DATASHEET

NI 9403

32 DIO, 5 V/TTL, Bidirectional, 7 µs

- 5 V/TTL, sinking/sourcing digital I/O
- Bidirectional, configurable by line with shift-on-the-fly capability
- 60 VDC, CAT I isolation
- Industry-standard 37-pin DSUB connector
- -40 °C to 70 °C operating, 5 g vibration, 50 g shock

The NI 9403 is a 32-channel, 7 µs bidirectional digital I/O module for any NI CompactDAQ or CompactRIO chassis. You can configure the direction of each digital line on the NI 9403 for input or output. Each channel is compatible with 5 V/TTL signals and features 60 VDC, CAT I isolation. The NI 9403 also features ±30 V overvoltage protection and can source up to 2 mA output current per channel.

In an NI CompactDAQ chassis, you can use the NI 9403 as only a static (software-timed) digital I/O module. Due to the serial transfer of data, you cannot use these modules to route timing or triggering signals. With the NI 9403 in a CompactRIO chassis, you can use LabVIEW FPGA to program the NI 9403 for implementing custom counter/timers, pulse generation, and much more.

C SERIES DIGITAL INPUT/OUTPUT MODULE COMPARISON

Product Name	Signal Levels	Channels	Update Rate	Direction	Connectivity	Isolation Continuous
NI 9381	LVTTL	4	1 µs	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 µs	Bidirectional	DSUB	60 VDC Ch-Earth

Kit Contents	• NI 9403 • NI 9403 Getting Started Guide
Accessories	**Front-Mount** • NI 9923 Screw-Terminal Block (780179-01)
	Cable • DSUB Cable, 1 m (778621-01) • Din-Rail Spring-Terminal Block (778676-01)

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

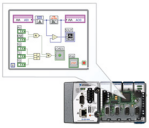
CompactDAQ is a portable, rugged data acquisition platform that integrates connectivity, data acquisition, and signal conditioning into modular I/O for directly interfacing to any sensor or signal. Using CompactDAQ with LabVIEW, you can easily customize how you acquire, analyze, visualize, and manage your measurement data.

Software

LabVIEW Professional Development System for Windows

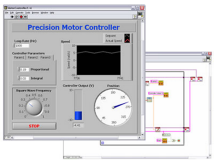
- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects
- Build DLLs, executables,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

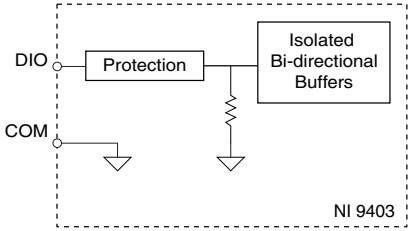


- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of 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 NI 9403 provides overvoltage, overcurrent, and short-circuit protection and isolated bi-directional buffers for each DIO channel.

Figure 1. NI 9403 Circuitry



The DIO channels have Schmitt trigger inputs and are compatible with 5 V/TTL logic devices. Each input channel has hysteresis for improved performance with noisy and non-monotonic input signals. Each channel also has a pull-down resistor.

NI 9403 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 To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

Caution Do not operate the NI 9403 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	32 digital input/output channels
Input/output type	TTL, single-ended
Default power-on line direction	Input
Input Current (0 V ≤ V_{in} ≤ 4.5 V)	±250 µA maximum
Module output current[1]	64 mA maximum
Input capacitance	30 pF
Timing	
Input	
Setup time[2]	10 ns minimum
Hold time[3]	60 ns minimum
Output	
Propagation delay[4]	330 ns maximum
Channel-to-channel skew[5]	265 ns maximum
Update/transfer time[6]	
cRIO-9151 R Series Expansion chassis	8 µS maximum
All other chassis	7 µS maximum
Direction change time	18 µS maximum
Overvoltage protection Channel-to-COM	±30 V maximum on up to 8 channels at a time; however, continued use at this level will degrade the life of the module.
MTBF	763,325 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

1 Module output current is the maximum guaranteed current that the module can drive from all the I/O lines without going into an overcurrent state.
2 *Setup time* is the amount of time input signals must be stable before reading from the module.
3 *Hold time* is the amount of time input signals must be stable after initiating a read from the module.
4 *Propagation delay* is the amount of time after writing to the module that the output signals become valid.
5 *Channel-to-channel skew* is the amount of time between the first output signal updating and the last output signal updating.
6 The update/transfer and direction change times are valid when the module is used in a CompactRIO system. When used in other systems, driver software and system latencies impact these times.

Digital Logic Levels	
Input	
Voltage	-0.25 V to 5.25 V
High, V_{IH}	2.2 V minimum
Low, V_{IL}	0.8 V maximum
Hysteresis, V_H	0.2 V minimum
Output	
High, V_{OH} (5.2 V maximum)	
Sourcing 100 µA	4.75 V minimum
Sourcing 2 mA	4.4 V minimum
Low, V_{OL}	
Sinking 100 µA	0.1 V maximum
Sinking 2 mA	0.26 V maximum

Power Requirements

Power consumption from chassis	
Active mode	1 W maximum
Sleep mode	25 µW maximum
Thermal dissipation (at 70 °C)	
Active mode	1 W maximum
Sleep mode	25 µW 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* and search by module number.

Weight	150 g (5.3 oz)

Safety Voltages

Connect only voltages that are within the following limits:

Channel-to-COM	±30 V maximum on up to 8 channels at a time, Measurement Category I
Isolation	
Channel-to-channel	None

Channel-to-earth ground	
Continuous	60 VDC, Measurement Category I
Withstand	
up to 3,000 m altitude	1,000 Vrms, verified by a 5 s dielectric withstand test
up to 5,000 m altitude	860 Vrms, 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.

Caution Do not connect the NI 9403 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 is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Industrial Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

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

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	5,000 m

Indoor use only.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at *ni.com/environment*. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

电子信息产品污染控制管理办法（中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

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