# NI-9402 Specifications

# Contents

# NI 9402 Datasheet

- BNC connectivity
- CompactDAQ counter compatibility
- Individually configurable channel directions

The NI 9402 is a digital input/output module for any CompactDAQ or CompactRIO system. You can configure the direction of the channels for input or output on a per-channel basis. Each channel features 1,000 Vrms transient isolation between the channel and the backplane.

With CompactRIO, you can use the LabVIEW FPGA Module to program the NI 9402 for implementing custom, high-speed counter/timers; digital communication protocols; pulse generation; and much more.

| | Kit Contents | • NI 9402<br>• NI 9402 Getting Started Guide |
|---|---|---|
| | Accessories | • BNC-to-BNC Male Cables (779697-02) |

| 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.

# 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
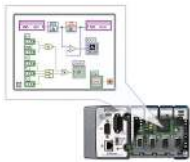
- Design FPGA applications for NI RIO hardware
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing 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
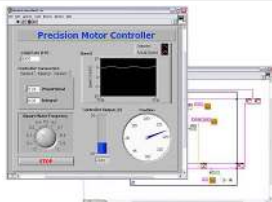
- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of 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

Each channel on the NI-9402 can be configured in software for input or output. Changing the direction on any channel does not affect the direction on other channels.

Figure 1. NI-9402 Circuitry for One Channel
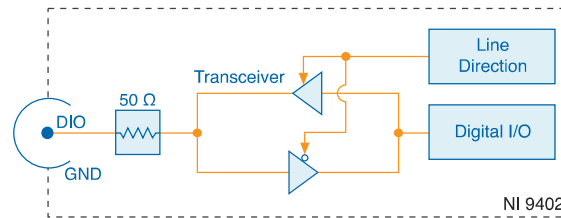


- Line direction logic enables/disables the line input and output transceiver. Setting the I/O line as input enables the input transceiver and disables the output receiver, and vice versa when the I/O line is set as output.

- The output impedance of the NI-9402 is 50 Ω, so the characteristic impedance of the BNC cable should be matched to 50 Ω to ensure optimal signal integrity.

# NI 9402 Specifications

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

**Caution** Do not operate the NI-9402 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 | 4 DIO channels |
|---|---|
| Default power-on line direction | Input |
| Input/output type | LVTTL, single-ended |

| **Digital logic levels** | |
|---|---|
| Maximum input voltage | 5.25 V |
| Input high, $V_{IH}$ | 2 V minimum |

| Input low, $V_{IL}$ | 0.8 V maximum |
|---|---|

**Output high, $V_{OH}$ (3.4 V maximum)**

| Sourcing 100 µA | 3.0 V minimum |
|---|---|
| Sourcing 2 mA | 2.8 V minimum |

**Output low, VOL**

| Sinking 100 µA | 0.1 V maximum |
|---|---|
| Sinking 2 mA | 0.3 V maximum |

**Maximum I/O switching frequency**

| 4 channels | 16 MHz |
|---|---|
| 2 channels | 20 MHz |

| I/O propagation delay[1],[2] | 55 ns maximum, 18 ns typical |
|---|---|
| I/O pulse width distortion[2] | 25 ns maximum |
| Input low current, $I_{IL}$ ($V_{IN}$ = 0 V) | -55 µA maximum |
| Input high current, $I_{IH}$ ($V_{IN}$ = 4.5 V) | 150 µA maximum |

**Input impedance**

| Input capacitance | 50 pF maximum |
|---|---|
| Input resistance | 49 kΩ minimum |

| Input rise/fall rate | 10 ns/V maximum |
|---|---|
| Input protection | ±30 V maximum on one channel at a time |
| MTBF | 1,482,777 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method |

# Power Requirements

| Power consumption from chassis | |
|---|---|
| Active mode | 550 mW maximum |
| Sleep mode | 1 mW maximum |

| Thermal dissipation (at 70 °C) | |
|---|---|
| Active mode | 550 mW maximum |
| Sleep mode | 1 mW maximum |

# Physical Characteristics

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

| Cable | 50 Ω BNC |
|---|---|
| Cable length | 2 m maximum |
| Weight | 199 g (6.9 oz) |

# Safety Voltages

Connect only voltages that are within the following limits:

| Channel-to-earth ground | ±30 V maximum |
|---|---|

| 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 Gc |
|---|---|

| Canada (C-UL) | Class I, Division 2, Groups A, B, C, D, T4; Ex nA IIC T4 Gc |
|---|---|
| Europe (ATEX) and International (IECEx) | Ex nA IIC T4 Gc<br><br>DEMKO 07 ATEX 0626664X<br><br>IECEx UL 14.0089X |

## Safety Compliance 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 C22.2 No. 61010-1
- EN 60079-0, EN 60079-7
- IEC 60079-0, IEC 60079-7
- UL 60079-0, UL 60079-7
- CSA C22.2 No. 60079-0, CSA C22.2 No. 60079-7

**Note** For safety certifications, refer to the product label or the Product Certifications and Declarations section.

## Electromagnetic Compatibility

## CE Compliance C E

- 2014/34/EU; 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, search by model number, and click the appropriate link.

# Shock and Vibration

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

| Operating vibration | |
| --- | --- |
| 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 60068-2-30) | 10% RH to 90% RH, noncondensing |
| Storage humidity (IEC 60068-2-30) | 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. 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.

## 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。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

[1] Propagation delay is the maximum amount of time it takes for an input or output signal to propagate between the backplane and the I/O connector, and does not include any additional delay introduced by the cable.

[2] Measured at the I/O connector of a load with requirements similar to the NI 9402 and driven through a 2 m coaxial cable.