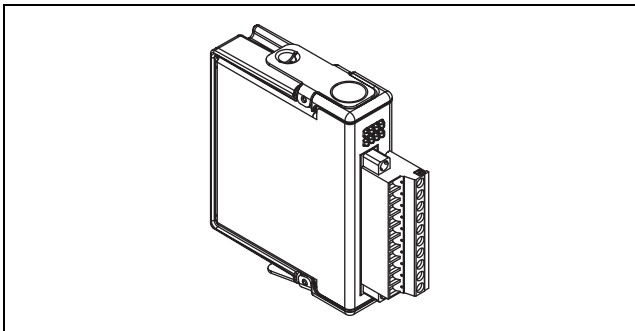


OPERATING INSTRUCTIONS

CompactRIO™ cRIO-9472/9474

8-Channel Digital Output Modules



These operating instructions describe how to use the National Instruments cRIO-9472 and cRIO-9474. 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-9472/9474 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-9472/9474 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 T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the cRIO-9472/9474 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. 03 ATEX 0324020X. Each module is marked  II 3G and is suitable for use in Zone 2 hazardous locations.

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.



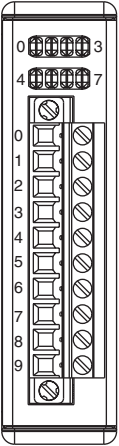
Caution When module terminals are live with hazardous voltages, make sure that the terminals are *not* accessible. You can use the cRIO-9932 connector kit or put the CompactRIO chassis in a suitably rated enclosure to prevent access to the terminals.

Wiring the cRIO-9472/9474

The cRIO-9472/9474 has a 10-terminal, detachable screw-terminal connector that provides connections for eight digital output channels. Each channel has a terminal, DO, to which you connect your device. Each channel has an LED that indicates the state of that channel.

You must connect an external power supply to the cRIO-9472/9474. This power supply provides the current for the devices you connect to the cRIO-9472/9474. Connect the positive lead of the power supply to the supply terminal, V_{sup} , and the negative lead of the power supply to the common terminal, COM. The eight digital output channels are internally referenced to the COM terminal. Refer to Table 1 for the terminal assignments.

Table 1. Terminal Assignments

Module	Terminal	Signal
	0	DO0
	1	DO1
	2	DO2
	3	DO3
	4	DO4
	5	DO5
	6	DO6
	7	DO7
	8	Supply (Vsup)
	9	Common (COM)

Connecting Devices to the cRIO-9472/9474

The cRIO-9472/9474 has *sourcing outputs*, meaning the DO terminal drives current or applies voltage to the device to which it is connected.

You can connect *sinking-input* devices or other DC devices to the cRIO-9472/9474. A sinking-input device provides a path for current or voltage. Make sure the device you connect to the cRIO-9472/9474 meets the module specifications. Refer to the [Specifications](#) section for more information about the output specifications of the cRIO-9472/9474.

Connect the device to the DO terminal on the cRIO-9472/9474. Connect the common of the device to the COM terminal. Figure 1 shows a possible configuration.

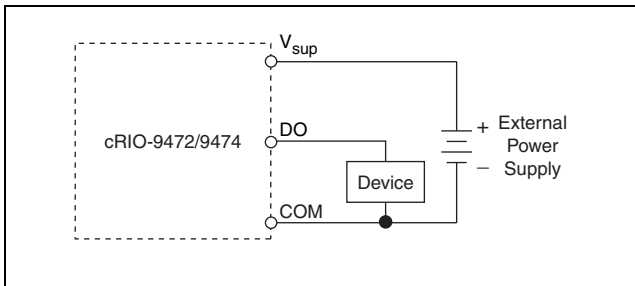


Figure 1. Connecting a Device to the cRIO-9472/9474

When the channel is on, the channel LED is on and the terminal associated with the channel drives a current or applies a voltage to the device. When the channel is off, the channel LED is off and the terminal does not drive current or apply voltage to the device. For more information about writing to digital output channels, refer to the *CompactRIO Bookshelf*.

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.

I/O Protection

The cRIO-9472/9474 is short-circuit proof in accordance with IEC1131-2 and provides overcurrent protection.

Understanding Short-Circuit-Proof Devices

Each channel on the cRIO-9472/9474 has circuitry that protects it from current surges resulting from short circuits. Whether the module suffers damage from these overcurrent conditions depends on the following factors:

- The amount of current through the channel
- The amount of time the current is above the current limit
- The frequency of the current surges

When the amount of current through the DO terminal is greater than the guaranteed trip current for the module, the channel trips

and goes into an overcurrent state. In an overcurrent state, the channel turns off and the module is not damaged. If the current through the terminal is higher than the minimum possible trip current and lower than the guaranteed trip current, the state of the channel is indeterminate and depends on factors such as the current level, the temperature, and the power supply.

To prevent false tripping, higher inrush currents that exist for less than the trip time do not trip the protection circuitry. Refer to the *Specifications* section for more information about the maximum continuous output current, trip current, and trip time. You also can refer to the IEC 1131-2 standard for more information about short-circuit-proof devices.

Power Supplies and Overcurrent Conditions

If there is a short circuit, the current through the DO channel can exceed the current rating for the power supply and the maximum continuous output current for the cRIO-9472/9474.

If the power supply you are using with the cRIO-9472/9474 cannot supply more than the guaranteed trip current, the cRIO-9472/9474 may be damaged if there is an overcurrent condition.

Detecting an Overcurrent Condition

If a device connected to the module is not working while the channel is on, the module channel may be in an overcurrent state. Neither the software nor the module LEDs indicate if there is an overcurrent condition. A channel LED may be on even though the channel is off because of an overcurrent condition. To determine if the channel is in an overcurrent state, measure the voltage between the DO terminal and the Vsup terminal. If the voltage is equal to the voltage of the external power supply connected to the module, the channel is in an overcurrent state.

Resetting Channels After an Overcurrent Condition

After you have determined and fixed the cause of the overcurrent condition, reset the channel. To reset the channel, turn the channel off. For more information about writing to digital output channels, refer to the *CompactRIO Bookshelf*. Alternatively, you can disconnect the external power supply from the module. However, doing so disconnects power from all of the module channels. Normal operation can resume after you correct the overcurrent condition and reset the channel.

Specifications

The following specifications are typical for the range -40 to 70 °C unless otherwise noted. The specifications are the same for the cRIO-9472 and cRIO-9474 unless otherwise noted.

Output Characteristics

Number of channels	8
Output type	Sourcing
Supply voltage range (V_{sup})	
cRIO-9472	6 to 30 V
cRIO-9474	5 to 30 V
Output voltage	$V_{sup} - (I_0 \cdot R_0)$
Output impedance (R_0)	0.13 Ω max; 0.07 Ω typ
Continuous output current (I_0)	
cRIO-9472	0.75 A max per channel
cRIO-9474	1 A max per channel
I/O protection	
Voltage	30 V max
Reversed voltage	None

Trip currents

Minimum possible
trip current..... 6 A

Minimum guaranteed
trip current..... 13 A

Current	Trips Channel	Damages Module
0 to 1 A	Channel does not trip.	Module is not damaged.
1 to 6 A	Channel does not trip.	Module may be damaged.
6 to 13 A	Channel may trip.	Module may be damaged.
>13 A	Channel trips.	Module is not damaged.

Trip time 10 μ s at 13 A

Output delay time (full load)

cRIO-9472 100 μ s max

cRIO-9474 1 μ s max

MTBF

cRIO-9472	563,343 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method
cRIO-9474	479,889 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.

cRIO-9472 Power Requirements

Power consumption from chassis

Active mode	230 mW max
Sleep mode	0.4 mW max

Thermal dissipation (at 70 °C)

Active mode	1.5 W max
Sleep mode	55 mW max

cRIO-9474 Power Requirements

Power consumption from chassis

Active mode 660 mW max

Sleep mode 0.6 mW max

Thermal dissipation (at 70 °C)

Active mode 1.5 W max

Sleep mode 0.6 mW 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..... Approx. 150 g (5.3 oz)

Safety

Safety Voltages

Connect only voltages that are within these limits.

Channel-to-COM 30 V max,
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.

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-9472/9474 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 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,
ATEX nC IIC T4

Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx 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	-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 model number or product line, and click the appropriate link in the Certification column.

National Instruments Contact Information

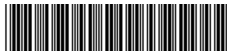
Go to ni.com/support for the most current manuals, examples, and troubleshooting information. For telephone support in the United States, create a service request at ni.com/support and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

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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,
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