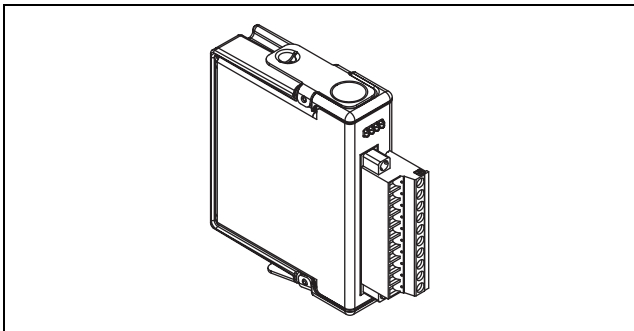


OPERATING INSTRUCTIONS

CompactRIO™ cRIO-9435

4-Channel, Universal Digital Input Module



These operating instructions describe how to use the National Instruments cRIO-9435 module. For information about installing, configuring, and programming the CompactRIO system, refer to the *CompactRIO Bookshelf* at **Start»Program Files»National Instruments»CompactRIO»Search the CompactRIO Bookshelf**.

Safety Guidelines

Operate the cRIO-9435 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-9435 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 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the cRIO-9435 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.

Safety Guidelines for Hazardous Voltages

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.

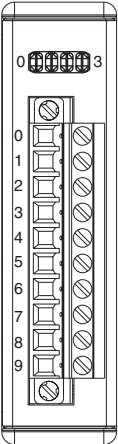


Caution When module terminals are live with hazardous voltages, make sure that the terminals are *not* accessible. You can use the cRIO-9932 connector kit or put the CompactRIO chassis in a suitably rated enclosure to prevent access to the terminals.

Wiring the cRIO-9435

The cRIO-9435 has a 10-terminal, detachable screw-terminal connector that provides connections for four digital input channels. Each channel has two terminals, DIa and DIb, to which you can connect voltage signals. The cRIO-9435 measures whether the difference between the DIa and DIb terminals is greater than or less than the digital logic levels. Refer to the [Specifications](#) section for more information about digital logic levels. Each channel has an LED that indicates the state of that channel. Refer to Table 1 for the terminal assignments for each channel.

Table 1. Terminal Assignments

Module	Terminal	Signal
	0	DI0a
	1	DI0b
	2	DI1a
	3	DI1b
	4	DI2a
	5	DI2b
	6	DI3a
	7	DI3b
	8	No connection
	9	No connection

Connecting Sinking-Output Devices to the cRIO-9435

You can connect *sinking-output* devices to the cRIO-9435.

A sinking-output device provides a path for current or voltage.

Connect the device to the DIa and DIb terminals on the cRIO-9435.

Figure 1 shows a possible configuration.

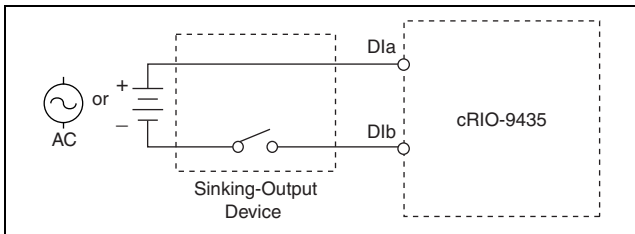


Figure 1. Connecting a Sinking-Output Device to the cRIO-9435

The cRIO-9435 channel registers as ON when the sinking-output device provides a path for current or voltage from the DIa or DIb terminal. The cRIO-9435 registers as OFF when the device does not provide a path for the current or voltage. The channel LED turns on and off to indicate the state of the channel.

Connecting Sourcing-Output Devices to the cRIO-9435

You can connect *sourcing-output* devices to the cRIO-9435. A sourcing-output device drives current or applies voltage to the DIa or DIb terminal. Connect the device to the DIa and DIb terminals on the cRIO-9435. Figure 2 shows a possible configuration.

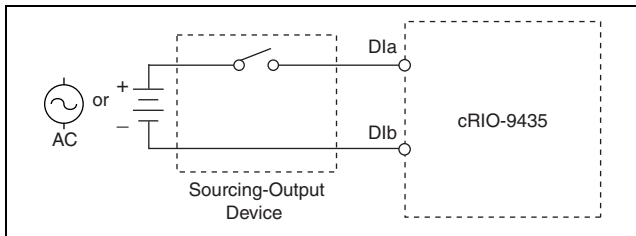


Figure 2. Connecting a Sourcing-Output Device to the cRIO-9435

The cRIO-9435 channel registers as ON when the sourcing-output device drives current or applies a voltage to the cRIO-9435 terminal. The cRIO-9435 registers as OFF when the device does not drive a current or apply a voltage to the terminal. The channel LED turns on and off to indicate the state of the channel.

Connecting Switches to the cRIO-9435

You can connect switches to the cRIO-9435. Connect either the DIa or the DIb terminal to the switch and the other terminal to the system ground. Figure 3 shows a possible configuration.

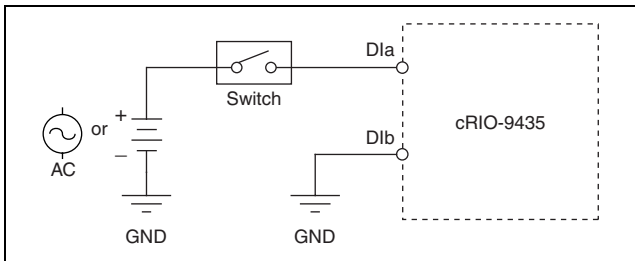


Figure 3. Connecting a Switch to the cRIO-9435

Sensing Power with the cRIO-9435

You can use the cRIO-9435 to sense when power is applied to a load. Connect the load to the DIa and DIb terminals on the cRIO-9435. Figure 4 shows a possible configuration.

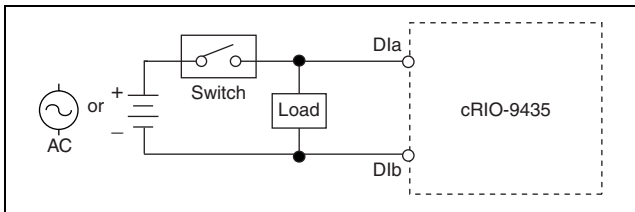


Figure 4. Connecting a Load to the cRIO-9435

cRIO-9435 Circuitry

The input terminals, DIa and DIb, are interchangeable. When an external device applies a voltage across the DIa and DIb terminals, current flows through the terminals and turns on the optoisolator. The channel LED turns on and the chassis registers the channel as ON. The module limits the current flow. Refer to the [Specifications](#) section for more information about the module-limited input current.

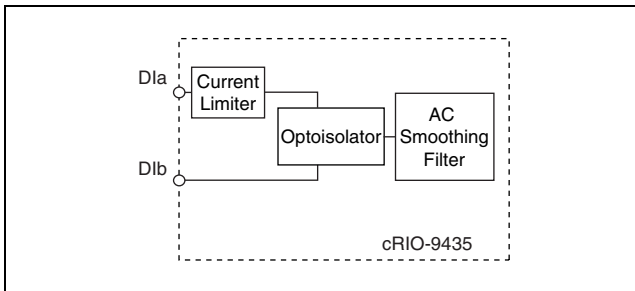


Figure 5. cRIO-9435 Digital Input Circuit for One Channel

Digital Logic Levels

When an external device applies an AC signal across the DIa and DIb terminals, the channel registers as ON or OFF depending on the voltage and frequency of the signal. When an external device applies a DC signal across the terminals, the channel registers as ON or OFF depending on the differential voltage of the signal. Refer to the *Specifications* section for more information.

Input Delay Time

The input delay time is the minimum amount of time that the voltage across a channel must remain at the ON or OFF level to change the channel from ON to OFF or from OFF to ON. Refer to the *Specifications* section for more information.

Sleep Mode

You can enable sleep mode for the CompactRIO system in software. Typically, when a system is in sleep mode, you cannot communicate with the modules. In sleep mode, the system minimizes power consumption. The system thermal dissipation may decrease. 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.

Specifications

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

Input Characteristics

Number of channels 4

Input type Sinking or sourcing

Digital logic levels

OFF state

Input voltage $\leq \pm 1$ VDC/VAC_{peak}

Input current $\leq \pm 200$ μ A DC/AC_{peak}

ON state

DC input voltage $\geq \pm 4$ VDC

DC input current ≥ 600 μ A DC

AC input voltage ≥ 10 V_{rms} at 50/60 Hz

AC input voltage ≥ 3 V_{rms} at 1 kHz

I/O protection

Input voltage (DIa–DIb) 250 VAC, ± 250 VDC max

Input current ± 1.4 mA, internally limited

Input delay time	2.8 ms max
MTBF	700,726 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.

Power Requirements

Power consumption from chassis

Active mode 105 mW max

Sleep mode 1.3 mW max

Thermal dissipation (at 70 °C)

Active mode 1.4 W max

Sleep mode 1.35 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
Length stripped from end of terminal wire.....	10 mm (0.39 in.) for low voltages
Torque for screw terminals	0.5 to 0.6 N · m (4.4 to 5.3 lb · in.)
Weight.....	Approx. 150 g (5.3 oz)

Safety

Safety Voltages

Connect only voltages that are within these limits.

DIa-to-DIb	250 V _{rms} max, Installation Category II
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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).

Isolation

Channel-to-channel No isolation between channels

Channel-to-earth ground

Continuous 250 V_{rms}

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

Safety Standards

The cRIO-9435 is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- EN 61010-1, IEC 61010-1
- UL 3111-1, UL 61010B-1
- CAN/CSA C22.2 No. 1010.1



Note For UL and other safety certifications, refer to the product label or visit ni.com/hardref.nsf, search by module 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, AEx nC IIC T4



Note The cRIO-9435 is not approved for use in hazardous locations in Europe.

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	-40 to 70 °C
Storage temperature	-40 to 85 °C
Ingress protection.....	IP 40

Humidity	10 to 90% 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 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.

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/hardref.nsf, search by module number or product line, and click the appropriate link in the Certification column.

National Instruments Contact Information

Go to ni.com/support for the most current manuals, examples, and troubleshooting information. For telephone support in the United States, create a 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,
Canada (Calgary) 403 274 9391, Canada (Montreal) 514 288 5722,
Canada (Ottawa) 613 233 5949, Canada (Québec) 514 694 8521,
Canada (Toronto) 905 785 0085, Canada (Vancouver) 514 685 7530,
China 86 21 6555 7838, Czech Republic 420 2 2423 5774,
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,
Greece 30 2 10 42 96 427, India 91 80 51190000,
Israel 972 0 3 6393737, Italy 39 02 413091, Japan 81 3 5472 2970,
Korea 82 02 3451 3400, Malaysia 603 9131 0918,
Mexico 001 800 010 0793, Netherlands 31 0 348 433 466,
New Zealand 0800 553 322, Norway 47 0 66 90 76 60,
Poland 48 0 22 3390 150, 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,
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Switzerland 41 56 200 51 51, Taiwan 886 2 2528 7227,
Thailand 662 992 7519, United Kingdom 44 0 1635 523545

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