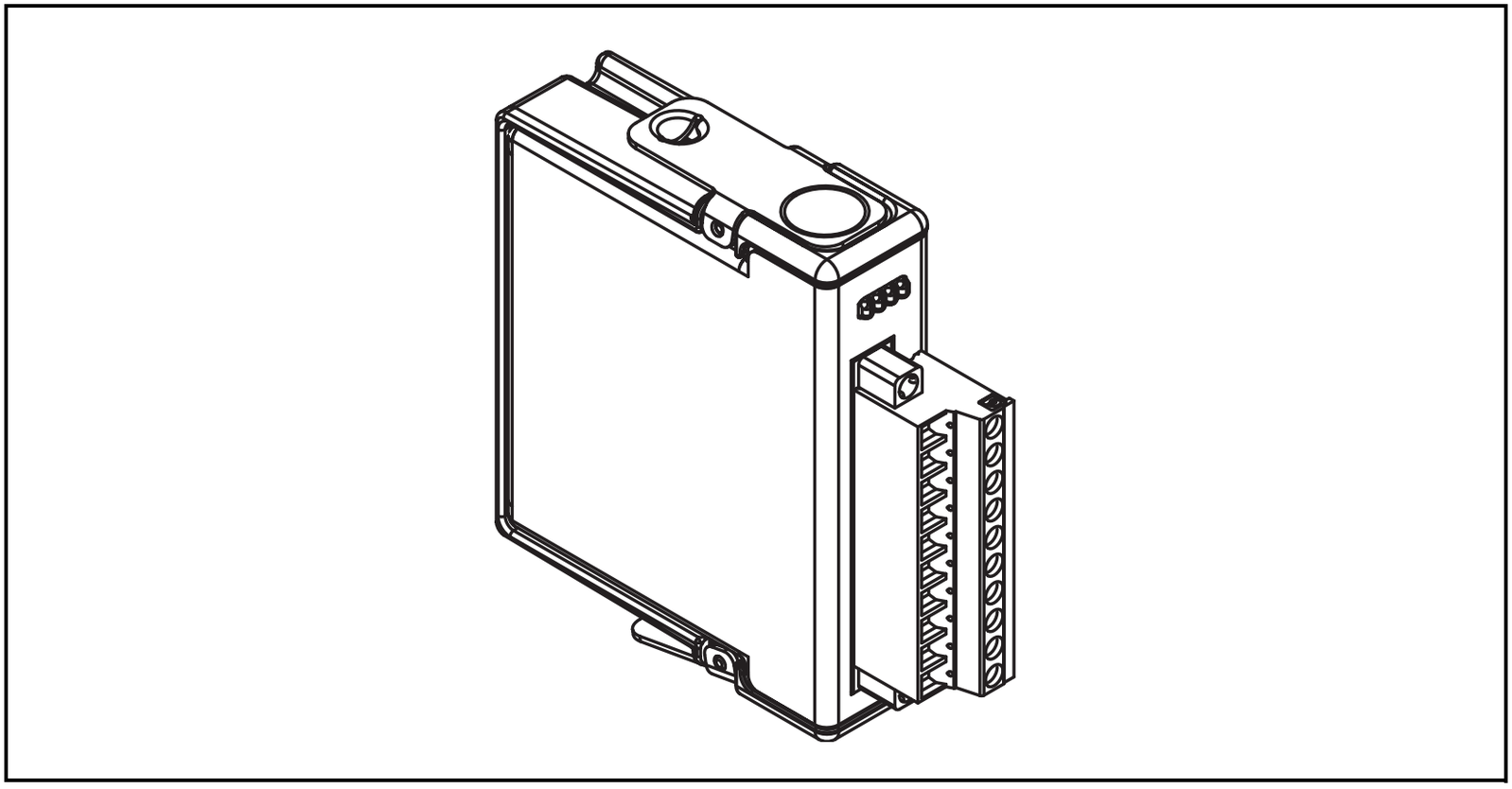
OPERATING INSTRUCTIONS

CompactRIO™ cRIO-9481

4-Channel SPST Relay Module



NATIONAL INSTRUMENTS™

These operating instructions describe how to use the National Instruments cRIO-9481 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-9481 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-9481 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-9481 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 the device has been powered off or the area is known to be nonhazardous.

Caution Do *not* remove modules unless the device has been powered 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_{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.

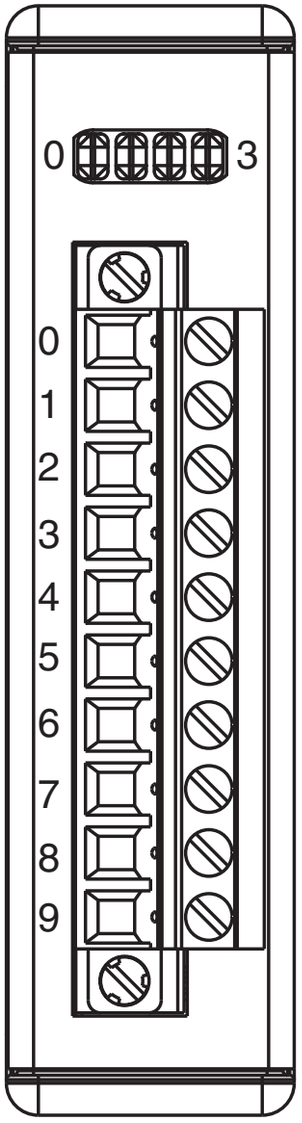
Caution Make sure that devices and circuits connected to the module are properly insulated from human contact.

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-9481

The cRIO-9481 has a 10-terminal, detachable screw-terminal connector that provides connections for four electromechanical relay channels. Each channel has two interchangeable terminals, CHa and CHb. 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	CH0a
	1	CH0b
	2	CH1a
	3	CH1b
	4	CH2a
	5	CH2b
	6	CH3a
	7	CH3b
	8	No connection
	9	No connection

Connecting Loads to the cRIO-9481

You can connect loads to the cRIO-9481. Connect the load to one of the leads of the power source. Connect either the CHa or the CHb terminal to the load and the other terminal to the other lead of the power source. Figure 1 shows a possible configuration.

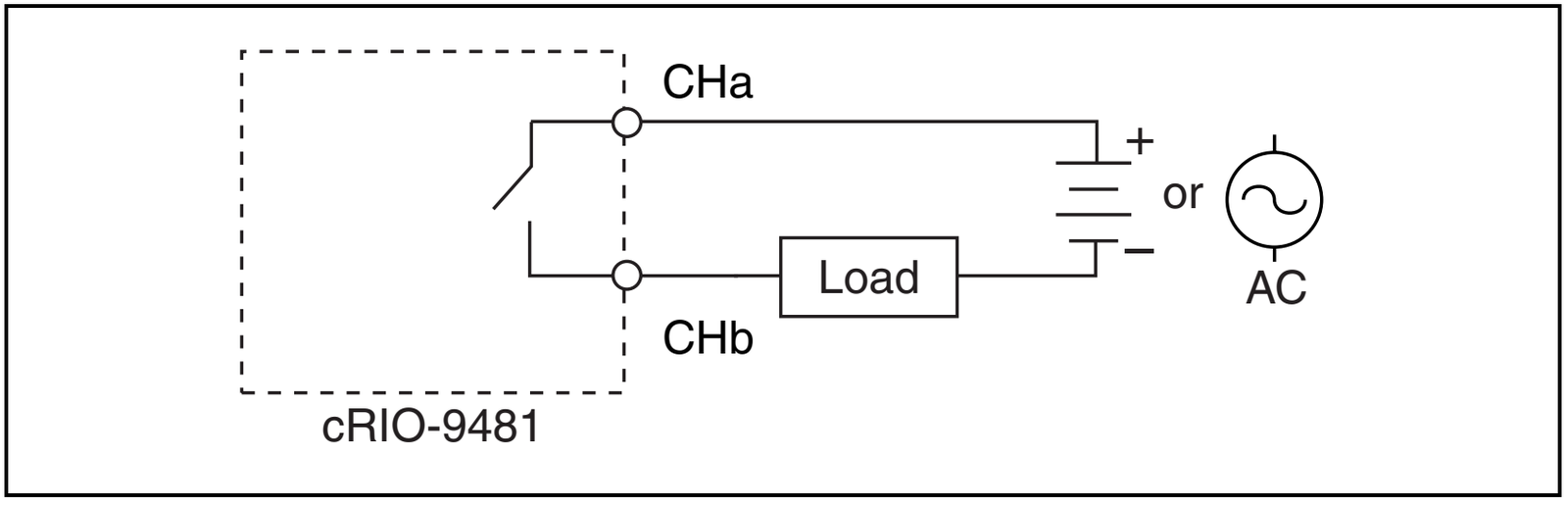


Figure 1. Connecting a Load to the cRIO-9481

When you write an ON command to a channel, the terminal that is connected to the load drives current or applies voltage to the load. When you write an OFF command to a channel, the terminal does not drive current or apply voltage to the load. The channel LED turns on and off to indicate the state of the channel.

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.

Output Characteristics

Number of channels 4

Relay type ..... Single pole single throw (SPST)

Switching capacity (resistive load)

Switching voltage ..... 60 VDC max, 250 V_{rms} max

Switching current (per channel)

One channel ON..... 4 A max at 30 VDC,
1 A max at 60 VDC,
4 A max at 250 V_{rms}

All channels ON..... 2 A max at 30 VDC,
1 A max at 60 VDC,
2 A max at 250 V_{rms}

On resistance..... 50 mΩ typ

Switching rate ..... 1 operation per second

Relay open time ..... 5 ms max

Relay close time..... 10 ms max

Relay bounce time ..... 3 ms typ

Off state leakage ..... 10 µA max

Expected life cycles

Mechanical (no load)..... 20,000,000 typ

Electrical (connecting to load) ... 100,000 typ

MTBF ..... 460,321 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 ..... 500 mW max
- Sleep mode ..... 5 mW max

Thermal dissipation (at 70 °C)

- Active mode ..... 1.5 W max
- Sleep mode ..... 5 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.

CHa-to-CHb..... 250 V_{rms} max, 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).

Isolation

Channel-to-channel ..... 250 V_{rms}

Channel-to-earth ground

Continuous ..... 250 V_{rms}

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

Safety Standards

The cRIO-9481 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, 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-9481 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

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:

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,
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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,
Spain 34 91 640 0085, Sweden 46 0 8 587 895 00,
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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