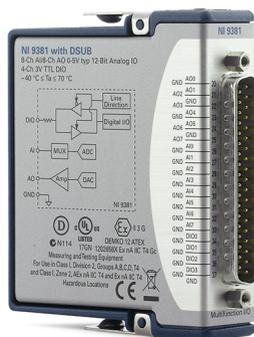


DATASHEET

NI 9381

8 AI/8 AO/4 DIO, 0 V to 5 V, 12 Bit, 20 kS/s Aggregate



- DSUB connectivity
- 4 LVTTTL lines with a 1 MHz update rate

The NI 9381 multifunction I/O module for CompactRIO systems. The NI 9381 combines common I/O circuitry into a single module to help system designers fit more functionality into a single system.

 <p>Kit Contents</p>	<ul style="list-style-type: none">• NI 9381• NI 9381 Getting Started Guide
 <p>Accessories</p>	<p>Front-Mount</p> <ul style="list-style-type: none">• NI 9923 Screw-Terminal Block <p>Cable</p> <ul style="list-style-type: none">• DSUB Cable, 1 m (778621-01)• Din-Rail Spring-Terminal Block (778676-01)

NI 9381 MODULE COMPARISON					
Product Name	Measurement Type	Channels	Range	Resolution	Connectivity
NI 9201	AI	8	±10 V	12 Bit	Screw-terminal, Spring-terminal, DSUB
NI 9263	AO	4	±10 V	16 Bit	Screw-terminal, Spring-terminal
NI 9381	AI, AO, DIO	8 AI, 8 AO, 4 DIO	0 V to 5 V, 3 V TTL	12 Bit	DSUB
NI 9401	DIO	8	5 V TTL	—	DSUB

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.

Software

LabVIEW Professional Development System for Windows



- Use advanced software tools for large project development
- 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



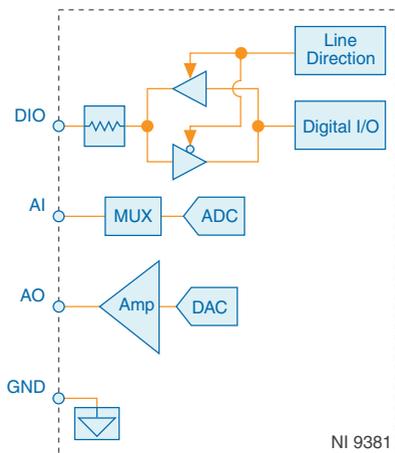
- Design FPGA applications for NI RIO hardware
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing 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 9381 Circuitry



- The module provides an analog-to-digital converter (ADC), eight digital-to-analog converters (DAC), and four digital lines.
- Line direction logic enables/disables the line input and output transceiver.

NI 9381 Specifications

The following specifications are typical for the range $-40\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$ unless otherwise noted.



Caution Do not operate the NI 9381 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.

Analog Input

Number of channels	8 single-ended channels
ADC resolution	12 bits
Type of ADC	Successive approximation register (SAR)
Input range	0 V to 5 V $\pm 1\%$
DNL	± 1.25 LSB
Conversion time	50 μs (20 kS/s)
Input coupling	DC

Input impedance	1 M Ω in parallel with 50 pF
Bandwidth	1 kHz
Stability	
Gain drift	80 ppm/ $^{\circ}$ C
Offset drift	85 μ V/ $^{\circ}$ C

Table 1. Accuracy¹

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range (Offset Error)
Calibrated	Maximum (-40 $^{\circ}$ C to 70 $^{\circ}$ C)	\pm 0.70%	\pm 13 mV
	Typical (23 $^{\circ}$ C, \pm 5 $^{\circ}$ C)	\pm 0.15%	\pm 6.5 mV
Uncalibrated ²	Maximum (-40 $^{\circ}$ C to 70 $^{\circ}$ C)	\pm 1.00%	\pm 16 mV
	Typical (23 $^{\circ}$ C, \pm 5 $^{\circ}$ C)	\pm 0.50%	\pm 7.5 mV

Analog Output

Number of channels	8 channels
DAC resolution	12 bits
Type of DAC	String
Startup voltage	0 V
Output range	0 V to 5 V \pm 1%
Current drive	\pm 1 mA
Output impedance	5 Ω
Update time	50 μ s (20 kS/s)
Short-circuit protection	Indefinitely
Slew rate	30 V/ms
Settling time	900 μ s
DNL	\pm 1 LSB
Capacitive drive	1,500 pF

¹ Accuracy is impacted for AC signals by an amount equal to $4.0/f \mu$ V, where f is the signal frequency in hertz

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

Stability

Gain drift	85 ppm/°C
Offset drift	180 μ V/°C

Table 2. Accuracy³

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	$\pm 1.02\%$	± 23.5 mV
	Typical (23 °C, ± 5 °C)	$\pm 0.19\%$	± 5 mV
Uncalibrated ⁴	Maximum (-40 °C to 70 °C)	$\pm 1.9\%$	± 50 mV
	Typical (23 °C, ± 5 °C)	$\pm 0.6\%$	± 10 mV

Digital Input/Output

Number of channels	4 channels
Default power-on line direction	Input
Input/output type	LVTTL, single-ended
Digital logic levels	
Maximum input voltage	5.2 V
Input high, V_{IH}	2 V
Input low, V_{IL}	0.8 V
Output high, V_{OH}	
Sourcing 100 μ A	2.7 V
Output low, V_{OL}	
Sinking 100 μ A	0.2 V
Maximum I/O switching frequency	1 MHz
Capacitive drive	100 pF

³ Accuracy is impacted for AC signals by an amount equal to $4.0/f \mu$ V, where f is the signal frequency in hertz

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

Physical Characteristics

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



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

Weight	145 g (5.1 oz)
--------	----------------

Power Requirements

Power consumption from chassis

Active mode	600 mW maximum
-------------	----------------

Sleep mode	1 mW maximum
------------	--------------

Thermal dissipation (at 70 °C)

Active mode	600 mW maximum
-------------	----------------

Sleep mode	1 mW maximum
------------	--------------

Safety Voltages

Isolation

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
---	-----------------

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 _{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

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. 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.)

Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9381 at ni.com/calibration.

Refer to the *NI Trademarks and Logo Guidelines* at ni.com/trademarks for information on NI trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies. For patents covering NI products/technology, refer to the appropriate location: **Help»Patents** in your software, the `patents.txt` file on your media, or the *National Instruments Patent Notice* at ni.com/patents. You can find information about end-user license agreements (EULAs) and third-party legal notices in the readme file for your NI product. Refer to the *Export Compliance Information* at ni.com/legal/export-compliance for the NI global trade compliance policy and how to obtain relevant HTS codes, ECCNs, and other import/export data. NI MAKES NO EXPRESS OR IMPLIED WARRANTIES AS TO THE ACCURACY OF THE INFORMATION CONTAINED HEREIN AND SHALL NOT BE LIABLE FOR ANY ERRORS. U.S. Government Customers: The data contained in this manual was developed at private expense and is subject to the applicable limited rights and restricted data rights as set forth in FAR 52.227-14, DFAR 252.227-7014, and DFAR 252.227-7015.

© 2016 National Instruments. All rights reserved.

375983A-02 Mar16