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Find the *National Instruments sbRIO-9401* at our website: *Click HERE*

DATASHEET

NI 9401

8 DIO, 5 V/TTL, Bidirectional, 100 ns



- DSUB connectivity
- CompactDAQ counter compatibility
- 60 VDC, 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	• NI 9401 • NI 9401 Getting Started Guide
Accessories	**Front-Mount** • NI 9924 Screw-Terminal Block (781922-01)
	Cable • DSUB Cable, 1 m (192568-01) • DIN Rail Screw-Terminal Block (781081-01)
	EMC Compliance • EMI Noise-Suppression Ferrite (782803-01)

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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

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.

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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.



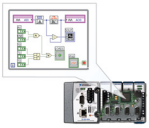
Software

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

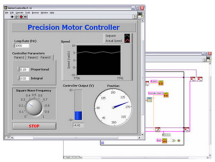
NI LabVIEW FPGA Module



- 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

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NI LabVIEW Real-Time Module

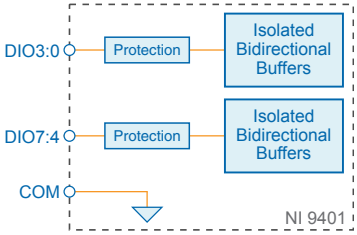


- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of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

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Input/output type	TTL, single-ended
Digital logic levels	
Input	
Voltage	5.25 V maximum
High, V_{IH}	2 V minimum
Low, V_{IL}	0.8 V maximum
Output High, V_{OH} (5.25 V maximum)	
Sourcing 100 µA	4.7 V minimum
Sourcing 2 mA	4.3 V minimum
Output Low, V_{OL}	
Sinking 100 µA	0.1 V maximum
Sinking 2 mA	0.4 V maximum
Maximum signal switching frequency, per channel	
Input	
8 input channels	9 MHz
4 input channels	16 MHz
2 input channels	30 MHz
Output[1]	
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 ($0 V \le V_{IN} \le 4.5 V$)	±250 µA
Input capacitance	30 pF
Input rise/fall time	500 ns maximum
Overvoltage protection, channel-to-COM[2]	±30 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

[1] By number of output channels with an output load of 1 mA, 50 pF
[2] Continued use at this level will degrade the life of the module.

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Power Requirements

Power consumption from chassis	
Active mode	580 mW maximum
Sleep mode	1 mW maximum
Thermal dissipation (at 70 °C)	
Active mode	580 mW maximum
Sleep mode	1 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* and search by module number.

Weight	145 g (5.1 oz)

Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage[3]	
Channel-to-COM	±30 V maximum on one channel at a time, Measurement Category I
Isolation voltages	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 VDC, Measurement Category I
Withstand	1,000 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.

[3] The maximum voltage that can be applied or output between any channel and COM without damaging the module or other devices.

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Caution Do not connect the NI 9401 to signals or use for measurements within Measurement Categories II, III, or IV.

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.

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 EMC requirements; Industrial Immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

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.

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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.

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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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