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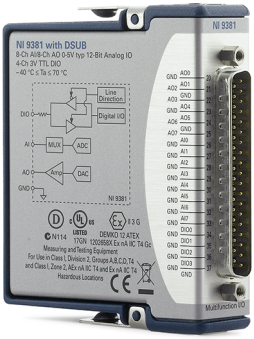
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DATASHEET

NI 9381

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



- DSUB connectivity
- 4 LVTTL 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.

Kit Contents	• NI 9381 • NI 9381 Getting Started Guide
Accessories	**Front-Mount** • NI 9923 Screw-Terminal Block
	Cable • DSUB Cable, 1 m (778621-01) • Din-Rail Spring-Terminal Block (778676-01)

NATIONAL INSTRUMENTS

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.

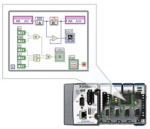
Software

LabVIEW Professional Development System for Windows



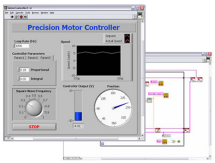
- Use advanced software tools for large project development
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects
- Build DLLs, executables, and MSI installers

NI LabVIEW FPGA Module



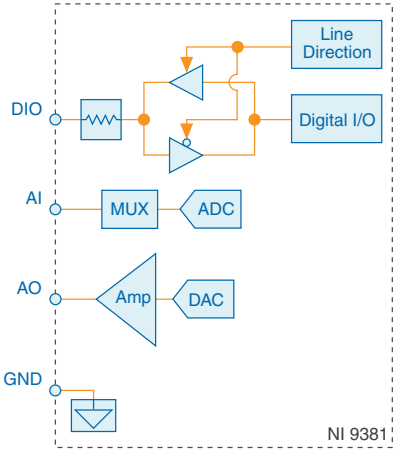
- Design FPGA applications for NI RIO hardware
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing 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 °C to 70 °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 ±1%
DNL	±1.25 LSB
Conversion time	50 µs (20 kS/s)
Input coupling	DC

Input impedance	1 MΩ in parallel with 50 pF
Bandwidth	1 kHz
Stability	
Gain drift	80 ppm/°C
Offset drift	85 µV/°C

Table 1. Accuracy[1]

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	±0.70%	±13 mV
	Typical (23 °C, ±5 °C)	±0.15%	±6.5 mV
Uncalibrated[2]	Maximum (-40 °C to 70 °C)	±1.00%	±16 mV
	Typical (23 °C, ±5 °C)	±0.50%	±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 ±1%
Current drive	±1 mA
Output impedance	5 Ω
Update time	50 µs (20 kS/s)
Short-circuit protection	Indefinitely
Slew rate	30 V/ms
Settling time	900 µs
DNL	±1 LSB
Capacitive drive	1,500 pF

[1] Accuracy is impacted for AC signals by an amount equal to $4.0f$ µV, 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 µV/°C

Table 2. Accuracy[3]

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	±1.02%	±23.5 mV
	Typical (23 °C, ±5 °C)	±0.19%	±5 mV
Uncalibrated[4]	Maximum (-40 °C to 70 °C)	±1.9%	±50 mV
	Typical (23 °C, ±5 °C)	±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 µA	2.7 V
Output low, V_{OL}	
Sinking 100 µA	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 $4.0f$ µV, 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 CE

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

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

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit *ni.com/*

certification, search by model number or product line, and click the appropriate link in the Certification column.

Shock and Vibration

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

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

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*.

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