)	NI 9986L (Cabled)
120 Ω Quarter-Bridge Adapter	NI 9984D (Cabled) NI 9984F (Front-Mounted)	NI 9984L (Cabled)
350 Ω Quarter-Bridge Adapter	NI 9985D (Cabled) NI 9985F (Front-Mounted)	NI 9985L (Cabled)
Custom Cables	NI 9988D Solder Cup	LEMO Plug
Pigtail I/O Cables	DSUB-to-Pigtail (1 m, 2 m)	LEMO-to-Pigtail (1 m, 2 m)
Power Connectors	2-Pos Micro Fit-to-Pigtail (1m)	—

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

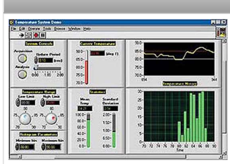
CompactRIO combines an open-embedded architecture with small size, extreme ruggedness, and C Series modules in a platform powered by the NI LabVIEW reconfigurable I/O (RIO) architecture. Each system contains an FPGA for custom timing, triggering, and processing with a wide array of available modular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

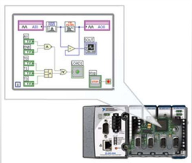
Software

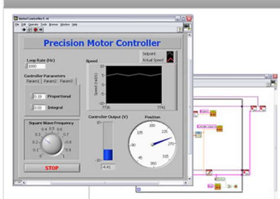
LabVIEW Professional Development System for Windows



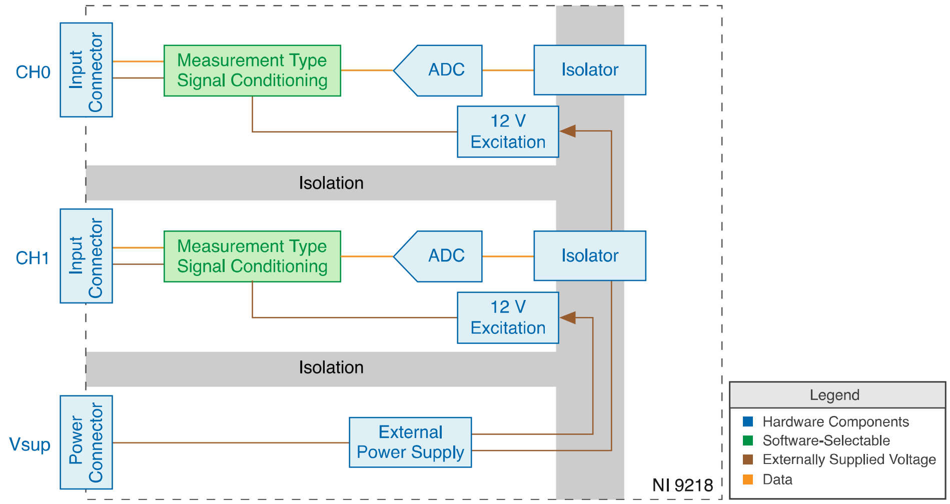
- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant

LabVIEW Professional Development System for Windows	
	■ Use advanced measurement analysis and digital signal processing ■ Take advantage of open connectivity with DLLs, ActiveX, and .NET objects ■ 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

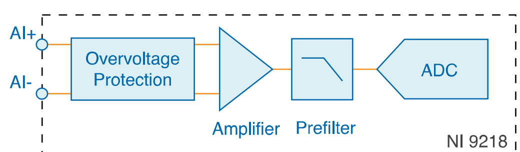
NI LabVIEW Real-Time Module	
	■ Design deterministic real-time applications with LabVIEW graphical programming ■ Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O ■ Take advantage of built-in PID control, signal processing, and analysis functions ■ Automatically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

NI-9218 Circuitry



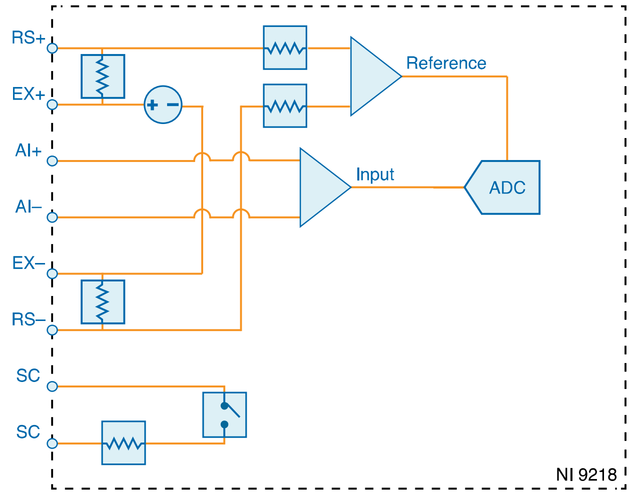
- Two 24-bit analog-to-digital converters (ADCs) simultaneously sample both AI channels.
- The NI-9218 provides channel-to-channel isolation.
- The NI-9218 reconfigures the signal conditioning for each measurement type.
- The NI-9218 provides excitation for IEPE and bridge completion measurement types.
- The NI-9218 can provide optional 12 V sensor excitation for ±16 V, ±65 mV, and ±20 mA measurement types.

±16 V and ±65 mV Signal Conditioning



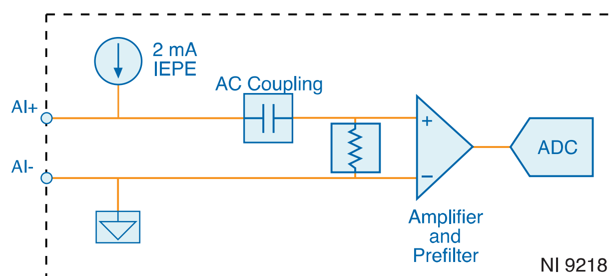
Input signals on each channel are buffered, conditioned, and then sampled by an ADC.

Full-Bridge Signal Conditioning



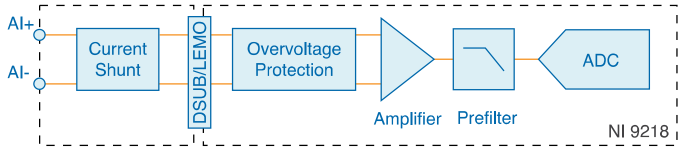
- The analog input connections sense then amplify the incoming analog signal.
- The excitation connections provide differential bridge-excitation voltage.
- Remote sensing continuously and automatically corrects for lead-wire induced excitation voltage loss when using the RS connections.
- Shunt calibration can be used to correct for lead-wire induced desensitization of the bridge.

IEPE Signal Conditioning



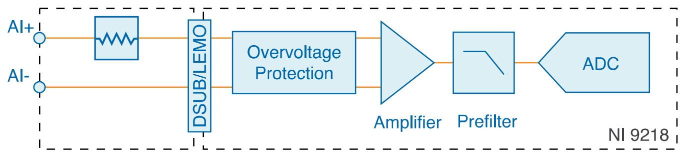
- The incoming analog signal is referenced to an isolated ground.
- Each channel is configured for AC coupling with an IEPE current.
- Each channel provides a TEDS Class 1 interface.

±20 mA Signal Conditioning



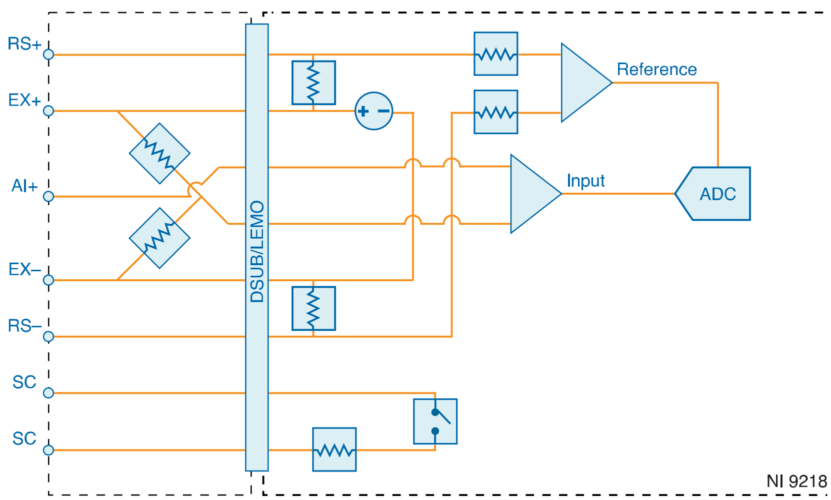
The NI 9983 provides a current shunt for the incoming analog signal.

±60 V Signal Conditioning



The NI 9987 provides an attenuator for the incoming analog signal.

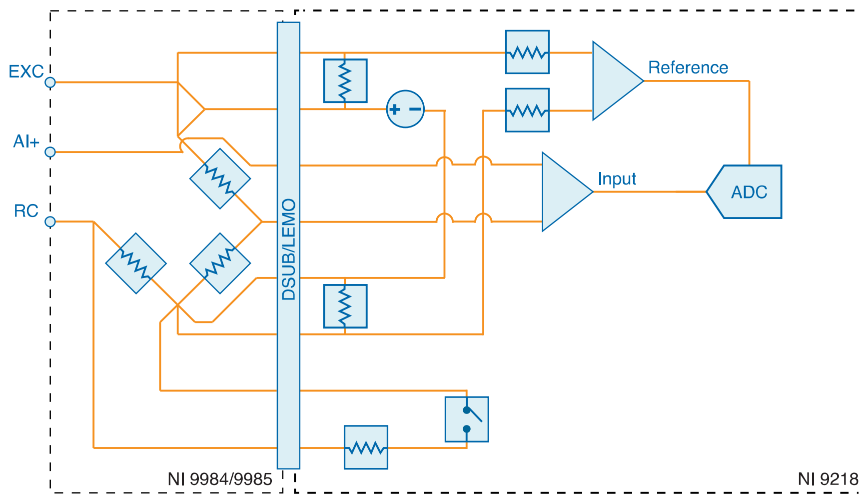
Half-Bridge Signal Conditioning



- The NI 9886 provides half bridge completion resistors for the incoming analog signal.

- You must connect AI+, EX+, and EX-.
- RS+ and RS- connections are optional.
- You do not need to connect the AI- signal because it is connected internally.

Quarter-Bridge Mode Conditioning



The NI 9984 and NI 9985 provide a quarter-bridge completion resistor and half-bridge completion resistors.

Filtering

The NI-9218 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 three important bandwidths to consider are the passband, the stopband, and the alias-free bandwidth.

The NI-9218 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-9218 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.

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 signal that appears in the alias-free bandwidth of the NI-9218 is not an aliased artifact 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, and it is equal to the data rate minus the stopband frequency.

NI 9218 Specifications

The following specifications are typical for the range -40 °C to 70 °C unless otherwise noted.

> **Caution** Do not operate the NI-9218 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

General Characteristics

Number of channels	2 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-Sigma
Sampling mode	Simultaneous

TEDS support

NI 9218 with DSUB	IEEE 1451.4 TEDS Class 1
NI 9218 with LEMO	IEEE 1451.4 TEDS Class 1 and TEDS Class 2

Internal master timebase (f_M)

Frequency	13.1072 MHz
Accuracy	100 ppm

Figure 1. Data Rates

$$\frac{f_M \div 256}{n}, \; n = 1, 2, \ldots, 31 \quad \frac{f_M \div 256}{n}, \; n = 1, 2, \ldots, 31$$

Data rate range (f_s) using internal master timebase	
Minimum	1.652 kS/s
Maximum	51.2 kS/s
Data rate range (f_s) using external master timebase	
Minimum	1 kS/s
Maximum	51.367 kS/s
Overvoltage protection	
Pin 2 to Pin 3	-20 V to 30 V
Any other pin-to-pin	±30 V

> **Note** Be aware when processing acquisitions that include full-scale data. Full-scale data readings indicate that an over-range has occurred in the analog front-end.

±16 V Characteristics

Input coupling	DC
Measurement range	
Typical	±16.3 V

Minimum	±16.0 V

Measurement Conditions		Gain Error	Offset Error
Calibrated	Typical, 23 °C ±5 °C	0.08%	0.70 mV
	Maximum, -40 °C to 70 °C	0.20%	9 mV
Uncalibrated[1]	Typical, 23 °C ±5 °C	1.2%	50 mV
	Maximum, -40 °C to 70 °C	2.0%	70 mV

Table 10. ±16 V Accuracy

Gain drift	15 ppm/°C
Offset drift	32 µV/°C
Integral non-linearity (INL)	150 µV

Input noise, RMS

51.2 kS/s	128 µV
25.6 kS/s	107 µV
4.27 kS/s	81 µV

Input impedance	390 kΩ
Input bandwidth, -3 dB	0.49 f_s

Flatness, DC-20 kHz, referred to 1 kHz

Typical	±30 mdB
Maximum	±50 mdB

Phase non-linearity, DC-20 kHz	0.30°
Input delay	(40 + [5/512])/$\mathbf{f_s}$ + 5.3 µs

Stopband

Frequency	0.55 $\mathbf{f_s}$
Rejection	100 dB

Alias-free bandwidth	0.45 $\mathbf{f_s}$
Oversample rate	64 $\mathbf{f_s}$
Rejection at oversample rate ($\mathbf{f_s}$ = 51.2 kS/s)	100 dB
Total Harmonic Distortion (THD), 1 kHz, -3 dBFS	-100 dBc
Spurious-Free Dynamic Range (SFDR), 1 kHz, 1 V RMS	101 dB

Crosstalk

60 Hz, 1 V RMS, common mode	-120 dBFS
1 kHz normal mode, full-scale aggressor	-109 dBFS

CMRR, 60 Hz 1 V RMS-to-earth ground	-120 dBFS

Powered sensor 12 V excitation

Voltage level	12 V ±5%
Voltage noise, RMS 100 kHz bandwidth	1 mV

Output current	
Typical	50.5 mA
Minimum	46.5 mA
Settling Time (to 1 % of final value after enabling)	200 ms

Related reference

- Vsup Power Requirements

±65 mV Characteristics

Input coupling	DC
Measurement range	
Typical	73.5 mV
Minimum	72 mV

Measurement Conditions		Gain Error	Offset Error
Calibrated	Typical, 23 °C±5 °C	0.13%	8 µV
	Maximum, -40 °C to 70 °C	0.20%	130 µV
Uncalibrated[2]	Typical, 23 °C±5 °C	1.2%	300 µV
	Maximum, -40 °C to 70 °C	2.0%	450 µV

Table 10. ±65 mV Accuracy

Gain drift	10 ppm/°C
Offset drift	320 nV/°C
Input noise, RMS	

51.2 kS/s	4.3 µV
25.6 kS/s	3 µV
4.27 kS/s	1.3 µV
Input impedance	>10 MΩ
Input bandwidth, -3 dB	0.49 **f_s**

Flatness, DC-20 kHz, referred to 1 kHz

Typical	-40 mdB to 0 mdB
Maximum	-150 mdB to 20 mdB

Phase non-linearity, DC-20 kHz	0.2°
Input delay	(40 + [5/512])/**f_s** + 3.9 µs

Stopband

Frequency	0.55 **f_s**
Rejection	100 dB

Alias-free bandwidth	0.45 **f_s**
Oversample rate	64 **f_s**
Rejection at oversample rate (**f_s** = 51.2 kS/s)	100 dB

Total Harmonic Distortion (THD), 1 kHz, -1 dBFS	-95 dBc
Spurious-Free Dynamic Range (SFDR), 1 kHz, -1 dBFS	95 dB
Crosstalk	
60 Hz, 1 V RMS, common mode	-120 dBFS
1 kHz normal mode, full-scale aggressor	-109 dBFS
CMRR, 60 Hz, 1 V RMS-to-earth ground	-133 dBFS
Powered sensor 12 V excitation	
Voltage level	12 V ±5%
Voltage noise, RMS 100 kHz bandwidth	1 mV
Output current	
Typical	50.5 mA
Minimum	46.5 mA
Settling Time (to 1% of final value after enabling)	200 ms

Related reference

- Vsup Power Requirements

Full-Bridge Characteristics

Input coupling	DC
Measurement range	

Typical	22.1 mV/V
Minimum	21.7 mV/V

Measurement Conditions			Gain	Offset	
				Without Offset Null	≤ 90 days, ±5 °C from Offset Null
Calibrated	3.3 V Excitation	Typical, 23 °C ±5 °C	0.10%	2.4 µV/V	0.5 µV/V
		Maximum -40 °C to 70 °C	0.20%	40 µV/V	5 µV/V
	2 V Excitation	Typical, 23 °C ±5 °C	0.10%	30 µV /V	0.8 µV/V
		Maximum -40 °C to 70 °C	0.20%	87 µV/V	8 µV/V
Uncalibrated[3]	3.3 V Excitation	Typical, 23 °C±5 °C	1.2%	100 µV/V	—
		Maximum -40 °C to 70 °C	2.0%	150 µV/V	—
	2 V Excitation	Typical, 23 °C±5 °C	1.2%	120 µV/V	—
		Maximum -40 °C to 70 °C	2.0%	200 µV/V	—

Table 3. Full-Bridge Accuracy

Gain drift	10 ppm/°C

Offset drift

3.3 V excitation	100 nV/V/°C
2 V excitation	160 nV/V/°C

Excitation Voltage	Sample Rate		
	4.27 kS/s	25.6 kS/s	51.2 kS/s
3.3 V	0.4 µV/V	1.0 µV/V	1.3 µV/V
2 V	0.7 µV/V	1.6 µV/V	2.1 µV/V

Table 11. Input Noise, RMS

Differential input impedance	>10 MΩ

Input bandwidth, -3 dB	0.49 $\mathbf{f_s}$
Flatness, DC-20 kHz, referred to 1 kHz	
Typical	-40 mdB to 0 mdB
Maximum	-150 mdB to 20 mdB
Phase non-linearity, DC-20 kHz	0.2°
Input delay	(40 + [5/512])/$\mathbf{f_s}$ + 3.9 µs
Stopband	
Frequency	0.55 $\mathbf{f_s}$
Rejection	100 dB
Alias-free bandwidth	0.45 $\mathbf{f_s}$
Oversample rate	64 $\mathbf{f_s}$
Rejection at oversample rate ($\mathbf{f_s}$ = 51.2 kS/s)	100 dB
Total Harmonic Distortion (THD), 1 kHz, -1 dBFS	-95 dBc
Spurious-Free Dynamic Range (SFDR), 1 kHz, -1 dBFS	95 dB
Crosstalk	
60 Hz, 1 V RMS, common mode	-120 dBFS
1 kHz, normal mode, full-scale aggressor	-109 dBFS

CMRR, 60 Hz, 1 V RMS-to-earth ground	-133 dBFS
Shunt calibration accuracy	50 kΩ ±0.2%

Strain excitation voltage

2 V level	2 V ±3%
3.3 V level	3.3 V ±3%

Output current

2 V level	17.8 mA
3.3 V level	10.1 mA

IEPE Characteristics

Input coupling	AC

Measurement range

Typical	5.33 V
Minimum	5.0 V

Measurement Conditions		Gain Error
Calibrated	Typical, 23 °C±5 °C	0.20% (0.017 dB)
	Maximum, -40 °C to 70 °C	0.40% (0.034 dB)
Uncalibrated[4]	Typical, 23 °C±5 °C	1.7% (0.146 dB)
	Maximum, -40 °C to 70 °C	2.0% (0.172 dB)

Table 5. IEPE Accuracy

Residual DC offset	<150 mV
Gain drift	25 ppm/°C
Input noise, RMS	
51.2 kS/s	50 µV
25.6 kS/s	38 µV
4.27 kS/s	25 µV
Input impedance	300 kΩ
Input bandwidth, -3 dB	0.49 $\mathbf{f_s}$
Flatness, 10 Hz-20 kHz, referred to 1 kHz	
Typical	±25 mdB
Maximum	±40 mdB
Phase non-linearity, 100 Hz-20 kHz	0.25°
AC cutoff frequency, -3 dB	0.5 Hz
Input delay	(40 + [5/512])/$\mathbf{f_s}$ + 3.9 µs
Stopband	
Frequency	0.55 $\mathbf{f_s}$
Rejection	100 dB

Alias-free bandwidth	0.45 $\mathbf{f_s}$
Oversample rate	64 $\mathbf{f_s}$
Rejection at oversample rate ($\mathbf{f_s}$ = 51.2 kS/s)	100 dB
Total Harmonic Distortion (THD), 1 kHz, -3 dBFS	-102 dBc
Spurious-Free Dynamic Range (SFDR), 1 kHz, 1 V RMS	107 dB
Intermodulation Distortion (IMD), (CCIF 11 kHz/12 kHz)	-97 dB
Crosstalk	
60 Hz, 1 V RMS, common mode	-120 dBFS
1 kHz normal mode, full-scale aggressor	-109 dBFS
CMRR, 60 Hz, 1 V RMS-to-earth ground	-122 dBFS
IEPE excitation current	
Typical	2.2 mA
Minimum	2.1 mA
Compliance voltage	
Typical	20.5 V
Minimum	19.5 V

If you are using an IEPE sensor, use the following equation to ensure that your configuration meets the IEPE compliance voltage range. This equation must resolve to 0 to 19.5.

Figure 2. IEPE Compliance Voltage Equation

$V_{bias} \pm V_{full-scale}$ $V_{bias} \pm V_{full-scale}$
where

- V_{bias}
is the bias voltage of the IEPE sensor
- $V_{full-scale}$
is the full-scale voltage of the IEPE sensor

±20 mA Characteristics

The ±20 mA measurement type requires the NI-9983 measurement-specific adapter. The characteristics are for the NI-9218 used in conjunction with the NI-9983.

Input coupling	DC

Measurement range

Typical	24.4 mA
Minimum	23.0 mA

Measurement Conditions		Gain Error	Offset Error
Calibrated	Typical, 23 °C±5 °C	0.40%	5 µA
	Maximum, -40 °C to 70 °C	0.60%	42 µA
Uncalibrated[5]	Typical, 23 °C±5 °C	1.5%	100 µA
	Maximum, -40 °C to 70 °C	2.0%	150 µA

Table 10. ±20 mA Accuracy

Gain drift	35 ppm/°C
Offset drift	105 nA/°C
Shunt resistance	3.01 Ω
Input noise, RMS	
51.2 kS/s	1.4 µA
25.6 kS/s	1.0 µA
4.27 kS/s	0.5 µA
Input impedance	45 Ω ±30%
Input bandwidth, -3 dB	0.49 $\mathbf{f_s}$
Input delay	(40 + [5/512])/$\mathbf{f_s}$ + 3.9 µs
Stopband	
Frequency	0.55 $\mathbf{f_s}$
Rejection	100 dB
Alias-free bandwidth	0.45 $\mathbf{f_s}$
Oversample rate	64 $\mathbf{f_s}$
Rejection at oversample rate ($\mathbf{f_s}$ = 51.2 kS/s)	100 dB
Crosstalk	

60 Hz, 1 V RMS, common mode		-120 dBFS
1 kHz normal mode, full-scale aggressor		-109 dBFS
CMRR, 60 Hz, 1 V RMS-to-earth ground		-99 dBFS
Powered sensor 12 V excitation		
Voltage level		12 V ±5%
Voltage noise, RMS, 100 kHz bandwidth		1 mV
Output current		
Typical	50.5 mA	
Minimum	46.5 mA	
Settling Time (to 1% of final value after enabling)		200 ms

Related reference

- Vsup Power Requirements

±60 V Characteristics

The ±60 V measurement type requires the NI-9987 measurement-specific adapter. The characteristics are for the NI-9218 used in conjunction with the NI-9987.

Input coupling		DC
Measurement range		
Typical	±62.1 V	

Minimum	±60 V

Measurement Conditions		Gain Error	Offset Error
Calibrated	Typical, 23 °C±5 °C	0.3%	3 mV
	Maximum, -40 °C to 70 °C	0.6%	40 mV
Uncalibrated[6]	Typical, 23 °C±5 °C	1.3%	200 mV
	Maximum, -40 °C to 70 °C	2.0%	300 mV

Table 10. ±60 V Accuracy

Gain drift	30 ppm/°C
Offset drift	120 µV/°C
Integral non-linearity (INL)	15 mV

Input noise, RMS

51.2 kS/s	500 µV
25.6 kS/s	420 µV
4.27 kS/s	320 µV

Input impedance	1.49 MΩ

Input bandwidth, -3 dB

NI-9987D/9987L	Lesser of 2.8 kHz or 0.49 $\mathbf{f_s}$
NI-9987F	Lesser of 7 kHz or 0.49 $\mathbf{f_s}$

Flatness, DC to 500 Hz, referred to DC, $\mathbf{f_s} \geq$ 1.652 kS/s	0.2 dB

Input delay	
NI-9987D	(40 + [5/512])/$\mathbf{f_s}$ + 58.7 µs
NI-9987L	(40 + [5/512])/$\mathbf{f_s}$ + 57.9 µs
NI-9987F	(40 + [5/512])/$\mathbf{f_s}$ + 27.2 µs
Stopband	
Frequency	0.55 $\mathbf{f_s}$
Rejection	100 dB
Alias-free bandwidth	0.45 $\mathbf{f_s}$
Oversample rate	64 $\mathbf{f_s}$
Rejection at oversample rate ($\mathbf{f_s}$ = 51.2 kS/s)	100 dB
Total Harmonic Distortion (THD), 8 V RMS, 500 Hz	-80 dBc
Spurious-Free Dynamic Range (SFDR), 8 V RMS, 500 Hz	-80 dB
Crosstalk	
60 Hz, 1 V RMS, common mode	-120 dBFS
1 kHz, normal mode, full-scale aggressor	-70 dBFS
CMRR, 60 Hz, 1 V RMS-to-earth ground	-89 dBFS

Half-Bridge Mode Characteristics

The half-bridge measurement type requires the NI-9986 measurement-specific adapter. The characteristics are for the NI-9218 used in conjunction with the NI-9986.

Input coupling	DC

Measurement range

Typical	22.1 mV/V
Minimum	21.7 mV/V

Measurement Conditions			Gain	Offset	
				Without Offset Null	≤ 90 days, ±5 °C from Offset Null
Calibrated	3.3 V and 2 V excitation	Typical 23 °C±5 °C	0.10%	700 µV/V	45 µV/V
		Maximum -40 °C to 70 °C	0.20%	1,000 µV/V	90 µV/V
Uncalibrated[7]	3.3 V and 2 V excitation	Typical 23 °C±5 °C	1.2%	800 µV/V	—
		Maximum -40 °C to 70 °C	2.0%	1.1 mV/V	—

Table 10. Half-Bridge Accuracy

Gain drift	10 ppm/°C
Offset drift	1.3 µV/V/°C

Excitation Voltage	Sample Rate		
	4.27 kS/s	25.6 kS/s	51.2 kS/s
3.3 V	0.4 µV/V	1.0 µV/V	1.3 µV/V

Excitation Voltage	Sample Rate		
	4.27 kS/s	25.6 kS/s	51.2 kS/s
2 V	0.7 μV/V	1.6 μV/V	2.2 μV/V

Table 11. Input Noise, RMS

Input bandwidth, -3 dB	0.49 $\mathbf{f_s}$

Flatness, DC-20 kHz, referred to 1 kHz

Typical	-40 mdB to 0 mdB
Maximum	-150 mdB to 20 mdB

Phase non-linearity, DC-20 kHz	0.2°
Input delay	(40 + [5/512])/$\mathbf{f_s}$ + 3.9 μs

Stopband

Frequency	0.55 $\mathbf{f_s}$
Rejection	100 dB

Alias-free bandwidth	0.45 $\mathbf{f_s}$
Oversample rate	64 $\mathbf{f_s}$
Rejection at oversample rate ($\mathbf{f_s}$ = 51.2 kS/s)	100 dB
Total Harmonic Distortion (THD), 1 kHz, -1 dBFS	-95 dBc
Spurious-Free Dynamic Range (SFDR), 1 kHz, -1 dBFS	95 dB

Crosstalk	
60 Hz, 1 V RMS, common mode	-120 dBFS
1 kHz, normal mode, full-scale aggressor	-85 dBFS
CMRR, 60 Hz, 1 V RMS-to-earth ground	-73 dBFS
Strain excitation voltage	
2 V level	2 V ±3%
3.3 V level	3.3 V ±3%
Output current	
2 V level	17.8 mA
3.3 V level	10.1 mA

Quarter-Bridge Characteristics

The quarter-bridge measurement type requires the NI-9984 or NI-9985 measurement-specific adapter. The characteristics are for the NI-9218 used in conjunction with the NI-9984 or the NI-9985.

Input coupling	DC
Measurement range	
Typical	22.1 mV/V
Minimum	21.7 mV/V

Measurement Conditions			Gain	Offset	
				Without Offset Null	≤ 90 days, ±5 °C from Offset Null
Calibrated	3.3 V and 2 V excitation	Typical 23 °C±5 °C	0.10%	700 µV/V	45 µV/V
		Maximum -40 °C to 70 °C	0.20%	1,000 µV/V	90 µV/V
Uncalibrated[8]	3.3 V and 2 V excitation	Typical 23 °C±5 °C	1.2%	800 µV/V	—
		Maximum -40 °C to 70 °C	2.0%	1.1 mV/V	—

Table 10. Quarter-Bridge Accuracy

Gain drift	10 ppm/°C
Offset drift	1.3 µV/V/°C

Quarter-bridge completion resistance

NI-9984	120 Ω
NI-9985	350 Ω

Excitation Voltage	Sample Rate		
	4.27 kS/s	25.6 kS/s	51.2 kS/s
350 Ω, 3.3 V	0.4 µV/V	1.0 µV/V	1.3 µV/V
120 Ω, 2 V	0.7 µV/V	1.6 µV/V	2.2 µV/V

Table 11. Input Noise, RMS

Input bandwidth, -3dB	0.49 $\mathbf{f_s}$

Flatness, DC-20 kHz, referred to 1 kHz

Typical	-40 mdB to 0 mdB

Maximum	-150 mdB to 20 mdB
Phase non-linearity, DC-20 kHz	0.2°
Input delay	(40 + [5/512])/$\mathbf{f_s}$ + 3.9 µs
Stopband	
Frequency	0.55 $\mathbf{f_s}$
Rejection	100 dB
Alias-free bandwidth	0.45 $\mathbf{f_s}$
Oversample rate	64 $\mathbf{f_s}$
Rejection at oversample rate ($\mathbf{f_s}$ = 51.2 kS/s)	100 dB
Total Harmonic Distortion (THD), 1 kHz, -1 dBFS	-95 dBc
Spurious-Free Dynamic Range (SFDR), 1 kHz, -1 dBFS	95 dB
Crosstalk	
60 Hz, 1 V RMS, common mode	-120 dBFS
1 kHz, normal mode, full-scale aggressor	-85 dBFS
CMRR, 60 Hz, 1 V RMS-to-earth ground	-73 dBFS
Strain excitation voltage	
2 V level	2 V ±3%

3.3 V level	3.3 V ±3%
Output current	
2 V level	17.8 mA
3.3 V level	10.1 mA

Power Requirements

Maximum power consumption from chassis	
Active mode	900 mW maximum
Sleep mode	500 µW maximum
Maximum thermal dissipation, from -40 °C to 70 °C	
Active mode	1.5 W maximum
Sleep mode	550 mW maximum

Vsup Power Requirements

Vsup input voltage range	9 V to 30 V
Maximum power consumption from Vsup	
Active mode	2 W maximum
Sleep mode	400 mW maximum

Physical Characteristics

If you need to clean the module, wipe it with a dry towel.

> **Tip** For two-dimensional drawings and three-dimensional models of the C Series module and connectors, visit ni.com/dimensions and search by module number.

Weight	
NI 9218 with DSUB	151 g (5.33 oz)
NI 9218 with LEMO	165 g (5.82 oz)

NI 998x Physical Characteristics

Screw-terminal wiring	
Gauge	0.05 mm^2 (30 AWG) to 1.31 mm^2 (16 AWG) copper conductor wire
Wire strip length	6 mm (0.236 in.) of insulation stripped from the end
Temperature rating	80 °C minimum
Wires per screw terminal	One or two wires per screw terminal
Ferrules, single wire	0.25 mm^2 (20 AWG) to 0.52 mm^2 (24 AWG)
Torque for screw terminals	0.2 N · m to 0.25 N · m (1.77 lb · in. to 2.21 lb · in.)
Wire securement	

NI 998xD, NI 998xL securement type	Three collets provided (ranging from 2.2 mm to 5.2 mm in diameter)
Torque for collet nut	1.5 N · m (13.3 lb · in.)
NI 998xF securement type	Zip tie provided

NI 998xD and NI 998xF connector securement

Securement type	Jackscrews provided
Jackscrew torque	0.4 N · m (3.6 in · lb)

Weight

NI 998xD, NI 998xL	142 g (5.0 oz) with cable
NI 998xF	34 g (1.2 oz)

NI-9218 with LEMO Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage, from any pin to any pinon a single connector[9]	±30 V

Isolation

Channel-to-channel, channel-to-Vsup, channel-to-earth, Vsup-to-earth (up to 5,000 m)[10]

Continuous	60 VDC, Measurement Category I
Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test

> **Caution** Any excitation output voltage to earth ground must remain below 60 VDC for each channel. To determine excitation output voltage to earth ground for a channel, add the maximum excitation voltage to the maximum potential on pin 3. The maximum excitation voltages are 2 V +3% and 3.3 V +3% for the bridge excitations, 12 V +5% for the +12 V excitation, and 22 V for the IEPE excitation.

NI-9218 with DSUB Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage, from any pin to any pinon a single connector[11]	±30 V

Isolation

Channel-to-channel, channel-to-Vsup inputs (up to 5,000 m)

Continuous	60 VDC, Measurement Category I
Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test

Channel-to-earth ground (up to 3,000 m)

Continuous	60 VDC, Measurement Category I
Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test

Channel-to-earth ground (up to 5,000 m)

Continuous	60 VDC, Measurement Category I
Withstand	860 Vrms

Vsup inputs-to-earth ground (up to 5,000 m)

Continuous	60 VDC, Measurement Category I
Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test

Caution Any excitation output voltage to earth ground must remain below 60 VDC for each channel. To determine excitation output voltage to earth ground for a channel, add the maximum excitation voltage to the maximum potential on pin 3. The maximum excitation voltages are 2 V +3% and 3.3 V +3% for the bridge excitations, 12 V +5% for the +12 V excitation, and 22 V for the IEPE excitation.

Hazardous Locations

U.S. (UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA IIC T4
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA IIC T4
Europe (ATEX) and International (IECEx)	Ex nA IIC T4 Gc

Safety and Hazardous Locations Standards

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 5, UL 60079-15; Ed 3

- CSA 60079-0:2011, CSA 60079-15:2012

> **Note** For UL and other safety certifications, refer to the product label or the Online Product Certification section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use; for radio equipment; and for telecommunication terminal equipment:

- EN 61326-1 (IEC 61326-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

> **Note** In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

> **Note** Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

> **Note** For EMC declarations and certifications, and additional information, refer to the Online Product Certification section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 94/9/EC; Potentially Explosive Atmospheres (ATEX)

Shock and Vibration

To meet these specifications, you must panel mount the system.

Operating vibration	
Random (IEC 60068-2-64)	5 g_{rms}, 10 Hz to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 Hz to 500 Hz
Operating shock (IEC 60068-2-27)	30 g, 11 ms half sine; 50 g, 3 ms half sine; 18 shocks at 6 orientations

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

Environmental

Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 70 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C
Ingress protection	IP40
Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
Storage humidity (IEC 60068-2-78)	5% RH to 95% RH, noncondensing
Pollution Degree	2
Maximum altitude	5,000 m

Indoor use only.

NI 998x Environmental

Operating temperature	-40 °C to 70 °C

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the **Engineering a Healthy Planet** web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

EU and UK Customers

- **Waste Electrical and Electronic Equipment (WEEE)**—At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

电子信息产品污染控制管理办法（中国 RoHS）

- **中国 RoHS**— NI 符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于 NI 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9218 at ni.com/calibration.

Calibration interval	2 years

[1] Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

[2] Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

[3] Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

[4] Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

[5] Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

[6] Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

[7] Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

[8] Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

[9] The maximum voltage between pin 2 and pin 3 on a single connector is -20 V to +30 V.

[10] Must use crimp contact LEMO plug (784162-01) to maintain these ratings. Ratings are invalidated if solder version is used.

[11] The maximum voltage between pin 2 and pin 3 on a single connector is -20 V to +30 V.