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# NI-9218

# Specifications

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2023-05-29



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## NI 9218 Accessories

		
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 9987F (Front-Mounted)	NI 9987L (Cabled)
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.

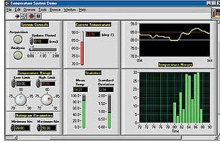
## CompactDAQ

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.



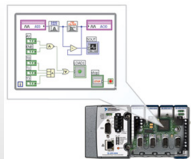
# Software

## LabVIEW Professional Development System for Windows



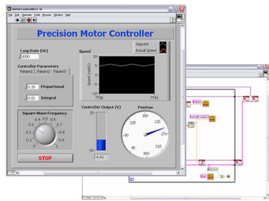
- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects
- Build DLLs, executables,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

## NI LabVIEW FPGA Module



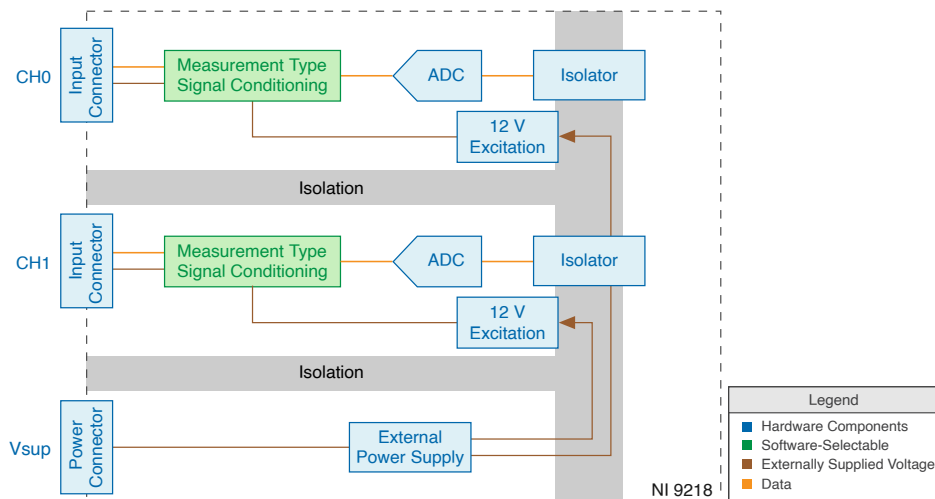
- Design FPGA applications for NI RIO hardware
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing 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

## Block Diagram

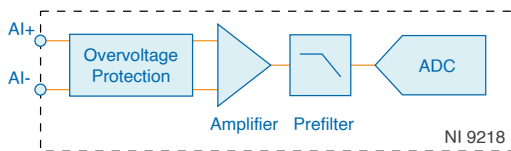


- Two 24-bit analog-to-digital converters (ADCs) simultaneously sample both AI channels.



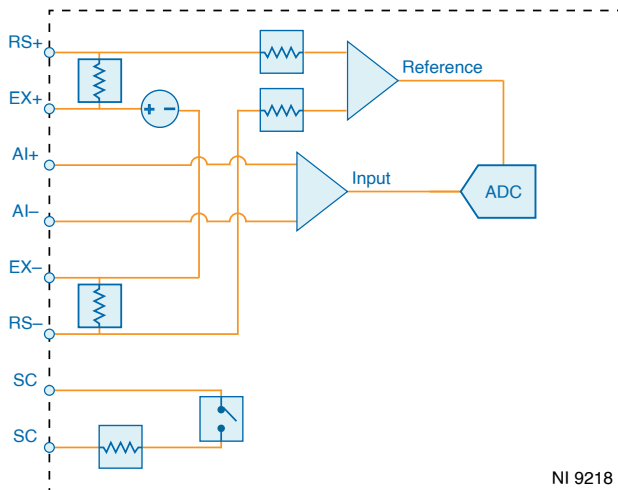
- The provides channel-to-channel isolation.
- The reconfigures the signal conditioning for each measurement type.
- The provides excitation for IEPE and bridge completion measurement types.
- The can provide optional 12 V sensor excitation for  $\pm 16$  V,  $\pm 65$  mV, and  $\pm 20$  mA measurement types.

## $\pm 16$ V and $\pm 65$ mV Signal Conditioning



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

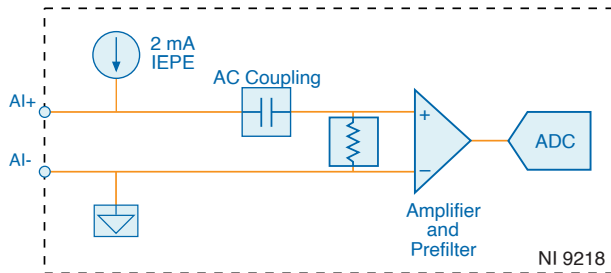
## Full-Bridge Signal Conditioning



- The analog input connections sense then amplify the incoming analog signal.
- The excitation connections provide differential bridge-excitation voltage.

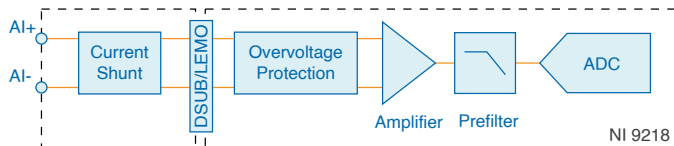
- Remote sensing continuously and automatically corrects for lead-wire induced excitation voltage loss when using the RS connections.
- Shunt calibration can be used to correct for lead-wire induced desensitization of the bridge.

## IEPE Signal Conditioning



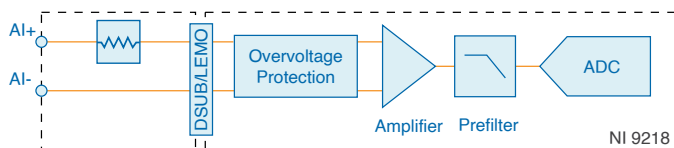
- The incoming analog signal is referenced to an isolated ground.
- Each channel is configured for AC coupling with an IEPE current.
- Each channel provides a TEDS Class 1 interface.

## $\pm 20$ mA Signal Conditioning



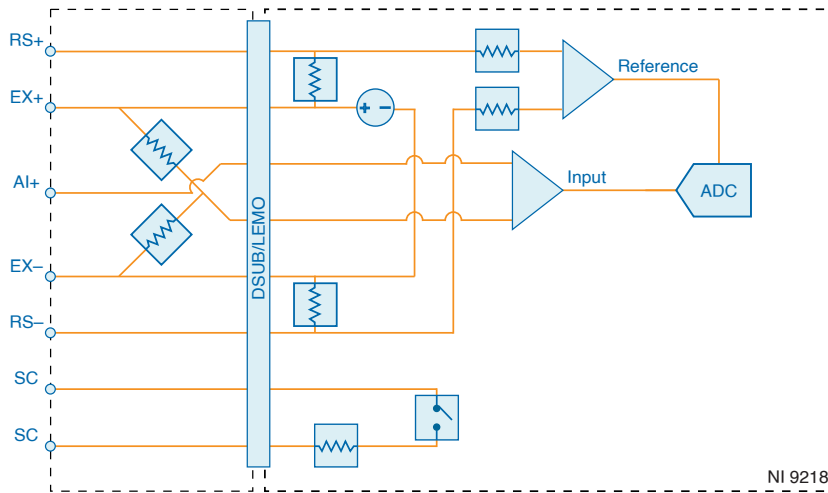
The NI-9983 provides a current shunt for the incoming analog signal.

## $\pm 60$ V Signal Conditioning



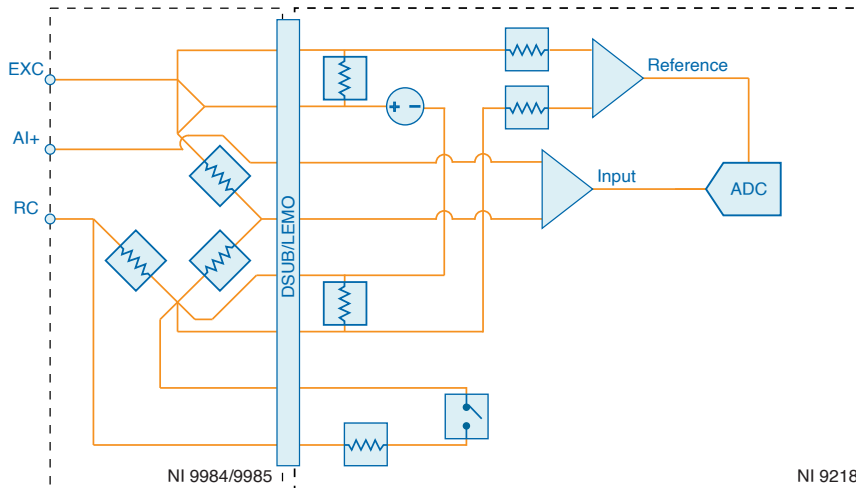
The NI-9987 provides an attenuator for the incoming analog signal.

## 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 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 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 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 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.

# Environmental Characteristics

<b>Temperature</b>	
Operating	-40 °C to 70 °C
Storage	-40 °C to 85 °C
<b>Humidity</b>	
Operating	10% RH to 90% RH, noncondensing
Storage	5% RH to 95% RH, noncondensing
Ingress protection	IP40
Pollution Degree	2
Maximum altitude	
<b>Shock and Vibration</b>	
<b>Operating vibration</b>	
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.

# Physical Characteristics

<b>Weight</b>	
NI-9218 with DSUB	151 g (5.33 oz)
NI-9218 with LEMO	165 g (5.82 oz)
Dimensions	Visit <a href="http://ni.com/dimensions">ni.com/dimensions</a> and search by module number.

## NI-998x Physical Characteristics

<b>Screw-terminal wiring</b>	
Gauge	0.05 mm (30 AWG) to 1.31 mm (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 (20 AWG) to .52 mm (24 AWG)
Torque for screw terminals	0.2 N · m to 0.25 N · m (1.77 lb · in.) to (2.21 lb · in.)
<b>Wire securement</b>	
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
<b>NI-998xD and NI-998xF connector securement</b>	
Securement type	Jackscrews provided
Jackscrew torque	0.4 N · m (3.6 in · lb)
<b>Weight</b>	
NI-998xD, NI-998xL	142 g (5.0 oz) with cable
NI-998xF	34 g (1.2 oz)



## NI-9218 Safety Voltages



**Caution** Any excitation output voltage to earth ground must remain below 60 V DC 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.



**Caution** Toute tension d'excitation de sortie par rapport à la terre doit rester inférieure à 60 V CC pour chaque voie. Pour déterminer la tension d'excitation de sortie par rapport à la terre pour une voie, ajoutez la tension d'excitation maximale au potentiel maximal sur la broche 3. Les tensions d'excitation maximales sont de 2 V +3% et 3,3 V +3% pour les excitations de pont, 12 V +5% pour l'excitation +12 V, et 22 V pour l'excitation IEPE.

## NI-9218 with LEMO Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage, from any pin to any pin on a single connector	±30 V
<b>Isolation</b>	
<b>Channel-to-channel, channel-to-Vsup, channel-to-earth, Vsup-to-earth (up to 5,000 m)</b>	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test

## NI-9218 with DSUB Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage, from any pin to any pin on a single connector	±30 V
<b>Isolation</b>	
<b>Channel-to-channel, channel-to-Vsup inputs (up to 5,000 m)</b>	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test
<b>Channel-to-earth ground (up to 3,000 m)</b>	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test
<b>Channel-to-earth ground (up to 5,000 m)</b>	
Continuous	60 V DC, Measurement Category I
Withstand	860 V RMS
<b>Vsup inputs-to-earth ground (up to 5,000 m)</b>	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test

## 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.