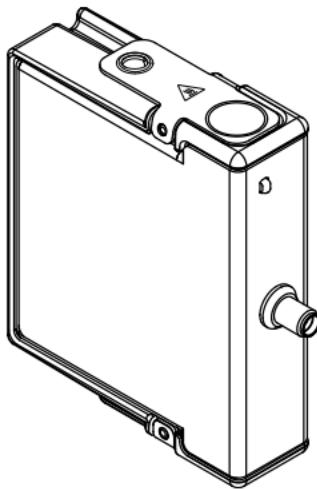


GETTING STARTED GUIDE  
**NI 9467**  
C Series GPS Synchronization Module



This document explains how to connect to the NI 9467.



**Note** Before you begin, complete the software and hardware installation procedures in your chassis documentation.



**Note** The guidelines in this document are specific to the NI 9467. The other components in the system might not meet the same safety ratings. Refer to the documentation for each component in the system to determine the safety and EMC ratings for the entire system.

## Safety Guidelines

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Operate the NI 9467 only as described in this document.



**Caution** Do not operate the NI 9467 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.

# Safety Guidelines for Hazardous Locations

The NI 9467 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nA IIC T4 and Ex nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI 9467 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.



**Caution** Do not disconnect I/O-side wires or connectors unless power has been switched off or the area is known to be nonhazardous.



**Caution** Do not remove modules unless power has been switched off or the area is known to be nonhazardous.



**Caution** Substitution of components may impair suitability for Class I, Division 2.



**Caution** For Division 2 and Zone 2 applications, install the system in an enclosure rated to at least IP54 as defined by IEC/EN 60079-15.



**Caution** For Division 2 and Zone 2 applications, install a protection device between the external power supply and the V<sub>sup</sub> pin. The device must prevent the V<sub>sup</sub>-to-COM voltage from exceeding 50 V if there is a transient overvoltage condition.

## Special Conditions for Hazardous Locations Use in Europe and Internationally

The NI 9467 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 07 ATEX 0626664X and is IECEx UL 14.0089X certified. Each NI 9467 is marked ☷ II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of  $-40^{\circ}\text{C} \leq \text{Ta} \leq 70^{\circ}\text{C}$ . If you are using the NI 9467 in Gas Group IIC hazardous locations, you must use the device in an NI chassis that has been evaluated as Ex nC IIC T4, Ex IIC T4, Ex nA IIC T4, or Ex nL IIC T4 equipment.



**Caution** You must make sure that transient disturbances do not exceed 140% of the rated voltage.



**Caution** The system shall only be used in an area of not more than Pollution Degree 2, as defined in IEC 60664-1.



**Caution** The system shall be mounted in an ATEX/IECEx-certified enclosure with a minimum ingress protection rating of at least IP54 as defined in IEC/EN 60079-15.



**Caution** The enclosure must have a door or cover accessible only by the use of a tool.

## Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.



**Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

## Special Conditions for Marine Applications

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit [ni.com/certification](http://ni.com/certification) and search for the LR certificate, or look for the Lloyd's Register mark on the product.



**Caution** In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained.

## NI 9467 Overview

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The NI 9467 is a stationary GPS timing module for C Series platforms. It provides accurate timing and geographic location information to the C Series host, which enables synchronization of C Series systems.

## Start-Up Behavior

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At start-up, the NI 9467 automatically begins determining its location through a process known as self-survey. During the self-survey, the module computes a location fix every second and averages the locations at the end to obtain a more accurate location. After the self-survey, the NI 9467 no longer computes new location fixes; it uses its known location and satellite signals to generate accurate timing signals.

Like all GPS receivers, the NI 9467 requires GPS satellite ephemeris and almanac data to compute accurate time and location. The ephemeris is detailed orbital information about each satellite (where each satellite is expected to be at a given time). The almanac data describes the general health of each satellite.

(for example, the receiver must not use signals from satellites marked as unhealthy) and contains coarse orbit information. The GPS satellites broadcast the ephemeris and almanac data every 30 seconds. Therefore, it usually takes approximately 30 seconds for it to receive the ephemeris and almanac data and start computing location and timing fixes.

## Status LED

---

The NI 9467 has a front panel LED to indicate status. The following table describes the meaning of each LED pattern.

Conditions	LED State
Normal operation	Solid green
Performing survey	Blinking green
Not enough or no satellites	Blinking yellow
Antenna error (no antenna or over-current)	Solid yellow
Unconfigured	Off



**Note** Although the module may not detect the presence of very low-power GPS antennas, it can still function correctly. Note that the LED and software may report antenna error under these conditions, and if the current consumed is close to the detection threshold the LED may flicker. Refer to the *Specifications* section for more details.

## Connecting the NI 9467

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The NI 9467 has one SMA female connector on its front panel for a GPS active antenna. The connector provides a DC voltage to power the antenna and also serves as input for the GPS RF signal.

## Installing the Antenna

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**Caution** National Instruments recommends using a lightning arrester in line with the GPS antenna installation to protect the NI 9467 and the C Series system from possible damage and operators from injury in the event of lightning.

The embedded GPS receiver in the NI 9467 requires signals from several satellites to compute accurate timing and location. The more satellites available to the receiver, the more accurately it can determine time and location. Therefore, the antenna location should be such that it receives signals from the greatest number of satellites possible. As the number of satellites visible to the antenna decreases, the synchronization performance may also decrease. Choose the antenna location so that the antenna has a clear view of the sky. There is no strict definition for a clear view of the sky, but a suitable guideline is that the GPS antenna should have a straight line of sight to the sky in all directions ( $360^{\circ}$ ) down to an imaginary line making a  $30^{\circ}$  angle with the ground. Locations far from trees and tall buildings that could block or reflect GPS satellite signals are best.

## Maximum Cable Length

Maximum cable length depends on the GPS antenna gain and the cable's loss per unit of distance. National Instruments recommends a GPS signal strength of between -135 dBm and -120 dBm at the NI 9467 SMA input. GPS signal strength on the Earth's surface is typically -130 dBm. Targeting a signal strength

of -125 dBm at the SMA input, you can compute the maximum cable length as:

$$\text{Max\_cable\_loss} = -130 \text{ dBm} + \text{antenna\_gain} - (-125 \text{ dBm})$$

$$\text{Max\_cable\_length} = \text{Max\_cable\_loss} / \\ (\text{loss\_per\_unit\_of\_distance})$$

For example, if you use an active antenna with gain of 28 dB and RG-58 cable, which has a rated loss at 1.5 GHz of about 0.8 dB/m (24.5 dB/100 ft), the maximum cable length you could use is:

$$\text{Max\_cable\_loss} = -130 \text{ dBm} + 28 \text{ dB} - (-125 \text{ dBm}) = 23 \text{ dB}$$

$$\text{Max\_cable\_length} = 23 \text{ dB} / (0.8 \text{ dB/m}) \approx 29 \text{ m}$$

## Sleep Mode

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This module supports a low-power sleep mode. Support for sleep mode at the system level depends on the chassis the module is plugged into. Refer to the chassis manual for information about support for sleep mode. If the chassis supports sleep mode, refer to the software help for information about enabling sleep mode. Visit [ni.com/info](http://ni.com/info) and enter `cseriesdoc` for information about C Series documentation.

Typically, when a system is in sleep mode, you cannot communicate with the modules. In sleep mode, the system consumes minimal power and may dissipate less heat than it does in normal mode. Refer to the *Specifications* section for more information about power consumption and thermal dissipation.

Notice that when the NI 9467 is in sleep mode, the GPS receiver is not powered and stops tracking satellites. When the module exits sleep mode and power to the GPS receiver is restored, the module goes through the normal power-up process, which includes the ephemeris/almanac data acquisition and self-survey process. Therefore, it can take approximately 30 seconds before usable timing and location signaling can be generated. Refer to *Start-Up Behavior* for more information.

## NI 9467 Specifications

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

## General Characteristics

Signal type	L1 frequency; GPS C/A code
Datum	WGS-84
RF GPS signal frequency	1575.42 MHz
Recommended signal strength at SMA <sup>1</sup>	-135 dBm to -120 dBm
Max RF power at input	3 dBm
Input impedance	50 Ω, nominal
MTBF	2,234,702 h at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method
PPS accuracy <sup>2</sup>	±100 ns, > 99% typical

<sup>1</sup> Higher signal strength might saturate the receiver and degrade performance.

<sup>2</sup> For the best timing accuracy performance, ensure that the GPS antenna has a clear view of the sky. Refer to the *Antenna Installation* section for more details.

## GPS Antenna Connector Characteristics

GPS antenna connector type	SMA female
DC voltage output for active antenna	+5 V ± 10%
Max. current output	30 mA
Minimum current for antenna presence detection	6 mA typical, 9.5 mA max
Over-voltage protection	± 30 VDC

## Power Requirements

Power consumption from chassis

Active mode	150 mA max
Sleep mode	1 mA

Thermal dissipation (at 70 °C)

Active mode	550 mW max
Sleep mode	5 mW

## Physical Characteristics

To clean the module, wipe it with a dry towel.

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Weight	141 g (4.5 oz)
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## Environmental

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

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

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Indoor use only.

## Shock and Vibration

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

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### Operating vibration

Random (IEC  
60068-2-64)      5 g<sub>rms</sub>, 10 Hz to 500 Hz

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Sinusoidal (IEC  
60068-2-6)      5 g, 10 Hz to 500 Hz

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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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## Safety and Hazardous Locations Standards



**Note** The NI 9467 module does not provide electrical isolation.

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.

## 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 (DEMKO)	Ex nA IIC T4 Gc

## Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for 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
- 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

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](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## 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](http://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](http://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](http://ni.com/environment/rohs_china)。(For information about China RoHS compliance, go to [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china).)

## Worldwide Support and Services

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The NI website is your complete resource for technical support. At [ni.com/support](http://ni.com/support), you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit [ni.com/services](http://ni.com/services) for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit [ni.com/register](http://ni.com/register) to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting [ni.com/certification](http://ni.com/certification). If your product supports calibration, you can obtain the calibration certificate for your product at [ni.com/calibration](http://ni.com/calibration).

NI corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. NI also has offices located around the world. For telephone support in the United States, create your service request at [ni.com/support](http://ni.com/support) or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the *Worldwide Offices* section of [ni.com/niglobal](http://ni.com/niglobal) to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

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## DATASHEET

# NI 9234

4 AI,  $\pm 5$  V, 24 Bit, 51.2 kS/s/ch Simultaneous, AC/DC Coupling, IEPE  
AC Coupling



- Software-selectable AC/DC coupling (AC coupled at 0.5 Hz)
- Software-selectable IEPE signal conditioning with AC coupling (2 mA)
- -40 °C to 70 °C operating, 5 g vibration, 50 g shock
- 24-bit resolution
- Anti-aliasing filters
- 102 dB dynamic range
- Smart TEDS sensor compatibility

The NI 9234 is a four-channel dynamic signal acquisition module for making high-accuracy measurements from IEPE sensors. The NI 9234 delivers 102 dB of dynamic range and incorporates Integrated Electronics Piezoelectric (IEPE) signal conditioning at 2 mA constant current for accelerometers and microphones. The four input channels simultaneously acquire at rates up to 51.2 kS/s. In addition, the module includes built-in anti-aliasing filters that automatically adjust to your sampling rate. Compatible with a single-module USB carrier and NI CompactDAQ and CompactRIO hardware, the NI 9234 is ideal for a wide variety of mobile or portable applications such as industrial machine condition monitoring and in-vehicle noise, vibration, and harshness testing.

	<p>Kit Contents</p> <ul style="list-style-type: none"><li>• NI 9234</li><li>• NI 9234 Getting Started Guide</li></ul>
	<p>Recommended Accessories</p> <ul style="list-style-type: none"><li>• BNC Cable (x4) (779697-02)</li></ul>

### C SERIES ANALOG MODULE COMPARISON

Product Name	Signal Ranges	Channels	Sample Rate	Input Configurations	Noise at Maximum Sample Rate	Connectivity	Isolation Continuous
NI 9218	$\pm 5$ V	2	51.2 kS/s/ch	IEPE with AC Coupling	50 $\mu$ Vrms	9-Position DSUB, LEMO	60 VDC Ch-Ch
NI 9230	$\pm 30$ V	3	12.8 kS/s/ch	IEPE with AC Coupling, AC Coupling, DC Coupling	106 $\mu$ Vrms	Screw Terminal	60 VDC Ch-Earth
NI 9232	$\pm 30$ V	3	102.4 kS/s/ch	IEPE with AC Coupling, AC Coupling, DC Coupling	251 $\mu$ Vrms	Screw Terminal	60 VDC Ch-Earth
NI 9234	$\pm 5$ V	4	51.2 kS/s/ch	IEPE with AC Coupling, AC Coupling, DC Coupling	50 $\mu$ Vrms	BNC	None
NI 9251	$\pm 4.24$ Vpk	2	102.4 kS/s/ch	AC Coupling, DC Coupling	8.8 $\mu$ Vrms	mini XLR	None

## 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.



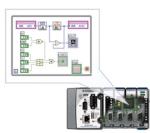
# Software

## LabVIEW Professional Development System for Windows



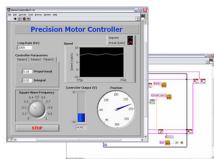
- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects
- Build DLLs, executables,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

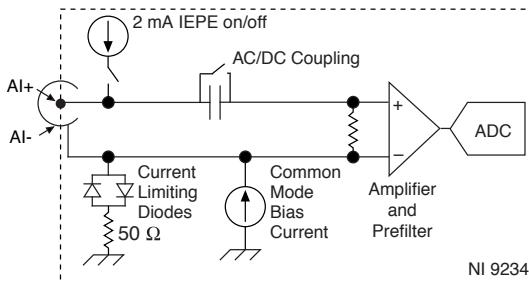


- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of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

## Circuitry

The input signal on each channel is buffered, conditioned, and then sampled by a 24-bit Delta-Sigma ADC.

**Figure 1.** NI 9234 Input Circuitry for One Channel



The NI 9234 analog input channels are referenced to chassis ground through a  $50\ \Omega$  resistor. To minimize ground noise, make sure the chassis ground is connected to earth ground. Each channel is protected from overvoltages.

## AC/DC Coupling

You can configure each channel in software for AC or DC coupling. For channels set to AC coupling, you can turn the IEPE excitation current on or off. Refer to your software help for more information about configuring AC/DC coupling and enabling excitation current.

## NI 9234 TEDS

The NI 9234 also has TEDS circuitry. For more information about TEDS, visit [ni.com/info](http://ni.com/info) and enter the Info Code `rcteds`.

# Filtering

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The NI 9234 uses a combination of analog and digital filtering to provide an accurate representation of in-band signals and reject 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.

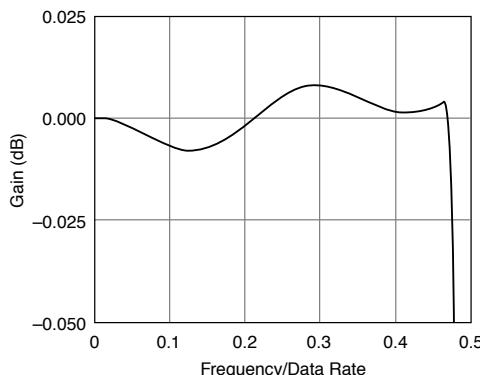
The NI 9234 represents signals within the passband, as quantified primarily by passband ripple and phase nonlinearity. All signals that appear in the alias-free bandwidth are either unaliased signals or signals that have been filtered by at least the amount of the stopband rejection.

## 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 9234 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 2.** Typical Passband Response for the NI 9234

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## 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 signals that appear in the alias-free bandwidth are not aliased artifacts 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. The alias-free bandwidth is equal to the data rate minus the stopband frequency.

# Data Rates

---

The frequency of a master timebase ( $f_M$ ) controls the data rate ( $f_s$ ) of the NI 9234. The NI 9234 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 9234 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 9234:

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

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 9234 has a different set of data rates.



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

## NI 9234 Specifications

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



**Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.



**Caution** Do not operate the NI 9234 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.

## Input Characteristics

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Number of channels	4 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-Sigma (with analog prefiltering)
Sampling mode	Simultaneous
Type of TEDS supported	IEEE 1451.4 TEDS Class I

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**Internal master timebase ( $f_M$ )**

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Frequency	13.1072 MHz
Accuracy	±50 ppm maximum

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**Data rate range ( $f_s$ )**

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**Using internal master timebase**

---

Minimum	1.652 kS/s
Maximum	51.2 kS/s

---

**Using external master timebase**

---

Minimum	0.391 kS/s
Maximum	52.734 kS/s

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**Data rates <sup>1</sup> ( $f_s$ )**  $(f_M \div 256)/n, n = 1, 2, \dots, 31$ 

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**Input coupling** AC/DC (software-selectable)

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**AC cutoff frequency**

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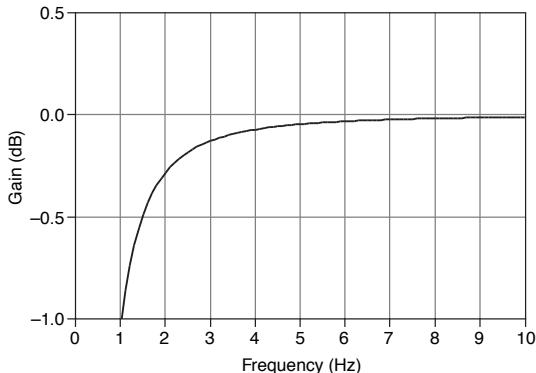
-3 dB	0.5 Hz
-0.1 dB	4.6 Hz maximum

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<sup>1</sup> The data rate must remain within the appropriate data range. Refer to the [Data Rates](#) for more information.

**Figure 3.** AC Cutoff Frequency Response



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Input range  $\pm 5$  V

AC voltage full-scale range

Minimum	$\pm 5$ Vpk
---------	-------------

Typical	$\pm 5.1$ Vpk
---------	---------------

Maximum	$\pm 5.2$ Vpk
---------	---------------

Common-mode voltage range  
(AI- to earth ground)  $\pm 2$  V maximum

IEPE excitation current (software-selectable on/off)

Minimum	2.0 mA
---------	--------

Typical	2.1 mA
---------	--------

Power-on glitch  $90 \mu\text{A}$  for  $10 \mu\text{s}$

IEPE compliance voltage  $19$  V maximum

---

If you are using an IEPE sensor, use the following equation to make sure your configuration meets the IEPE compliance voltage range.

$(V_{\text{common-mode}} + V_{\text{bias}} \pm V_{\text{full-scale}})$  must be 0 to 19

Where

$V_{\text{common-mode}}$  is the common-mode voltage applied to the NI 9234

$V_{\text{bias}}$  is the bias voltage of the IEPE sensor

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

Overvoltage protection (with respect to chassis ground)

For a signal source  $\pm 30$  V

connected to AI+ and AI-

For a low-impedance source  $-6$  V to  $30$  V

connected to AI+ and AI-

Input delay  $(40 + 5/512)/f_s + 2.6 \mu\text{s}$

**Table 1.** Accuracy

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range <sup>2</sup> (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	0.34%, $\pm 0.03$ dB	$\pm 0.14\%$ , 7.1 mV
	Typical (25 °C $\pm 5$ °C)	0.05%, $\pm 0.005$ dB	$\pm 0.006\%$ , 0.3 mV
Uncalibrated <sup>3</sup>	Maximum (-40 °C to 70 °C)	1.9%, $\pm 0.16$ dB	$\pm 0.27\%$ , 13.9 mV
	Typical (25 °C $\pm 5$ °C)	0.48%, $\pm 0.04$ dB	$\pm 0.04\%$ , 2.3 mV

Gain drift

Typical  $0.14 \text{ mdB}/^\circ\text{C}$  (16 ppm/ $^\circ\text{C}$ )

Maximum  $0.45 \text{ mdB}/^\circ\text{C}$  (52 ppm/ $^\circ\text{C}$ )

Offset drift

Typical  $19.2 \mu\text{V}/^\circ\text{C}$

Maximum  $118 \mu\text{V}/^\circ\text{C}$

Channel-to-channel matching

Phase ( $f_{in}$  in kHz)  $(f_{in} * 0.045^\circ + 0.04$  maximum)

Gain

Typical  $0.01$  dB

Maximum  $0.04$  dB

Passband

Frequency  $0.45 * f_s$

Flatness ( $f_s = 51.2$  kS/s)  $40 \text{ mdB}$  (pk-to-pk maximum)

<sup>2</sup> Range = 5.1 Vpk

<sup>3</sup> 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.

Phase nonlinearity ( $f_s = 51.2$ kS/s)	$\pm 0.45^\circ$ maximum
Stopband	
Frequency	$0.55 * f_s$
Rejection	100 dB
Alias-free bandwidth	$0.45 * f_s$
Oversample rate	$64 * f_s$
Crosstalk (1 kHz)	-110 dB
CMRR ( $f_{in} \leq 1$ kHz)	
Minimum	40 dB
Typical	47 dB
SFDR ( $f_{in} = 1$ kHz, -60 dBFS)	120 dB

**Table 2.** Idle Channel Noise and Noise Density

Idle Channel	51.2 kS/s	25.6 kS/s	2.048 kS/s
Noise	97 dBFS	99 dBFS	103 dBFS
	50 $\mu$ Vrms	40 $\mu$ Vrms	25 $\mu$ Vrms
Noise density	310 nV/ $\sqrt{\text{Hz}}$	350 nV/ $\sqrt{\text{Hz}}$	780 nV/ $\sqrt{\text{Hz}}$

Input impedance	
Differential	305 k $\Omega$
AI- (shield) to chassis ground	50 $\Omega$

**Table 3.** Total Harmonic Distortion (THD)

Input Amplitude	1 kHz	8 kHz
-1 dBFS	-95 dB	-87 dB
-20 dBFS	-95 dB	-80 dB

Intermodulation distortion (-1 dBFS)	
DIN 250 Hz/8 kHz 4:1 amplitude ratio	-80 dB
CCIF 11 kHz/12 kHz 1:1 amplitude ratio	-93 dB
MTBF	390,362 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

# Power Requirements

Power consumption from chassis

Active mode	900 mW maximum
Sleep mode	25 µW maximum
Thermal dissipation (at 70 °C)	
Active mode	930 mW maximum
Sleep mode	25 µW maximum

# Physical Characteristics

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

Weight	173 g (6.1 oz)
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# Safety Voltages

Connect only voltages that are within the following limits:

Channel-to-earth ground	±30 V maximum, Measurement Category I
Isolation	
Channel-to-channel	None
Channel-to-earth ground	None

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.



**Caution** Do not connect the NI 9234 to signals or use for measurements within Measurement Categories II, III, or IV.

# 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 sensitive electrical equipment for measurement, control, and laboratory use:

- EN 61326 (IEC 61326): Class A emissions; Basic 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** For the standards applied to assess the EMC of this product, refer to the [Online Product Certification](#) section.



**Note** For EMC compliance, operate this device with shielded cabling.

## CE Compliance

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 <sub>rms</sub> , 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

## 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](http://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](http://ni.com/environment/weee).

# 电子信息产品污染控制管理办法（中国 RoHS）



40

**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](http://ni.com/environment/rohs_china)。(For information about China RoHS compliance, go to [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china).)

## Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9234 at [ni.com/calibration](http://ni.com/calibration).

Calibration interval

1 year

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## DATASHEET

# NI 9239

4 AI,  $\pm 10$  V, 24 Bit, 50 kS/s/ch Simultaneous



- BNC or screw-terminal connectivity
- Anti-alias filters
- 250 Vrms, CAT II, channel-to-channel isolation (screw terminal); 60 VDC, CAT I, channel-to-channel isolation (BNC)

The NI 9239 is an analog input module for use in NI CompactDAQ or CompactRIO systems. Each channel provides a  $\pm 10$  V measurement range at a 24-bit resolution. The NI 9239 outputs 50 kS/s of data at the maximum sampling rate. Designed for both speed and accuracy, the NI 9239 is an effective general-purpose analog module because of its resolution, sample rate, and input range.

	<p>Kit Contents</p> <ul style="list-style-type: none"><li>• NI 9239</li><li>• NI 9239 Getting Started Guide</li></ul>
	<p>Accessories</p> <ul style="list-style-type: none"><li>• NI 9971 Backshell Connector Kit (Screw Terminal)</li><li>• EMI Suppression Ferrite (BNC)</li></ul>

C SERIES DIFFERENTIAL INPUT MODULE COMPARISON						
Product Name	Signal Levels	Channels	Sample Rate	Simultaneous	Resolution	Connectivity
NI 9215	±10 V	4	100 kS/s/ch	Yes	16-Bit	Screw-Terminal, Spring-Terminal, BNC
NI 9220	±10 V	16	100 kS/s/ch	Yes	16-Bit	Spring-Terminal, DSUB
NI 9222	±10 V	4	500 kS/s/ch	Yes	16-Bit	Screw-Terminal, BNC
NI 9223	±10 V	4	1 MS/s/ch	Yes	16-Bit	Screw-Terminal, BNC
NI 9229	±60 V	4	50 kS/s/ch	Yes	24-Bit	Screw-Terminal, BNC
NI 9239	±10 V	4	50 kS/s/ch	Yes	24-Bit	Screw-Terminal, BNC

## NI C Series Overview

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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



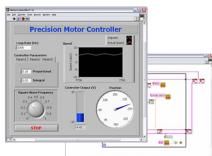
- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects
- Build DLLs, executables,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

## NI LabVIEW FPGA Module



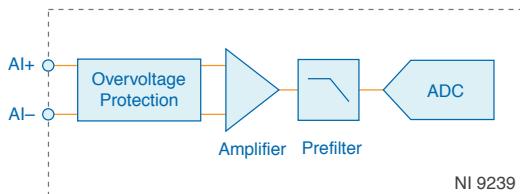
- Design FPGA applications for NI RIO hardware
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing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

## NI 9239 Input Circuitry



- Input signals on each channel are conditioned, buffered, and then sampled by an ADC.
- Each AI channel provides an independent signal path and ADC, enabling you to sample all channels simultaneously.

## Filtering

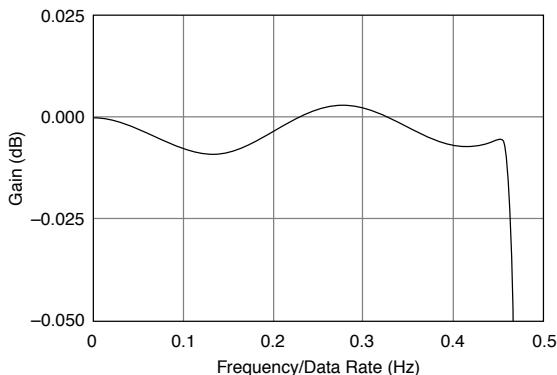
The NI 9239 uses a combination of analog and digital filtering to provide an accurate representation of in-band signals and reject out-of-band signals. The filters discriminate between signals based on the frequency range, or bandwidth, of the signal. The three important bandwidths to consider are the passband, the stopband, and the anti-imaging bandwidth.

The NI 9239 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 9239 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 Response for the NI 9239



## 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 signals that appear in the alias-free bandwidth are not aliased artifacts 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. The alias-free bandwidth is equal to the data rate minus the stopband frequency.

## Data Rates

The frequency of a master timebase ( $f_M$ ) controls the data rate ( $f_s$ ) of the NI 9239. The NI 9239 includes an internal master timebase with a frequency of 12.8 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 9239 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 9239:

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

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 12.8 MHz, the result is data rates of 50 kS/s, 25 kS/s, 16.667 kS/s,

and so on down to 1.613 kS/s, depending on the value of  $n$ . When using an external timebase with a frequency other than 12.8 MHz, the NI 9239 has a different set of data rates.



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

## NI 9239 Specifications

The following specifications are typical for the range -40 °C to 70 °C unless otherwise noted. All voltages are relative to the AI- signal on each channel unless otherwise noted.



**Caution** Do not operate the NI 9239 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.

### Input Characteristics

Number of channels	4 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	±100 ppm maximum
Data rate range ( $f_s$ ) using internal master timebase	
Minimum	1.613 kS/s
Maximum	50 kS/s
Data rate range ( $f_s$ ) using external master timebase	
Minimum	390.625 S/s
Maximum	51.2 kS/s

## Figure 2. Data Rates<sup>1</sup> ( $f_s$ )

$$\frac{f_M \div 256}{n}, n = 1, 2, \dots, 31$$

Input voltage ranges (AI+ to AI-)

Nominal	$\pm 10$ V
Typical	$\pm 10.52$ V
Minimum	$\pm 10.3$ V
Overshoot protection	$\pm 100$ V
Input coupling	DC
Input impedance (AI+ to AI-)	$1 \text{ M}\Omega$

Table 1. NI 9239 Accuracy

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range <sup>2</sup> (Offset Error)
Calibrated	Typical (25 °C, $\pm 5$ °C)	$\pm 0.03\%$	$\pm 0.008\%$
	Maximum (-40 °C to 70 °C)	$\pm 0.13\%$	$\pm 0.06\%$
Uncalibrated <sup>3</sup>	Typical (25 °C, $\pm 5$ °C)	$\pm 0.3\%$	$\pm 0.11\%$
	Maximum (-40 °C to 70 °C)	$\pm 1.4\%$	$\pm 0.70\%$

Input noise  $70 \mu\text{VRms}$

Stability

Gain drift  $\pm 5 \text{ ppm}/^\circ\text{C}$

Offset drift  $\pm 26 \mu\text{V}/^\circ\text{C}$

Post-calibration gain match  
(channel-to-channel, 20 kHz)  $0.22 \text{ dB}$  maximum

Phase mismatch

Channel-to-channel  $0.075^\circ/\text{kHz}$  maximum

Module-to-module  $(0.075^\circ/\text{kHz} \cdot f_{\text{in}}) + (360^\circ \cdot f_{\text{in}}/f_M)$

Phase nonlinearity ( $f_s = 50 \text{ kS/s}$ )  $0.11^\circ$  maximum

<sup>1</sup> The data rate must remain within the appropriate data rate range.

<sup>2</sup> Range equals 10.52 V

<sup>3</sup> 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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**Figure 3.** Input delay

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$$40 \frac{5}{512} / f_s + 3.3 \mu\text{s}$$

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Passband

Frequency	$0.453 \cdot f_s$
Flatness ( $f_s = 50$ kS/s)	$\pm 100$ mdB maximum

Stopband

Frequency	$0.547 \cdot f_s$
Rejection	100 dB
Alias-free bandwidth	$0.453 \cdot f_s$
-3 dB prefilter bandwidth ( $f_s = 50$ kS/s)	24.56 kHz
Crosstalk (1 kHz)	-130 dB
CMRR ( $f_{in} = 60$ Hz)	126 dB
SFDR (1 kHz, -60 dBFS)	128 dBFS

Total Harmonic Distortion (THD)

1 kHz, -1 dBFS	-99 dB
1 kHz, -20 dBFS	-105 dB

MTBF

NI 9239 with screw terminal	662,484 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method
NI 9239 with BNC	864,132 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method

## Power Requirements

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Power consumption from chassis

Active mode	
NI 9239 with screw terminal	740 mW maximum
NI 9239 with BNC	800 mW maximum
Sleep mode	25 $\mu$ W maximum

Thermal dissipation

Active mode	
NI 9239 with screw terminal	760 mW maximum
NI 9239 with BNC	820 mW maximum
Sleep mode	16 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](http://ni.com/dimensions) and search by module number.

## Screw-terminal wiring

Gauge	0.05 mm <sup>2</sup> to 1.5 mm <sup>2</sup> (30 AWG to 14 AWG) copper conductor wire
Wire strip length	6 mm (0.24 in.) of insulation stripped from the end
Temperature rating	90 °C minimum
Torque for screw terminals	0.22 N · m to 0.25 N · m (1.95 lb · in. to 2.21 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 <sup>2</sup> to 1.5 mm <sup>2</sup>

## Connector securement

Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)
Weight	
NI 9239 with screw terminal	147 g (5.2 oz.)
NI 9239 with BNC	169 g (6.0 oz.)

# NI 9239 with Screw Terminal Safety Voltages

Connect only voltages that are within the following limits:

## Isolation

Channel-to-channel	
Continuous	250 Vrms, Measurement Category II
Withstand	1,390 V, verified by a 5 s dielectric withstand test
Channel-to-earth ground	
Continuous	250 Vrms, Measurement Category II
Withstand	2,300 V, verified by a 5 s dielectric withstand test

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 not intended for direct connection to the *MAINS* building installations of Measurement Categories CAT II, CAT III, or CAT IV.



**Caution** If using in Division 2 or Zone 2 hazardous locations applications, do not connect the NI 9239 with screw terminal to signals or use for measurements within Measurement Categories II, III, or 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.



**Caution** Do not connect the NI 9239 with screw terminal to signals or use for measurements within Measurement Categories III or IV.

## NI 9239 with BNC Safety Voltages

Connect only voltages that are within the following limits:

### Isolation

#### Channel-to-channel

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

#### Channel-to-earth ground

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

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,

<sup>4</sup> Channel-to-channel and channel-to-earth ground

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 not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.



**Caution** Do not connect the NI 9239 with BNC to signals or use for measurements within Measurement Categories II, III, or IV.

## 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:

- EN 61326-1 (IEC 61326-1): 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.

## CE Compliance

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 <sub>rms</sub> , 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

## 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	2,000 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](http://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](http://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](http://ni.com/environment/rohs_china)。(For information about China RoHS compliance, go to [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china).)

## Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9239 at [ni.com/calibration](http://ni.com/calibration).

Calibration interval	1 year
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375939B-02 Apr16

## SPECIFICATIONS

# cRIO-9042

1.60 GHz Quad-Core CPU, 4 GB DRAM, 4 GB Storage, Kintex-7 70T FPGA, Extended Temperature, 4-Slot CompactRIO Controller

## Definitions

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*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.

## Conditions

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

## Processor

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CPU	Intel Atom E3940
Number of cores	4
CPU frequency	1.6 GHz (base), 1.8 GHz (burst)
On-die L2 cache	2 MB

# Software

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**Note** For minimum software support information, visit [ni.com/info](http://ni.com/info) and enter the Info Code `swsupport`.

Supported operating system	NI Linux Real-Time (64-bit)
Supported C Series module programming modes	Real-Time (NI-DAQmx) Real-Time Scan (I/O Variables) LabVIEW FPGA
<hr/>	
Application software	
LabVIEW <sup>1</sup>	LabVIEW 2017 or later, LabVIEW Real-Time Module 2017 or later, LabVIEW FPGA Module 2017 or later,
C/C++ Development Tools for NI Linux Real-Time <sup>2</sup>	Eclipse Edition 2014 or later
Driver software	NI CompactRIO Device Drivers December 2017 or later

## Network/Ethernet Port

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Number of ports	2
Network interface	10Base-T, 100Base-TX, and 1000Base-T Ethernet
Compatibility	IEEE 802.3
Communication rates	10 Mb/s, 100 Mb/s, 1000 Mb/s auto-negotiated
Maximum cabling distance	100 m/segment

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<sup>1</sup> LabVIEW FPGA Module is not required when using Real-Time Scan (I/O Variables) mode or Real-Time (NI-DAQmx) mode. To program the user-accessible FPGA on the cRIO-9042, the LabVIEW FPGA Module is required.

<sup>2</sup> C/C++ Development Tools for NI Linux Real-Time is an optional interface for C/C++ programming of the cRIO-9042 processor. Visit [ni.com/info](http://ni.com/info) and enter Info Code `RIOCdev` for more information about the C/C++ Development Tools for NI Linux Real-Time.

# Network Timing and Synchronization

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Protocol	IEEE 802.1AS-2011 IEEE 1588-2008 (default end-to-end profile)
Supported ethernet ports	Port 0, port 1
Network synchronization accuracy <sup>3</sup>	<1 µs



**Note** The cRIO-9042 employs time-aware transmission support. For more information about time-aware transmission support, visit [ni.com/info](http://ni.com/info) and enter Info Code `timeaware`.

## RS-232 Serial Port

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Maximum baud rate	115,200 b/s
Data bits	5, 6, 7, 8
Stop bits	1, 2
Parity	Odd, even, mark, space
Flow control	RTS/CTS, XON/XOFF, DTR/DSR
RI wake maximum low level	0.8 V
RI wake minimum high level	2.4 V
RI overvoltage tolerance	±24 V

## RS-485 Serial Port

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Maximum baud rate	230,400 b/s
Data bits	5, 6, 7, 8
Stop bits	1, 2
Parity	Odd, even, mark, space
Flow control	XON/XOFF

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<sup>3</sup> Network synchronization is system-dependent. For information about network synchronization accuracy, visit [ni.com/info](http://ni.com/info) and enter Info Code `criosync`.

Wire mode	4-wire, 2-wire, 2-wire auto
Isolation voltage	60 V DC continuous, port to earth ground

 **Note** The RS-485 serial port ground and shield are functionally isolated from chassis ground to prevent ground loops, but do not meet IEC 61010-1 for safety isolation.

Cable requirement	Unshielded, 30 m maximum length (limited by EMC/surge)
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 **Note** RS-485 is capable of 1.2 km (4,000 ft) length without surge limitation.

## USB Ports

Port 1: 

Type	USB Type-A, host port
USB interface	USB 2.0, Hi-Speed
Maximum data rate	480 Mb/s
Maximum current	900 mA

Port 2: 

Type	USB Type-C, host port
USB interface	USB 3.1 Gen1, SuperSpeed
Maximum data rate	5 Gb/s
Maximum current	900 mA
Alternate modes	DisplayPort

Port 3: 

Type	USB Type-C, dual role port (device or host)
USB interface	USB 3.1 Gen1, SuperSpeed
Maximum data rate	5 Gb/s
Maximum current	900 mA

## DisplayPort over USB Type-C

Maximum resolution 3840 × 2160 at 60 Hz

Supported standard DisplayPort 1.2

Supported USB ports Port 2: 

## SD Card Slot

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SD card support	SD and SDHC standards
Supported interface speeds	UHS-I SDR50 and DDR50



**Notice** Full and high speed SD cards are prohibited for use with the cRIO-9042.

## Memory

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Nonvolatile memory (SSD)	4 GB
Nonvolatile memory (SSD) type	Planar SLC NAND



**Note** Visit [ni.com/info](http://ni.com/info) and enter the Info Code `ssdbp` for information about the life span of the nonvolatile memory and about best practices for using nonvolatile memory.

### Volatile memory (DRAM)

Density	4 GB
Type	DDR3L
Maximum theoretical data rate	12.8 GB/s

## Reconfigurable FPGA

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FPGA type	Xilinx Kintex-7 7K70T
Number of flip-flops	82,000
Number of 6-input LUTs	41,000
Number of DSP slices ( $18 \times 25$ multipliers)	240
Available block RAM	4,860 kbits
Number of DMA channels	16
Number of logical interrupts	32

## Internal Real-Time Clock

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Accuracy	200 ppm; 40 ppm at 25 °C
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# Controller PFI 0

Maximum input or output frequency	1 MHz
Cable length	3 m (10 ft)
Cable impedance	50 Ω
PFI 0 connector	SMB
Power-on state	High impedance
I/O standard compatibility	5 V TTL
I/O voltage protection	±30 V
Maximum operating conditions	
I <sub>OL</sub> output low current	8 mA maximum
I <sub>OH</sub> output high current	-8 mA maximum

**Table 1.** DC Input Characteristics

Voltage	Minimum	Maximum
Positive going threshold	1.43 V	2.28 V
Negative going threshold	0.86 V	1.53 V
Hysteresis	0.48 V	0.87 V

**Table 2.** DC Output Characteristics

Voltage	Conditions	Minimum	Maximum
High	—	—	5.25 V
	Sourcing 100 μA	4.65 V	—
	Sourcing 2 mA	3.60 V	—
	Sourcing 3.5 mA	3.44 V	—
Low	Sinking 100 μA	—	0.10 V
	Sinking 2 mA	—	0.64 V
	Sinking 3.5 mA	—	0.80 V

# Real-Time Streaming Performance

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Data throughput is dependent on the application, system, and performance of the removable storage media. For information about optimizing data throughput on the cRIO-9042 visit [ni.com/info](http://ni.com/info) and enter Info Code optdata.

Data throughput from system memory to target

SD card	40 MB/s
USB Type-C	100 MB/s

## Real-Time (NI-DAQmx) Mode

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The following specifications are applicable for modules and slots programmed in Real-Time (NI-DAQmx) mode. For more information about using modules in LabVIEW FPGA mode or Real-Time Scan (I/O Variables) mode, visit [ni.com/info](http://ni.com/info) and enter Info Code swsupport.

### Analog Input

Input FIFO size	253 samples per slot
Maximum sample rate <sup>4</sup>	Determined by the C Series module or modules
Timing accuracy <sup>5</sup>	50 ppm of sample rate
Timing resolution	12.5 ns
Number of channels supported	Determined by the C Series module or modules
Number of hardware-timed tasks	8

### Analog Output

Hardware-timed tasks	
Number of hardware-timed tasks	8
Number of channels supported	
Onboard regeneration	16
Non-regeneration	Determined by the C Series module or modules
Non-hardware-timed tasks	
Number of non-hardware-timed tasks	Determined by the C Series module or modules
Number of channels supported	Determined by the C Series module or modules

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<sup>4</sup> Performance dependent on type of installed C Series module and number of channels in the task.

<sup>5</sup> Does not include group delay. For more information, refer to the documentation for each C Series module.

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Maximum update rate	1.6 MS/s
 <b>Note</b> Streaming applications are limited by system-dependent factors and the capability of C Series modules.	

Timing accuracy	50 ppm of sample rate
Timing resolution	12.5 ns
Waveform onboard regeneration FIFO	8,191 samples shared among channels used
Waveform streaming FIFO	253 samples per slot

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## Digital Waveform

### Waveform acquisition (DI) FIFO

Parallel modules	255 samples per slot
Serial modules	127 samples per slot

### Waveform onboard regeneration (DO) FIFO

Parallel modules	2,047 samples shared among slots used
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### Waveform streaming (DO) FIFO

Parallel modules	255 samples per slot
Serial modules	127 samples per slot

### Sample clock frequency

Digital input	0 MHz to 10 MHz
Digital output	
ot0:6 timing engine	0 MHz to 3.5 MHz
ot7 timing engine	0 MHz to 10 MHz

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 <b>Note</b>	Streaming applications are limited by system-dependent factors and the capability of C Series modules.
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Timing accuracy	50 ppm
Number of digital input hardware-timed tasks	8
Number of digital output hardware-timed tasks	8

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## General-Purpose Counters/Timers

Number of counters/timers	4
Resolution	32 bits

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Counter measurements	Edge counting, pulse, semi-period, period, two-edge separation, pulse width
Position measurements	X1, X2, X4 quadrature encoding with Channel Z reloading; two-pulse encoding
Output applications	Pulse, pulse train with dynamic updates, frequency division, equivalent time sampling
Internal base clocks	80 MHz, 20 MHz, 13.1072 MHz, 12.8 MHz, 10 MHz, 100 kHz
External base clock frequency	0 MHz to 20 MHz
Base clock accuracy	50 ppm
Output frequency	0 MHz to 20 MHz
Inputs	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down
Routing options for inputs	Any module PFI, controller PFI, analog trigger, many internal signals
FIFO	Dedicated 127-sample FIFO

## Frequency Generator

Number of channels	1
Base clocks	20 MHz, 10 MHz, 100 kHz
Divisors	1 to 16 (integers)
Base clock accuracy	50 ppm
Output	Any controller PFI or module PFI terminal

## Module PFI

Functionality	Static digital input, static digital output, timing input, and timing output
Timing output sources <sup>6</sup>	Many analog input, analog output, counter, digital input, and digital output timing signals
Timing input frequency	0 MHz to 20 MHz
Timing output frequency	0 MHz to 20 MHz

<sup>6</sup> Actual available signals are dependent on type of installed C Series module.

# Digital Triggers

Source	Any controller PFI or module PFI terminal
Polarity	Software-selectable for most signals
Analog input function	Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase
Analog output function	Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase
Counter/timer function	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down

## Module I/O States

At power-on	Module-dependent. Refer to the documentation for each C Series module.
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## Time-Based Triggers and Timestamps

 **Note** Time-based triggers and timestamps are only supported in NI-DAQmx 18.1 or later.

Number of time-based triggers	5
Number of timestamps	6
<b>Analog input</b>	
Time-based triggers	Start Trigger, Sync Pulse
Timestamps	Start Trigger, Reference Trigger, First Sample
<b>Analog output</b>	
Time-based triggers	Start Trigger, Sync Pulse
Timestamps	Start Trigger, First Sample
<b>Digital input</b>	
Time-based triggers	Start Trigger
Timestamps	Start Trigger, Reference Trigger, First Sample
<b>Digital output</b>	
Time-based triggers	Start Trigger
Timestamps	Start Trigger, First Sample

## Counter/timer input

Time-based triggers	Arm Start Trigger
Timestamps	Arm Start Trigger
Counter/timer output	
Time-based triggers	Start Trigger, Arm Start Trigger
Timestamps	Start Trigger, Arm Start Trigger

## CMOS Battery

Typical battery life with power applied to power connector	10 years
Typical battery life when stored at temperatures up to 25 °C	7.8 years
Typical battery life when stored at temperatures up to 85 °C	5.4 years

## Power Requirements



**Note** Some C Series modules have additional power requirements. For more information about C Series module power requirements, refer to the C Series module(s) documentation.



**Note** Sleep mode for C Series modules is not supported in Real-Time (DAQmx) Mode.

Voltage input range (measured at the cRIO-9042 power connector)

V1	9 V to 30 V
V2	9 V to 30 V

Maximum power consumption

 **Note** The C terminal of the power connector is functionally isolated from chassis ground to prevent ground loops, but does not meet IEC 61010-1 for safety isolation



**Note** The maximum power consumption specification is based on a fully populated system running a high-stress application at elevated ambient temperature and with all C Series modules and USB devices consuming the maximum allowed power.

Typical standby power consumption

3.4 W at 24 V DC input

Recommended power supply

100 W, 24 V DC

Typical leakage current from secondary power input (V2) while system is powered from primary power input (V1)

At 9 V	0.4 mA
At 30 V	1.93 mA



**Notice** Do not connect V2 to a DC Mains supply or to any supply that requires a connecting cable longer than 3 m (10 ft). A DC Mains supply is a local DC electricity supply network in the infrastructure of a site or building. V1 may be connected to DC Mains.



**Notice** Include a switch or circuit breaker in the installation to disconnect the system from DC Mains. The switch or circuit breaker must be suitably rated, accessible, and marked as the disconnecting device for the system.

EMC ratings for inputs as described in IEC 61000

V1	Short lines, long lines, and DC distributed networks
V2	Short lines only
Power input connector	4-position, 3.5 mm pitch, pluggable screw terminal with screw locks, Sauro CTF04BV8-AN000A

## Physical Characteristics

Weight (unloaded)	1,800 g (3 lbs, 15 oz)
Dimensions (unloaded)	219.5 mm × 88.1 mm × 121.2 mm (8.64 in. × 3.47 in. × 4.77 in.)
Power connector wiring	
Gauge	0.5 mm <sup>2</sup> to 2.1 mm <sup>2</sup> (20 AWG to 14 AWG) copper conductor wire
Wire strip length	6 mm (0.24 in.) of insulation stripped from the end
Temperature rating	85 °C
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

Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.20 N · m to 0.25 N · m (1.8 lb · in. to 2.2 lb · in.)
Insulation rating	300 V, maximum

## Safety Voltages

Connect only voltages that are below these limits.

V1 terminal to C terminal	30 V, maximum
V2 terminal to C terminal	30 V, maximum
Chassis ground to C terminal	30 V, maximum

## Environmental

Temperature (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2)

Operating	-40 °C to 70 °C
Storage	-40 °C to 85 °C
Ingress protection	IP20
Operating humidity (Tested in accordance with IEC 60068-2-30)	10% RH to 90% RH, noncondensing
Storage humidity (Tested in accordance with IEC 60068-2-30)	5% RH to 95% RH, noncondensing
Pollution Degree	2
Maximum altitude	5,000 m

Indoor use only.

## Hazardous Locations

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

# Shock and Vibration

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To meet these specifications, you must mount the cRIO-9042 system directly on a flat, rigid surface as described in the user manual, affix ferrules to the ends of the terminal wires, and use retention accessories for the USB 2.0 host port (NI USB Extender Cable, 152166-xx), USB type-C ports (NI Locking USB Cables, 143556-xx; NI USB Extender Cable, 143555-xx; NI USB Display Adapters, 143557-xx or 143558-xx). All cabling should be strain-relieved near input connectors. Take care to not directionally bias cable connectors within input connectors when applying strain relief.

## Operating vibration

Random (IEC 60068-2-64)	5 g <sub>rms</sub> , 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

# Safety Compliance and Hazardous Locations Standards

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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 C22.2 No. 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 6, UL 60079-15; Ed 4
- CSA C22.2 No. 60079-0, CSA C22.2 No. 60079-15



**Note** For UL and other safety certifications, refer to the product label or the [Product Certifications and Declarations](#) section.

# Electromagnetic Compatibility

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This product meets the requirements of the following EMC standards for 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
- 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.



**Notice** For EMC declarations and certifications, and additional information, refer to the *Product Certifications and Declarations* section.

## CE Compliance

---

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)
- 2014/34/EU; Potentially Explosive Atmospheres (ATEX)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)

## Product Certifications and Declarations

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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/certification](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## Environmental Management

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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](http://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](http://ni.com/environment/weee).

## Battery Replacement and Disposal



**Battery Directive** This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directive 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit [ni.com/environment/batterydirective](http://ni.com/environment/batterydirective).

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The NI website is your complete resource for technical support. At [ni.com/support](http://ni.com/support), you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit [ni.com/services](http://ni.com/services) for information about the services NI offers.

Visit [ni.com/register](http://ni.com/register) to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

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377159F-02 October 26, 2018