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Find the *National Instruments NI 9260* at our website: ***Click HERE***

DATASHEET

NI 9260

2 AO, 3 Vrms, 24 Bit, 51.2 kS/s/ch Simultaneous



- BNC and mini-XLR connectivity
- -105 db THD+N typical
- 10 µVrms noise typical
- 23 kHz bandwidth

The NI 9260 is a 2-channel analog output module for any NI CompactDAQ and NI CompactRIO system with a 51.2 kS/s update rate, 24-bit resolution, and 3 Vrms output range. The NI 9260 is an instrument-grade dynamic signal generator for testing audio components, testing capabilities of consumer electronic devices, and providing excitation in structural test applications. Unlike sound-card-based solutions, the NI 9260 can be deployed quickly and recalibrated to guarantee long-term measurement repeatability and decreased test time. The NI 9260 also features ±30 V overvoltage protection and short circuit protection for safe deployment.

Kit Contents	• NI 9260 • NI 9260 Getting Started Guide
Accessories	• BNC Male to BNC Male Cables (BNC) • Extended Temperature Cable (mini-XLR)

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C SERIES ANALOG OUTPUT MODULE COMPARISON							
Product Name	Module Type	Signal Ranges	Channels	Sample Rate	Simultaneous	Resolution	Connectivity
NI 9260	Voltage Output	3 Vrms	2	51.2 kS/s/ch	Yes	24-Bit	BNC, mini XLR
NI 9263	Voltage Output	±10 V	4	100 kS/s/ch	Yes	16-Bit	Screw-Terminal, Spring-Terminal
NI 9264	Voltage Output	±10 V	16	25 kS/s/ch	Yes	16-Bit	Spring-Terminal, 37-Pin DSUB
NI 9265	Current Output	0 mA to 20 mA	4	100 kS/s/ch	Yes	16-Bit	Screw-Terminal
NI 9269	Voltage Output	±10 V	4	100 kS/s/ch	Yes	16-Bit	Screw-Terminal

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.

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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.



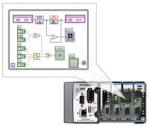
Software

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

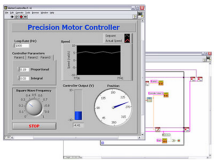
NI LabVIEW FPGA Module



- 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

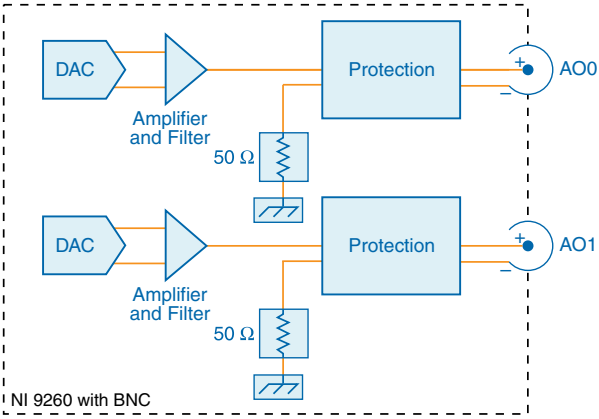
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NI LabVIEW Real-Time Module



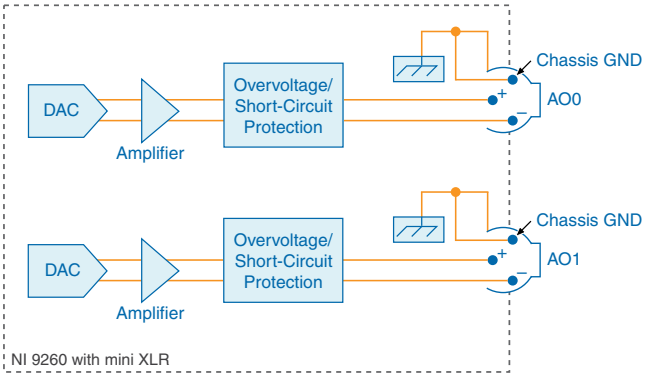
- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of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

Circuitry



The Delta-Sigma DAC has a resolution of 24 bits and can update at a maximum rate of 51.2 kS/s. The output stage of the NI 9260 with BNC is pseudo-differential. AO- is terminated using a 50 Ω resistor to GND.

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The output stage of the NI 9260 with mini XLR is balanced and fully differential. The AO- pin represents one output of the differential output driver and is capable of driving signals into the minimum load. Connecting this pin to GND will short circuit the output.

The outputs of the DAC are buffered, conditioned, and filtered before reaching the module connectors. The NI 9260 may drive a maximum signal of 3 Vrms on AO+ with respect to AO-. Each channel is DC-coupled and protected against short circuits and ±30 V overvoltages.

Related Information

Output Characteristics on page 7

Data Rates

The frequency of a master timebase (f_M) controls the data rate (f_s) of the NI 9260. The NI 9260 includes an internal master timebase with a frequency of 13.1072 MHz, but the module also can accept an external master timebase or export its own master timebase. To synchronize the data rate of an NI 9260 with other modules that use master timebases to control sampling, all of the modules must share a single master timebase source.

The following equation provides the available data rates of the NI 9260:

$$f_s = \frac{f_M \div 256}{n}$$

where n is any integer from 1 to 31.

However, the data rate must remain within the appropriate data rate range. When using the internal master timebase of 13.1072 MHz, the result is data rates of 51.2 kS/s, 25.6 kS/s, 17.067 kS/s, and so on down to 1.652 kS/s depending on the value of n. When using an external timebase with a frequency other than 13.1072 MHz, the NI 9260 has a different set of data rates.

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

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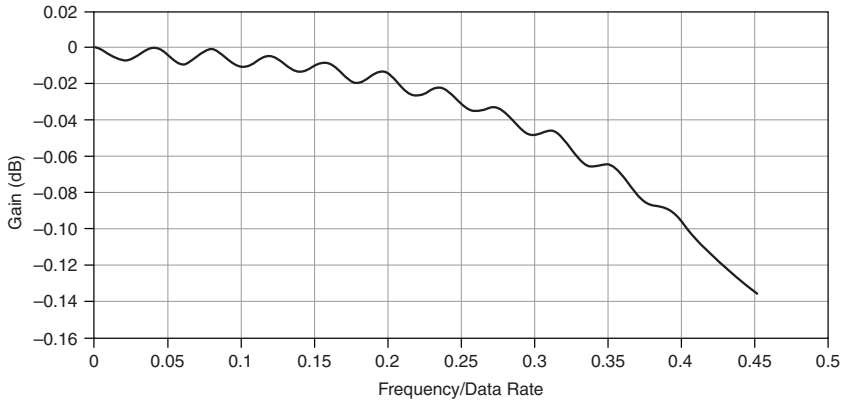
Filtering

The NI 9260 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 anti-imaging bandwidth.

Passband

The signals within the passband have frequency-dependent gain or attenuation. The amount of variation in gain with respect to frequency is called the passband flatness. The digital filters and the analog switched capacitor filter of the NI 9260 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.

Figure 1. Typical Passband Flatness



Stopband

The filter significantly attenuates all signals above the stopband frequency. The primary goal of the filter is to prevent images of the fundamental frequency to propagate to the connected measurement device. 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 except for interpolation images.

Interpolation and Anti-Imaging

A sample signal repeats itself throughout the frequency spectrum. These repetitions begin above one-half the sample rate, f_S, and, theoretically, continue up through the spectrum to infinity. Because the sample data actually represents only the frequency components below one-half f_S (the passband), it is necessary to filter out the extra images of the signal. The NI 9260 accomplishes this filtering in three stages.

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First, the data is digitally interpolated by the digital interpolation filter, which moves the effective sample rate at eight times f_s. A linear-phase digital filter then removes almost all energy above one-half f_s as specified in the *Stopband* section.

Second, the DAC resamples the data to a new frequency that is eight times higher than the f_s. This filter has a sin x/x response, yielding nulls at multiples of eight times f_s. Images still exist at 8 * f_s - output frequency.

Third, a switched capacitor filter and a four-pole analog filter with fixed cut-off frequency filters the remaining images. The switched capacitor filter scales with the sample rate but the four-pole analog filter does not. Using a higher sample rate pushes the images at a higher frequency where the analog filters are more effective at reducing their amplitude.

NI 9260 Specifications

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

Caution Electromagnetic interference can adversely affect the measurement accuracy of the NI 9260 with BNC. The output ports of this device are not protected for electromagnetic interference. As a result, this device may experience reduced output or other temporary performance degradation when connected cables are routed in an environment with radiated or conducted radio frequency electromagnetic interference.

Caution Do not operate this product in a manner not specified in the user documentation. 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.

Output Characteristics

Number of channels	2 analog output channels
DAC resolution	24 bits
Type of DAC	Delta-Sigma
Output state	
Power-on	10 kΩ impedance
Power-down	10 kΩ impedance
Startup voltage[1, 2]	0 V
Output coupling	DC

[1] When the 9260 with BNC powers on, a glitch occurs for 500 µs peaking at 400 mV.

[2] A step of 100 mV occurs for 200 µs when the 9260 outputs the first waveform following a power up, reset, or clock source change.

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Internal master timebase (f_M)	
Frequency	13.1072 MHz
Accuracy	±100 ppm maximum
Data rate range (f_S)	
Using internal master timebase	
Minimum	1.652 kS/s
Maximum	51.2 kS/s
Using external master timebase	
Minimum	1.613 kS/s
Maximum	51.2 kS/s
Oversample rate	256 * f_S
Output delay	30.767/f_S + 3.2 µs
Overvoltage protection	±30 V
Short-circuit protection	Yes
Minimum working load	600 Ω
Output impedance	1 Ω
Output voltage range	
Minimum	3 Vrms (±4.243 Vpk)
Typical	3.08 Vrms (±4.357 Vpk)
Maximum	3.16 Vrms (±4.468 Vpk)
Output common voltage[3]	±6 mV

Table 1. Accuracy

Measurement Conditions		Percent of Reading (Gain Error)[4]	Percent of Range[5] (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	±0.6%, ±0.05 dB	±0.7%, ±30 mV
	Typical (25 °C, ±5 °C)	±0.03%, ±0.0025 dB	±0.025%, ±1 mV

[3] NI 9260 with mini XLR only

[4] Load greater than 10 kΩ. For loads lower than 10 kΩ, the gain error at the module output is affected by the output impedance of the module of 1 Ω.
Additional gain error = -(output impedance/resistive load) * 100 [%]. For the minimum working load of 600 Ω, this error will be -0.167%.

[5] Range equals 4.357 Vpk

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Table 1. Accuracy (Continued)

Measurement Conditions		Percent of Reading (Gain Error)[4]	Percent of Range[5] (Offset Error)
Uncalibrated[6]	Maximum (-40 °C to 70 °C)	±2.6%, ±0.25 dB	±1.15%, ±50 mV
	Typical (25 °C, ±5 °C)	±0.7%, ±0.06 dB	±0.14%, ±6 mV

Drift	
Gain	25 ppm/°C
Offset	100 µV/°C
Channel-to-channel mismatch	
Gain	0.05 dB
Phase (f_{in} in kHz)	f_{in} * 0.033° maximum
Passband	
Frequency	0.45 * f_s
Flatness	
0 Hz to 10 kHz	-0.02 dB
0 Hz to 23 kHz	-0.13 dB
Phase linearity	±0.1°
Stopband	
Frequency	0.55 * f_s
Rejection	100 dB
Image rejection (f_s = 51.2 kS/s)	>70 dB
Crosstalk (20 Hz to 23 kHz)	-120 dBc
Non-harmonic SFDR (f_s = 51.2 kS/s)	-130 dB
Idle channel noise	10 µVrms

[4] Load greater than 10 kΩ. For loads lower than 10 kΩ, the gain error at the module output is affected by the output impedance of the module of 1 Ω.
Additional gain error = -(output impedance/resistive load) * 100 [%]. For the minimum working load of 600 Ω, this error will be -0.167%.

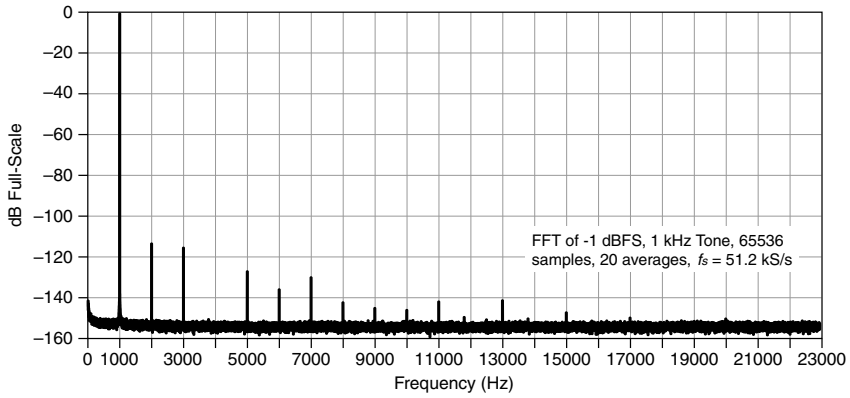
[5] Range equals 4.357 Vpk

[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.

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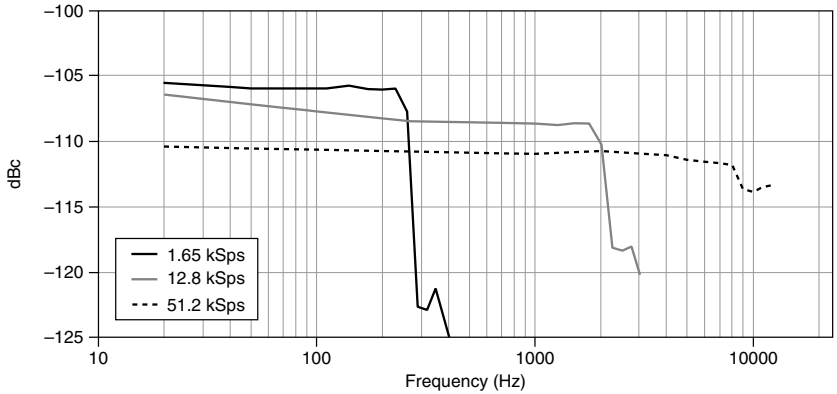
Dynamic range[7]	110 dB
Intermodulation Distortion (IMD)[8]	-110 dB

Figure 2. Power Spectrum



THD+N[9]	-105 dB
THD[9]	-110 dB

Figure 3. THD vs Frequency



7 1 kHz output frequency, -60 dBFS output amplitude, BW = 23 kHz
8 CCIF 14 kHz + 15 kHz, each tone amplitude is -6 dBFS
9 -1dbFS, f_S = 51.2 kS/s, BW = 20 Hz to 23 kHz

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Power Requirements

Power consumption from chassis	
Active mode	0.93 W maximum
Sleep mode	500 µW maximum
Thermal dissipation (at 70 °C)	
NI 9260 with BNC	
Active mode	0.84 W maximum
Sleep mode	0.34 W maximum
NI 9260 with mini XLR	
Active mode	1.23 W maximum
Sleep mode	0.73 W maximum

Physical Characteristics

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

Weight	
NI 9260 with BNC	150 g (5.3 oz)
NI 9260 with mini XLR	140 g (4.9 oz)

Safety Voltages

Channel-to-earth ground	±30 V maximum
Isolation Voltages	
Channel-to-channel	None
Channel-to-earth ground	None

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

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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 for the NI 9260 with BNC

This product meets the requirements of the following EMC standards for sensitive electrical equipment for measurement, control, and laboratory use:

- EN 61326-2-1 (IEC 61326-2-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, 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.

Electromagnetic Compatibility for the NI 9260 with mini XLR

This product meets the requirements of the following EMC standards for sensitive electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions

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- AS/NZS CISPR 11: Group 1, 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)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit *ni.com/certification*, search by model number or product line, and click the appropriate link in the Certification column.

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

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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.

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 *Minimize Our Environmental Impact* 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.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers 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）

中国客户 National Instruments 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 National Instruments 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`.)

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Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9260 at *ni.com/calibration*.

Calibration interval	1 year

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