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# NI-9401

# Specifications

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# NI-9401 Datasheet



- DSUB connectivity
- CompactDAQ counter compatibility
- 60 V DC, CAT I, channel-to-earth isolation

The NI-9401 is a bidirectional digital module for any NI CompactDAQ or CompactRIO chassis. The eight DIO channels are grouped in two ports that you can configure independently for input or output. You can use the NI-9401 to implement custom digital systems such as counters/timers, digital communication protocols, pulse generation, and beyond.

	Kit Contents	<ul style="list-style-type: none"> <li>• NI 9401</li> <li>• NI 9401 Getting Started Guide</li> </ul>
	Accessories	<p><b>Front-Mount</b></p> <ul style="list-style-type: none"> <li>• NI 9924 Screw-Terminal Block (781922-01)</li> </ul> <p><b>Cable</b></p> <ul style="list-style-type: none"> <li>• DSUB Cable, 1 m (192568-01)</li> <li>• DIN Rail Screw-Terminal Block (781081-01)</li> </ul> <p><b>EMC Compliance</b></p> <ul style="list-style-type: none"> <li>• EMI Noise-Suppression Ferrite (782803-01)</li> </ul>

C SERIES DIGITAL INPUT/OUTPUT MODULE COMPARISON						
Product Name	Signal Levels	Channels	Update Rate	Direction	Connectivity	Isolation Continuous
NI 9381	LVTTL	4	1 $\mu$ s	Bidirectional	DSUB	None
NI 9401	5 V/TTL	8	100 ns	Bidirectional	DSUB	60 VDC Ch-Earth
NI 9402	LVTTL	4	55 ns	Bidirectional	BNC	None
NI 9403	5 V/TTL	32	7 $\mu$ s	Bidirectional	DSUB	60 VDC Ch-Earth

## 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.

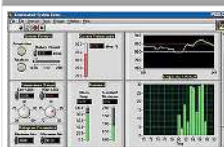
## CompactDAQ

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



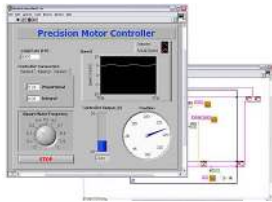
- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects
- Build DLLs, executables,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

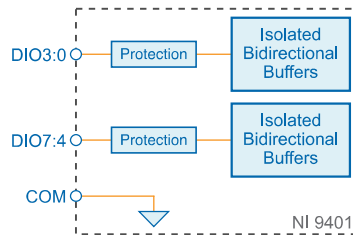


- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of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

## Input/Output Circuitry

The eight DIO channels are internally referenced to COM, so you can use any of the nine COM lines as a reference for the external signal.

Figure 1. NI-9401 Input/Output Circuitry



## NI 9401 Specifications

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

**Caution** Do not operate the NI-9401 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/Output Characteristics

Number of channels	8 DIO channels
Default power-on line direction	Input
Input/output type	TTL, single-ended
<b>Digital logic levels</b>	
<b>Input</b>	
Voltage	5.25 V maximum
High, $V_{IH}$	2 V minimum

Low, $V_{IL}$	0.8 V maximum
<b>Output High, <math>V_{OH}</math> (5.25 V maximum)</b>	
Sourcing 100 $\mu$ A	4.7 V minimum
Sourcing 2 mA	4.3 V minimum
<b>Output Low, <math>V_{OL}</math></b>	
Sinking 100 $\mu$ A	0.1 V maximum
Sinking 2 mA	0.4 V maximum
<b>Maximum signal switching frequency, per channel</b>	
<b>Input</b>	
8 input channels	9 MHz
4 input channels	16 MHz
2 input channels	30 MHz
<b>Output<sup>[1]</sup></b>	
8 output channels	5 MHz
4 output channels	10 MHz
2 output channels	20 MHz
I/O propagation delay	100 ns maximum



I/O pulse width distortion	10 ns
Input current ( $0\text{ V} \leq V_{IN} \leq 4.5\text{ V}$ )	$\pm 250\ \mu\text{A}$
Input capacitance	30 pF
Input rise/fall time	500 ns maximum
Overvoltage protection, channel-to-COM <sup>[2]</sup>	$\pm 30\text{ V}$ maximum on one channel at a time
MTBF	1,244,763 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

## Power Requirements

<b>Power consumption from chassis</b>	
Active mode	580 mW maximum
Sleep mode	1 mW maximum
<b>Thermal dissipation (at 70 °C)</b>	
Active mode	580 mW maximum
Sleep mode	1 mW maximum

## Physical Characteristics

Dimensions	Visit <a href="https://ni.com/dimensions">ni.com/dimensions</a> and search by module number.
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Weight	145 g (5.1 oz)
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## Safety Voltages

Connect only voltages that are within the following limits:

<b>Maximum voltage<sup>[3]</sup></b>	
Channel-to-COM	±30 V maximum on one channel at a time, Measurement Category I
<b>Isolation voltages</b>	
Channel-to-channel	None
<b>Channel-to-earth ground</b>	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test

## 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; Class I, Zone 2, Ex nA IIC T4 Gc
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

- EN 61326 EMC requirements; Industrial Immunity
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

## 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)

## Product Certifications and Declarations

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/product-certifications](https://ni.com/product-certifications), search by model number, and click the appropriate link.

## Shock and Vibration

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

<b>Operating vibration</b>	
Random	5 g RMS, 10 Hz to 500 Hz
Sinusoidal	5 g, 10 Hz to 500 Hz
Operating shock	30 g, 11 ms half sine; 50 g, 3 ms half sine; 18 shocks at 6 orientations

## 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 **Engineering a Healthy Planet** 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.

## EU and UK Customers

-  **Waste Electrical and Electronic Equipment (WEEE)**—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 RoHS**— NI 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 NI 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).)

<sup>1</sup> By number of output channels with an output load of 1 mA, 50 pF

<sup>2</sup> Continued use at this level will degrade the life of the module.

<sup>3</sup> The maximum voltage that can be applied or output between any channel and COM without damaging the module or other devices.