

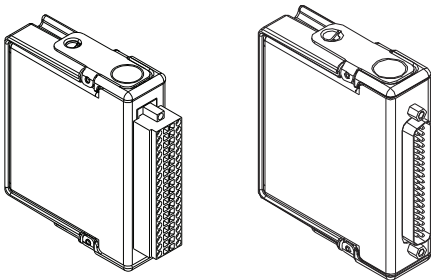
OPERATING INSTRUCTIONS AND SPECIFICATIONS

# NI 9375

32-Channel, Sinking Digital Input/Sourcing Digital Output Module

Français    Deutsch    日本語    한국어    简体中文

[ni.com/manuals](http://ni.com/manuals)



This document describes how to use the National Instruments 9375 and includes specifications and pin assignments for the NI 9375. In this document, the NI 9375 with spring terminal and the NI 9375 with DSUB are referred to inclusively as the NI 9375. For information about installing, configuring, and programming the system, refer to the system documentation. Visit [ni.com/info](http://ni.com/info) and enter the following info codes:

- `cseriesdoc`—for information about C Series and system documentation.
- `compatibility`—for information about chassis and carrier compatibility for the modules you are using.
- `rdsoftwareversion`—for information about which software you need for the modules you are using.



**Note** The safety guidelines and specifications in this document are specific to the NI 9375. The other components in the system might not meet the same safety ratings and specifications. Refer to the documentation for each component in the system to determine the safety ratings and specifications for the entire system. Visit [ni.com/info](http://ni.com/info) and enter `cseriesdoc` for information about C Series documentation.

# Safety Guidelines

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Operate the NI 9375 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 NI 9375 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nA IIC T4, and Ex nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI 9375 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 Division 2 and Zone 2 applications, install the system in an enclosure rated to at least IP 54 as defined by IEC 60529 and EN 60529.



**Caution** For Division 2 and Zone 2 applications, install a protection device between any two terminals. The device must prevent the  $V_{\text{sup}}$ -to-COM voltage from exceeding 42 V if there is a transient overvoltage condition.

## Special Conditions for Hazardous Locations Use in Europe

This equipment has been evaluated as Ex nA IIC T4 equipment under DEMKO Certificate No. 07 ATEX 0626664X. Each module is marked  $\text{Ex}$  II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of  $-40\text{ }^{\circ}\text{C} \leq T_a \leq 70\text{ }^{\circ}\text{C}$ . If you are using the NI 9375 in Gas Group IIC hazardous locations, you must use the device in an NI chassis that has been evaluated as Ex nC IIC T4, EEx nC IIC T4, Ex nA IIC T4, or Ex nL IIC T4 equipment.

# Electromagnetic Compatibility Guidelines

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This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) as stated in the product specifications. These requirements and limits are designed to provide reasonable protection against harmful interference when the product is operated in its intended operational electromagnetic environment. There is no guarantee that interference will not occur in a particular installation. To minimize the potential for the product to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

The following statements contain important information needed before installing and using this product:



**Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.



**Caution (NI 9375 with spring terminal)** Electrostatic Discharge (ESD) can damage this product. To prevent damage, use industry-standard ESD prevention measures during installation, maintenance, and operation.

## Special Guidelines for Marine Applications

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit [ni.com/certification](http://ni.com/certification) and search for the LR certificate, or look for the Lloyd's Register mark on the product label.

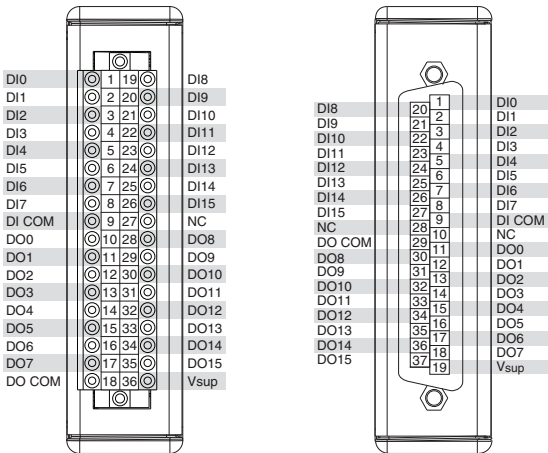


**Caution** In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained.

# Connecting the NI 9375

The NI 9375 provides connections for 16 digital input channels and 16 digital output channels.

**Figure 1.** NI 9375 Terminal and Pin Assignments



The NI 9375 has a bank of 16 digital input channels and a bank of 16 digital output channels. The two banks are isolated from each other and from earth ground. Refer to the *Safety* section for more information about isolation.

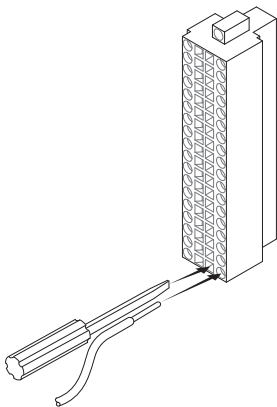
## Connecting Wires to the NI 9375 Spring-Terminal Connector

Use the flathead screwdriver that is included with your C Series module or a flathead screwdriver with a blade smaller than 2.3 mm × 1.0 mm (0.09 in. × 0.04 in.) to connect wires to the detachable spring-terminal connector. Insert the screwdriver into a spring clamp activation slot to open the corresponding connector terminal. Press a wire into the open connector terminal and remove the screwdriver from the activation slot to clamp the wire into place. Refer to the *Specifications* section for more information about spring-terminal wiring. Refer to Figure 2 for an illustration of connecting wires to the NI 9375.



**Figure 2.** Connecting Wires to the NI 9375 Spring-Terminal Connector

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## Connecting Digital Input Channels

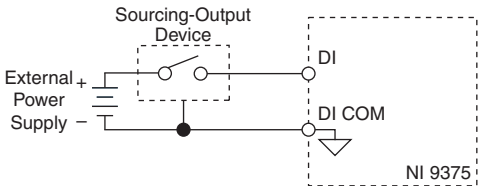
The digital input bank has 16 simultaneously-sampled digital input channels. Each channel has a DI terminal or pin to which you can connect a digital output device. DI COM is the common terminal or pin for the DI bank.

The digital input channels are sinking inputs, meaning that when the external device drives a current or applies a voltage to the DI terminal pin, DI provides a path to DI COM for the current or voltage. The NI 9375 internally limits current signals connected to DI. For more information about input current levels, refer to the [Specifications](#) section.

You can connect 2-, 3-, and 4-wire sourcing-output devices to the digital inputs of the NI 9375. A sourcing-output device drives current or applies voltage to the DI terminal or pin. An example of a sourcing-output device is an open collector PNP.

Connect the sourcing-output device to the DI terminal or pin on the NI 9375. Connect the common of the external device to the DI COM terminal or pin. Refer to Figure 3 for an illustration of connecting a device to the NI 9375.

**Figure 3.** Connecting a Device to the DI Bank (Three-Wire Device Shown)



A digital input channel registers as ON when the sourcing-output device drives enough current or applies enough voltage to the DI terminal or pin. If no device is connected to the DI terminal, the channel registers as OFF. Refer to the [Specifications](#) section for more information about the ON and OFF states.

## Connecting Digital Output Channels

The digital output bank has 16 digital output channels. Each channel has a DO terminal or pin to which you can connect your device. DO COM is the common terminal or pin for the DO bank.

You must connect an external power supply to the NI 9375. The power supply provides the current for the output channels. Connect the positive lead of the power supply to the supply terminal or pin,

$V_{\text{sup}}$ , and the negative lead of the power supply to DO COM. Refer to the *Specifications* section for information about the power supply voltage range.



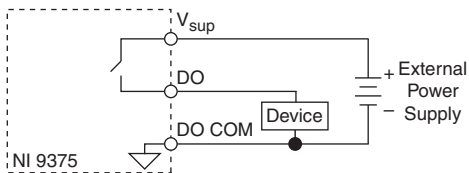
**Caution** Do *not* remove or insert modules if the external power supply connected to the  $V_{\text{sup}}$  and DO COM pins is powered on.

The NI 9375 has current sourcing outputs, meaning the DO terminal or pin is driven to  $V_{\text{sup}}$  when the channel is turned on.

You can directly connect the NI 9375 to a variety of industrial devices such as solenoids, motors, actuators, relays, and lamps. Make sure the devices you connect to the NI 9375 are compatible with the output specifications of the module. Refer to the *Specifications* section for more information about the output specifications.

Connect the device to DO and DO COM, and connect the external power supply to  $V_{\text{sup}}$  and DO COM, as shown in Figure 4.

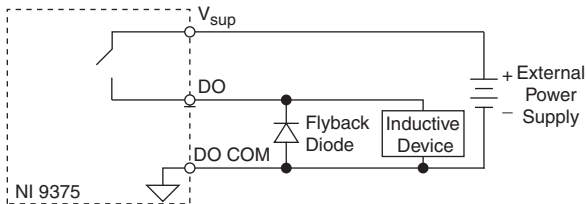
**Figure 4.** Connecting a Device to the DO Bank



## Protecting the Digital Outputs from Flyback Voltages

If the channel is switching an inductive or energy-storing device such as a solenoid, motor, or relay, and the device does not have flyback protection, install an external flyback diode as shown in Figure 5.

**Figure 5.** Connecting a Flyback Diode



## Calculating the Allowable Current Per Module

The NI 9375 has a per module continuous output current specification. Use the following equation to determine whether the total module current of your loads for channels that are turned on are within the specification.

$$(I_{DO0})^2 + (I_{DO1})^2 + \dots + (I_{DO15})^2 = TotalModuleCurrent$$

For example, an NI 9375 with spring terminal with two channels at 250 mA, six channels at 125 mA, and eight channels at 62 mA has the following per module continuous output current.

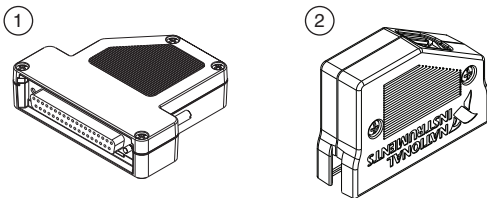
$$\{[(250\text{mA})^2 \cdot 2] + [(125\text{mA})^2 \cdot 6] + [(62\text{mA})^2 \cdot 8]\} = 0.25\text{A}^2$$

Refer to the [Specifications](#) section for more information about the per module continuous current output.

## Wiring for High Vibration Applications

If an application is subject to high vibration, National Instruments recommends that you use a backshell kit or shielded cable to protect the connections. For the NI 9375 with spring terminal, use the NI 9940 backshell to protect the connections. For the NI 9375 with DSUB, use a 37-pin shielded cable or the NI 9923 connector block to protect the connections. Refer to Figure for an illustration of the NI 9940 connector backshell and the NI 9923 connector block.

**Figure 6.** NI 9923 and NI 9940



1 NI 9923

2 NI 9940

## I/O Protection

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Each DO channel on the NI 9375 has circuitry that protects it from overcurrents resulting from a short-circuit or faulty loads.



**Caution** Overvoltage and reverse bias voltage conditions can damage the NI 9375. Check the voltage specifications for all devices that you connect to the NI 9375.

When a short circuit is present on a digital output channel, the DO channel cycles off and on until the short circuit is removed or the current returns to an acceptably low level. An overcurrent state can affect the performance of the NI 9375 and other modules in the system. To ensure safe and proper operation, the digital outputs should not exceed the maximum continuous output current specification. Refer to the *Specifications* section for more information about the continuous current output.



# Sleep Mode

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This module supports a low-power sleep mode. Support for sleep mode at the system level depends on the chassis that the module is plugged into. Refer to the chassis manual for information about support for sleep mode. If the chassis supports sleep mode, refer to the software help for information about enabling sleep mode. Visit [ni.com/info](http://ni.com/info) and enter `cseriesdoc` for information about C Series documentation.

Typically, when a system is in sleep mode, you cannot communicate with the modules. In sleep mode, the system consumes minimal power and may dissipate less heat than it does in normal mode. Refer to the *Specifications* section for more information about power consumption and thermal dissipation.

# Specifications

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The following specifications are typical for the range  $-40\text{ }^{\circ}\text{C}$  to  $70\text{ }^{\circ}\text{C}$  unless otherwise noted. All voltages are relative to COM unless otherwise noted.

## Input/Output Characteristics

Number of channels .....	32 channels: 16 digital input and 16 digital output
MTBF .....	Contact NI for Bellcore MTBF or MIL-HDBK-217F specifications.

## Digital Input

Input type .....	Sinking
Input voltage range .....	0 VDC to 30 VDC

## Digital logic levels

### OFF state

Input voltage .....  $\leq 5 \text{ V}$

Input current.....  $\leq 150 \mu\text{A}$

### ON state

Input voltage .....  $\geq 10 \text{ V}$

Input current.....  $\geq 330 \mu\text{A}$

### Hysteresis

Input voltage .....  $1.7 \text{ V min}$

Input current.....  $50 \mu\text{A min}$

Input impedance.....  $30 \text{ k}\Omega \pm 5\%$

Setup time<sup>1</sup> .....  $1 \mu\text{s max}$

Update/transfer time<sup>2</sup> .....  $7 \mu\text{s max}$

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<sup>1</sup> *Setup time* is the amount of time input signals must be stable before reading from the module.

<sup>2</sup> *Update/transfer time* is the maximum time the software takes to read data from the module. The update/transfer time is valid when the module is used in a CompactRIO system. When used in other systems, driver software and system latencies impact this time.

## Digital Output

Output type .....	Sourcing
Power-on output state .....	Channels off
External power supply voltage range ( $V_{sup}$ ).....	6 VDC to 30 VDC
Continuous output current ( $I_0$ )	
NI 9375 with spring terminal	
All channels on .....	125 mA max (per channel)
One channel on .....	500 mA max
Per module <sup>1</sup> .....	0.25 A <sup>2</sup> max
NI 9375 with DSUB	
All channels on .....	100 mA max (per channel)
One channel on .....	400 mA max
Per module <sup>1</sup> .....	0.16 A <sup>2</sup> max
Output impedance ( $R_0$ ) .....	0.3 $\Omega$ max
Output voltage ( $V_0$ ).....	$V_{sup} - (I_0 R_0)$
Reversed-voltage protection .....	None

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<sup>1</sup> Refer to the [Calculating the Allowable Current Per Module](#) section for information on calculating other allowable current ratings.

Current limiting .....	None
$V_{sup}$ current consumption.....	18 mA
Update/transfer time <sup>1</sup> .....	7 $\mu$ s max
Propagation delay <sup>2</sup> .....	500 $\mu$ s max

## Power Requirements

### Power consumption from chassis

Active mode .....	450 mW max
Sleep mode .....	25 $\mu$ W max

### Thermal dissipation (at 70 °C)

Active mode .....	1.5 W max
Sleep mode .....	0.6 W max

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<sup>1</sup> *Update/transfer time* is the maximum time the software takes to write data to the module. The update/transfer time is valid when the module is used in a CompactRIO system. When used in other systems, driver software and system latencies impact this time.

<sup>2</sup> *Propagation delay* is the amount of time it takes the output signals to change state after being written to.

## Physical Characteristics

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



**Note** For two-dimensional drawings and three-dimensional models of the C Series module and connectors, visit [ni.com/dimensions](http://ni.com/dimensions) and search by module number.

Spring-terminal wiring..... 18 AWG to 28 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end

### Weight

NI 9375 with spring terminal ..... 159 g (5.6 oz)

NI 9375 with DSUB ..... 148 g (5.3 oz)

# Safety

## Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM or

$V_{\text{sup}}$ -to-COM..... 30 VDC max

Isolation

DI bank-to-DO bank..... 60 VDC max

Channel-to-channel ..... No isolation between  
channels

Channel-to-earth ground

Continuous ..... 60 VDC,  
Measurement Category I

Withstand ..... 1,000  $V_{\text{rms}}$ , verified by a 5 s  
dielectric withstand test

Measurement 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.



**Caution** Do *not* connect the NI 9375 to signals or use for measurements within Measurement Categories II, III, or IV.

## Hazardous Locations

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



## Safety Standards

This product meets 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, CSA 61010-1



**Note** For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

## Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



**Note** For EMC declarations and certifications, refer to the *Online Product Certification* section.

## CE Compliance

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

## Online Product Certification

To obtain product certifications and the Declaration of Conformity (DoC) for this product, visit [ni.com/certification](http://ni.com/certification), search by module number or product line, and click the appropriate link in the Certification column.

## Shock and Vibration

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

### Operating vibration

Random (IEC 60068-2-64)..... 5 g<sub>rms</sub>, 10 Hz to 500 Hz

Sinusoidal (IEC 60068-2-6) ..... 5 g, 10 Hz 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

## 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..... IP 40

Operating humidity (IEC 60068-2-56).....	10% to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56).....	5% 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 *NI and the Environment* Web page at [ni.com/environment](http://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.

## Waste Electrical and Electronic Equipment (WEEE)



**EU Customers** At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit [ni.com/environment/weee](http://ni.com/environment/weee).

## 电子信息产品污染控制管理办法（中国 RoHS）



**中国客户** National Instruments 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 National Instruments 中国 RoHS 合规性信息，请登录 [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china)。(For information about China RoHS compliance, go to [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china).)

## Where to Go for Support

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The National Instruments Web site is your complete resource for technical support. At [ni.com/support](http://ni.com/support) you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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](http://ni.com/support) and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, visit the Worldwide Offices section of [ni.com/niglobal](http://ni.com/niglobal) to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

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