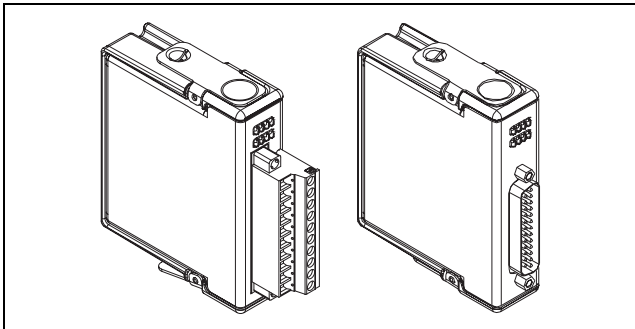


OPERATING INSTRUCTIONS

CompactRIO™ cRIO-9421/9423

8-Channel Digital Input Modules



These operating instructions describe how to use the NI cRIO-9421 and the cRIO-9423. In this document, the cRIO-9421 with screw terminal and cRIO-9421 with DSUB are referred to inclusively as the cRIO-9421. For information about installing, configuring, and programming the CompactRIO system, refer to the *CompactRIO Bookshelf* at **Start»All Programs»National Instruments»CompactRIO»Search the CompactRIO Bookshelf**.

Safety Guidelines

Operate the cRIO-9421/9423 only as described in these operating instructions.



Hot Surface This icon denotes that the component may be hot. Touching this component may result in bodily injury.

Safety Guidelines for Hazardous Locations

The cRIO-9421/9423 is suitable for use in Class I, Division 2, Groups A, B, C, and D hazardous locations; Class 1, Zone 2, AEx nC IIC T4 and Ex nC IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are

installing the cRIO-9421/9423 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.



Caution Do *not* disconnect I/O-side wires or connectors unless power has been switched off or the area is known to be nonhazardous.



Caution Do *not* remove modules unless power has been switched off or the area is known to be nonhazardous.




Caution Substitution of components may impair suitability for Class I, Division 2.



Caution For Zone 2 applications, install the CompactRIO system in an enclosure rated to at least IP 54 as defined by IEC 60529 and EN 60529.

Special Conditions for Safe Use in Europe

This equipment has been evaluated as EEx nC IIC T4 equipment under DEMKO Certificate No. 02 ATEX 0324020X. Each module is marked  II 3G and is suitable for use in Zone 2 hazardous locations.

Safety Guidelines for Hazardous Voltages

You can connect hazardous voltages to the cRIO-9421 with screw terminal and cRIO-9423 only. Do not connect hazardous voltages to the cRIO-9421 with DSUB.

If *hazardous voltages* are connected to the module, take the following precautions. A hazardous voltage is a voltage greater than $42.4 V_{\text{peak}}$ or 60 VDC to earth ground.



Caution Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.



Caution Do *not* mix hazardous voltage circuits and human-accessible circuits on the same module.



Caution Make sure that devices and circuits connected to the module are properly insulated from human contact.



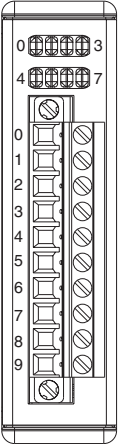
Caution When module terminals are live with hazardous voltages, make sure that the terminals are *not* accessible. You can use the cRIO-9932 connector kit or put the CompactRIO chassis in a suitably rated enclosure to prevent access to the terminals.

Wiring the cRIO-9421/9423

The cRIO-9421/9423 provides connections for eight digital input channels. The cRIO-9421 with screw terminal and the cRIO-9423 have a 10-terminal, detachable screw-terminal connector. The cRIO-9421 with DSUB has a 25-pin DSUB connector.

Each channel of the cRIO-9421/9423 has a terminal or pin, DI, to which you can connect voltage or current signals. The cRIO-9421/9423 also has a common terminal or pin, COM, that is internally connected to the isolated reference of the module. Each digital input channel on the cRIO-9421/9423 has an LED that indicates the state of that channel. Refer to Table 1 for the terminal assignments of the cRIO-9421 with screw terminal and cRIO-9423. Refer to Figure 1 for the pin assignments of the cRIO-9421 with DSUB.

Table 1. Terminal Assignments

| Module | Terminal | Signal |
|---|-----------------|---------------|
|  | 0 | DI0 |
| | 1 | DI1 |
| | 2 | DI2 |
| | 3 | DI3 |
| | 4 | DI4 |
| | 5 | DI5 |
| | 6 | DI6 |
| | 7 | DI7 |
| | 8 | No connection |
| | 9 | Common (COM) |

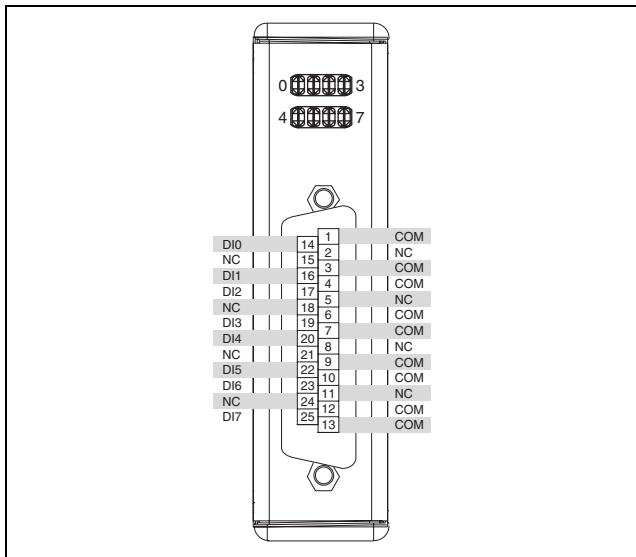


Figure 1. Pin Assignments

Connecting Devices to the cRIO-9421/9423

The cRIO-9421/9423 has *sinking inputs*, meaning that when current goes through or voltage is applied to the DI terminal or pin, DI provides a path to ground for the current or voltage. The cRIO-9421/9423 internally limits current signals connected to DI. For more information about input current protection, refer to the [Specifications](#) section.

You can connect 2-, 3-, and 4-wire *sourcing-output* devices to the cRIO-9421/9423. A sourcing-output device drives current or applies voltage to DI. An example of a sourcing-output device is a PNP open collector.

Connect the output of the sourcing-output device to DI on the cRIO-9421/9423. Connect the common of the external device to the COM terminal or pin. Figure 2 shows a possible configuration.

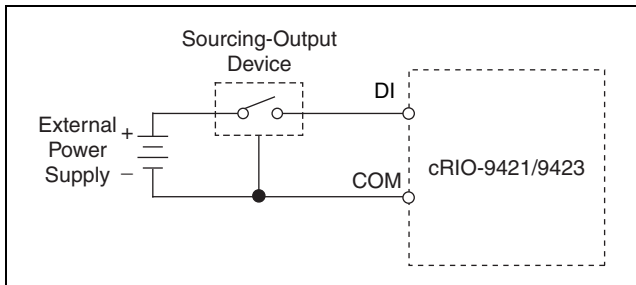


Figure 2. Connecting a Device to the cRIO-9421/9423 (3-Wire Device Shown)

The cRIO-9421/9423 channel registers as ON when the sourcing-output device applies a voltage or drives a current to DI that is in the input ON range. The channel registers as OFF when the device applies a voltage or drives a current to DI that is in the input OFF range. If no device is connected to DI, the channel registers as OFF. The channel LED turns on and off to indicate the state of the channel. Refer to the [Specifications](#) section for more information about ON and OFF ranges.

Sleep Mode

You can enable sleep mode for the CompactRIO system in software. In sleep mode, the system consumes less power and may dissipate less heat. Typically, when a system is in sleep mode, you cannot communicate with the modules. Refer to the [Specifications](#) section for more information about power consumption and thermal dissipation. Refer to the *CompactRIO Bookshelf* for more information about enabling sleep mode in software.

Upgrading NI-RIO Software

You may need to upgrade NI-RIO software when you add new modules to the CompactRIO system. For information about determining which software you need and how to upgrade the software, go to ni.com/info and enter `rdniriosoftware`.

Specifications

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

Input Characteristics

Number of channels 8

Input type Sinking

Digital logic levels

OFF state

Input voltage ≤ 5 V

cRIO-9421 input current ≤ 300 μ A

cRIO-9423 input current ≤ 150 μ A

ON state

Input voltage 11 to 30 V

Input current ≥ 3 mA

I/O protection

Input voltage

cRIO-9421 40 V max

cRIO-9423 35 V max

Reverse biased voltage–30 V max

Input current

cRIO-9421 7 mA max, internally limited

cRIO-9423 8.5 mA max,
internally limited

Input delay time

cRIO-9421 100 μ s max

cRIO-9423 1 μ s max

MTBF

cRIO-9421 2,086,204 hours at 25 °C;
Bellcore Issue 6, Method 1,
Case 3, Limited Part Stress
Method

cRIO-9423 979,623 hours at 25 °C;
Bellcore Issue 6, Method 1,
Case 3, Limited Part Stress
Method



Note Contact NI for Bellcore MTBF specifications at other temperatures or for MIL-HDBK-217F specifications. Go to ni.com/certification and

search by model number or product line for more information about MTBF and other product certifications.

cRIO-9421 Power Requirements

Power consumption from chassis

Active mode 240 mW max

Sleep mode 7 mW max

Thermal dissipation (at 70 °C)..... 1.3 W max

cRIO-9423 Power Requirements

Power consumption from chassis

Active mode 290 mW max

Sleep mode 7 mW max

Thermal dissipation (at 70 °C)..... 1.5 W max

Physical Characteristics

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

| | |
|----------------------------------|--|
| Screw-terminal wiring | 12 to 24 AWG copper conductor wire with 10 mm (0.39 in.) of insulation stripped from the end |
| Torque for screw terminals | 0.5 to 0.6 N · m (4.4 to 5.3 lb · in.) |

Weight

| | |
|--|------------------------|
| cRIO-9421 with screw terminal/9423 | Approx. 150 g (5.3 oz) |
| cRIO-9421 with DSUB | Approx. 145 g (5.1 oz) |

Safety

cRIO-9421 with Screw Terminal and cRIO-9423

Safety Voltages

Connect only voltages that are within these limits.

| | |
|----------------------|----------|
| Channel-to-COM | 30 V max |
|----------------------|----------|

Isolation

Channel-to-channel No isolation between channels

Channel-to-earth ground

Withstand 2,300 V_{rms}, 1 minute max

Continuous 250 V_{rms},

Installation Category II

Installation Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (for example, 115 V for U.S. or 230 V for Europe).

cRIO-9421 with DSUB Safety Voltages

Channel-to-COM 30 V max

Isolation

Channel-to-channel No isolation between channels

Channel-to-earth ground

Withstand 1,000 V_{rms}, 1 minute max

Continuous 60 VDC,

Installation Category I

Installation 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.

Safety Standards

The cRIO-9421/9423 is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1
- CAN/CSA-C22.2 No. 61010-1



Note For UL and other safety certifications, refer to the product label or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Hazardous Locations

| | |
|---------------------|---|
| U.S. (UL) | Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nC IIC T4 |
| Canada (C-UL) | Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nC IIC T4 |
| Europe (DEMKO)..... | EEx nC IIC T4 |

Environmental

CompactRIO modules are intended for indoor use only. For outdoor use, mount the CompactRIO system in a suitably rated enclosure. Refer to the installation instructions for the chassis you are using for more information about meeting these specifications.

| | |
|--|--------------------------------|
| Operating temperature (IEC60068-2-1, IEC 60068-2-2) | -40 to 70 °C |
| Storage temperature (IEC60068-2-1, IEC 60068-2-2) | -40 to 85 °C |
| Ingress protection..... | IP 40 |
| Operating humidity (IEC 60068-2-56)..... | 10 to 90% RH, noncondensing |
| Storage humidity (IEC 60068-2-56)..... | 5 to 95% RH, noncondensing |
| Maximum altitude..... | 2,000 m |
| Pollution Degree (IEC 60664) | 2 |

Shock and Vibration

To meet these specifications, you must panel mount the CompactRIO system and, for the cRIO-9421 with screw terminal and cRIO-9423, affix ferrules to the ends of the terminal wires.

| | |
|--|--|
| Operating vibration, random (IEC 60068-2-64)..... | 5 g _{rms} , 10 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 |
| Operating vibration, sinusoidal (IEC 60068-2-6) | 5 g, 10 to 500 Hz |

Electromagnetic Compatibility

| | |
|----------------|--|
| Emissions..... | EN 55011 Class A at 10 m FCC Part 15A above 1 GHz |
| Immunity..... | Industrial levels per EN 61326-1:1997 + A2:2001, Table A.1 |
| EMC/EMI | CE, C-Tick, and FCC Part 15 (Class A) Compliant |



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

FCC Compliance

Go to ni.com/info and enter `rdcriofcc` for information about using this product in compliance with FCC regulations.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety)..... 73/23/EEC

Electromagnetic Compatibility

Directive (EMC) 89/336/EEC



Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain 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.

National Instruments Contact Information

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at ni.com/support and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 1800 300 800, Austria 43 0 662 45 79 90 0,
Belgium 32 0 2 757 00 20, Brazil 55 11 3262 3599,
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Canada (Québec) 450 510 3055, Canada (Toronto) 905 785 0085,
Canada (Vancouver) 604 685 7530, China 86 21 6555 7838,
Czech Republic 420 224 235 774, Denmark 45 45 76 26 00,
Finland 385 0 9 725 725 11, France 33 0 1 48 14 24 24,
Germany 49 0 89 741 31 30, India 91 80 51190000,
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Japan 81 3 5472 2970, Korea 82 02 3451 3400,
Malaysia 603 9131 0918, Mexico 01 800 010 0793,
Netherlands 31 0 348 433 466, New Zealand 0800 553 322,
Norway 47 0 66 90 76 60, Poland 48 22 3390150,

Portugal 351 210 311 210, Russia 7 095 783 68 51,
Singapore 65 6226 5886, Slovenia 386 3 425 4200,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
Sweden 46 0 8 587 895 00, Switzerland 41 56 200 51 51,
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United Kingdom 44 0 1635 523545

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