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USER GUIDE AND SPECIFICATIONS

NI USB-9472

8-Channel, 24 V Logic, Sourcing Digital Output Device

このドキュメントの日本語版については、ni.com/manuals を参照してください。(For a Japanese language version, go to ni.com/manuals.)

This user guide describes how to use the National Instruments NI USB-9472 and lists the device specifications. In this user guide, the NI USB-9472 with screw terminal and the NI USB-9472 with D-SUB are referred to inclusively as the NI USB-9472.

Introduction

The NI USB-9472 data acquisition device provides a USB interface for eight channels of digital outputs with integrated signal conditioning. The NI USB-9472 consists of two components: an NI 9472 module and an NI USB-9162 carrier, as shown in Figure 1.

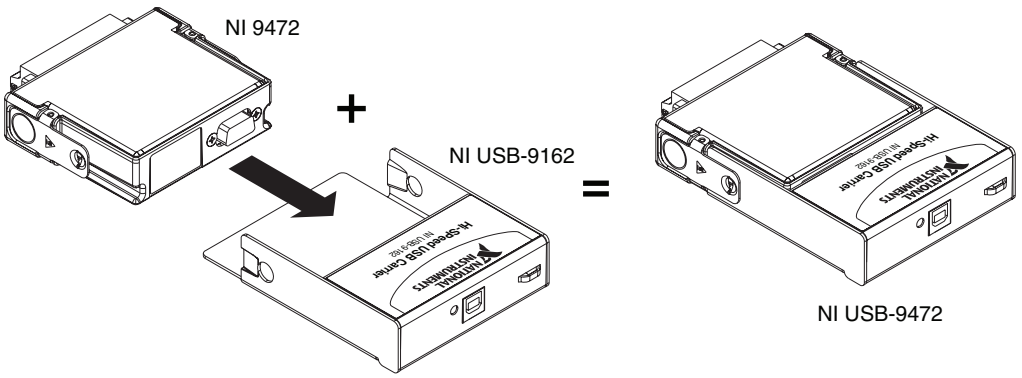


Figure 1. NI USB-9472 Components

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Dimensions

Figures 2 and 3 show the NI USB-9472 device dimensions.

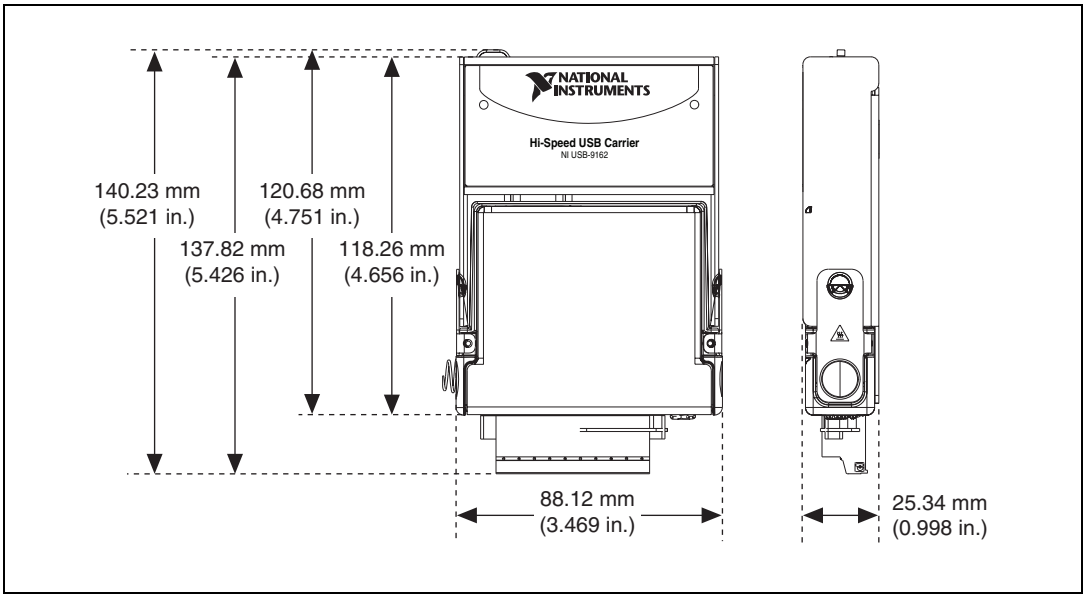


Figure 2. NI USB-9472 (Screw Terminal) Device in Millimeters (Inches)

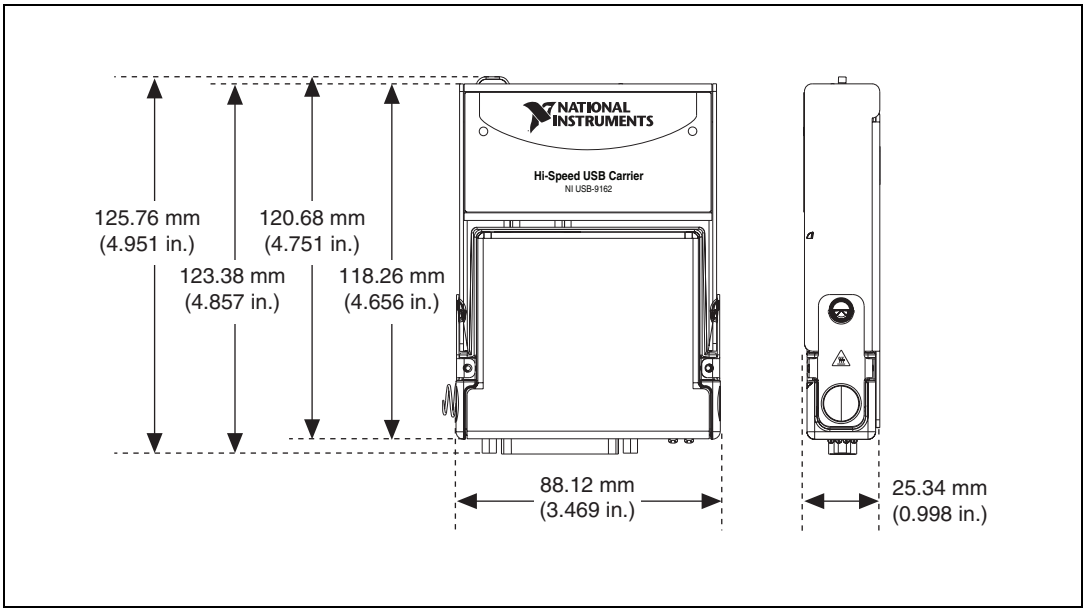


Figure 3. NI USB-9472 (D-SUB) Device in Millimeters (Inches)

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Safety Guidelines

Operate the NI USB-9472 only as described in these operating instructions.

Note Although the NI 9472 module may have more stringent certification standards than the NI USB-9472, when used with the NI USB-9162 carrier, the combined system may be limited. Refer to the *Specifications* section for more details.

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

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 The NI USB-9472 is not certified for use in 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_{pk} 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 by using the high voltage screw terminal backshell. Refer to the *Connecting Devices to the NI USB-9472* section for more information.

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Related Documentation

Each application software package and driver includes information about writing applications for taking measurements and controlling measurement devices. The following references to documents assume you have NI-DAQmx 8.7 or later, and where applicable, version 7.1 or later of the NI application software.

NI-DAQmx for Windows

The *DAQ Getting Started Guide* describes how to install your NI-DAQmx for Windows software, your NI-DAQmx-supported DAQ device, and how to confirm that your device is operating properly. Select **Start»All Programs»National Instruments»NI-DAQ»DAQ Getting Started Guide**.

The *NI-DAQ Readme* lists which devices are supported by this version of NI-DAQ. Select **Start»All Programs»National Instruments»NI-DAQ»NI-DAQ Readme**.

The *NI-DAQmx Help* contains general information about measurement concepts, key NI-DAQmx concepts, and common applications that are applicable to all programming environments. Select **Start»All Programs»National Instruments»NI-DAQ»NI-DAQmx Help**.

LabVIEW

If you are a new user, use the *Getting Started with LabVIEW* manual to familiarize yourself with the LabVIEW graphical programming environment and the basic LabVIEW features you use to build data acquisition and instrument control applications. Open the *Getting Started with LabVIEW* manual by selecting **Start»All Programs»National Instruments»LabVIEW»LabVIEW Manuals** or by navigating to the `labview\manuals` directory and opening `LV_Getting_Started.pdf`.

Use the *LabVIEW Help*, available by selecting **Help»Search the LabVIEW Help** in LabVIEW, to access information about LabVIEW programming concepts, step-by-step instructions for using LabVIEW, and reference information about LabVIEW VIs, functions, palettes, menus, and tools. Refer to the following locations on the Contents tab of the *LabVIEW Help* for information about NI-DAQmx:

- **Getting Started»Getting Started with DAQ**—Includes overview information and a tutorial to learn how to take an NI-DAQmx measurement in LabVIEW using the DAQ Assistant.
- **VI and Function Reference»Measurement I/O VIs and Functions**—Describes the LabVIEW NI-DAQmx VIs and properties.

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- **Taking Measurements**—Contains the conceptual and how-to information you need to acquire and analyze measurement data in LabVIEW, including common measurements, measurement fundamentals, NI-DAQmx key concepts, and device considerations.

LabWindows/CVI

The **Data Acquisition** book of the L*abWindows/CVI Help* contains measurement concepts for NI-DAQmx. This book also contains *Taking an NI-DAQmx Measurement in LabWindows/CVI*, which includes step-by-step instructions about creating a measurement task using the DAQ Assistant. In LabWindows™/CVI™, select **Help»Contents**, then select **Using LabWindows/CVI»Data Acquisition**.

The **NI-DAQmx Library** book of the *LabWindows/CVI Help* contains API overviews and function reference for NI-DAQmx. **Select Library Reference»NI-DAQmx Library** in the *LabWindows/CVI Help*.

Measurement Studio

If you program your NI-DAQmx-supported device in Measurement Studio using Visual C++, Visual C#, or Visual Basic .NET, you can interactively create channels and tasks by launching the DAQ Assistant from MAX or from within Visual Studio .NET. You can generate the configuration code based on your task or channel in Measurement Studio. Refer to the *DAQ Assistant Help* for additional information about generating code. You also can create channels and tasks, and write your own applications in your ADE using the NI-DAQmx API.

For help with NI-DAQmx methods and properties, refer to the NI-DAQmx .NET Class Library or the NI-DAQmx Visual C++ Class Library included in the *NI Measurement Studio Help*. For general help with programming in Measurement Studio, refer to the *NI Measurement Studio Help*, which is fully integrated with the Microsoft Visual Studio .NET help. To view this help file in Visual Studio. NET, select **Measurement Studio» NI Measurement Studio Help**.

To create an application in Visual C++, Visual C#, or Visual Basic .NET, follow these general steps:

1. In Visual Studio .NET, select **File»New»Project** to launch the New Project dialog box.
2. Find the Measurement Studio folder for the language you want to create a program in.
3. Choose a project type. You add DAQ tasks as a part of this step.

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ANSI C without NI Application Software

The *NI-DAQmx Help* contains API overviews and general information about measurement concepts. Select **Start»All Programs»National Instruments»NI-DAQ»NI-DAQmx Help**.

The *NI-DAQmx C Reference Help* describes the NI-DAQmx Library functions, which you can use with National Instruments data acquisition devices to develop instrumentation, acquisition, and control applications. Select **Start»All Programs»NationalInstruments»NI-DAQ» NI-DAQmx C Reference Help**.

.NET Languages without NI Application Software

With the Microsoft .NET Framework version 1.1 or later, you can use NI-DAQmx to create applications using Visual C# and Visual Basic .NET without Measurement Studio. You need Microsoft Visual Studio .NET 2003 or Microsoft Visual Studio 2005 for the API documentation to be installed.

The installed documentation contains the NI-DAQmx API overview, measurement tasks and concepts, and function reference. This help is fully integrated into the Visual Studio .NET documentation. To view the NI-DAQmx .NET documentation, go to **Start»Programs»National Instruments»NI-DAQ»NI-DAQmx .NET Reference Help**. Expand **NI Measurement Studio Help»NI Measurement Studio .NET Class Library»Reference** to view the function reference. Expand **NI Measurement Studio Help»NI Measurement Studio .NET Class Library»Using the Measurement Studio .NET Class Libraries** to view conceptual topics for using NI-DAQmx with Visual C# and Visual Basic .NET.

To get to the same help topics from within Visual Studio, go to **Help»Contents**. Select **Measurement Studio** from the **Filtered By** drop-down list and follow the previous instructions.

Device Documentation and Specifications

NI-DAQmx includes the Device Document Browser, which contains online documentation for supported DAQ, SCXI, and switch devices, such as help files describing device pinouts, features, and operation, and PDF files of the printed device documents. You can find, view, and/or print the documents for each device using the Device Document Browser at any time by inserting the CD. After installing the Device Document Browser, device documents are accessible from **Start»All Programs»National Instruments»NI-DAQ»Browse Device Documentation**.

Note You can download these documents at `ni.com/manuals`.

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Training Courses

If you need more help getting started developing an application with NI products, NI offers training courses. To enroll in a course or obtain a detailed course outline, refer to `ni.com/training`.

Technical Support on the Web

For additional support, refer to `ni.com/support` or `zone.ni.com`.

Installing the Software

Software support for the NI USB-9472 for Windows Vista/XP/2000 is provided by NI-DAQmx. The *DAQ Getting Started Guide*, which you can download at `ni.com/manuals`, offers NI-DAQmx users step-by-step instructions for installing software and hardware, configuring channels and tasks, and getting started developing an application.

Installing Other Software

If you are using other software, refer to the installation instructions that accompany your software.

Example Programs

The NI-DAQmx CD contains example programs that you can use to get started programming with the NI USB-9472. Refer to the *NI-DAQmx for USB Devices Getting Started Guide* that shipped with your device, and is also accessible from **Start»All Programs»National Instruments» NI-DAQ**, for more information.

Installing the NI USB-9472 Device

Before installing the device, you must install the software you plan to use with the device. Refer to the *Installing the Software* section of this guide and the documentation included with the software for more information.

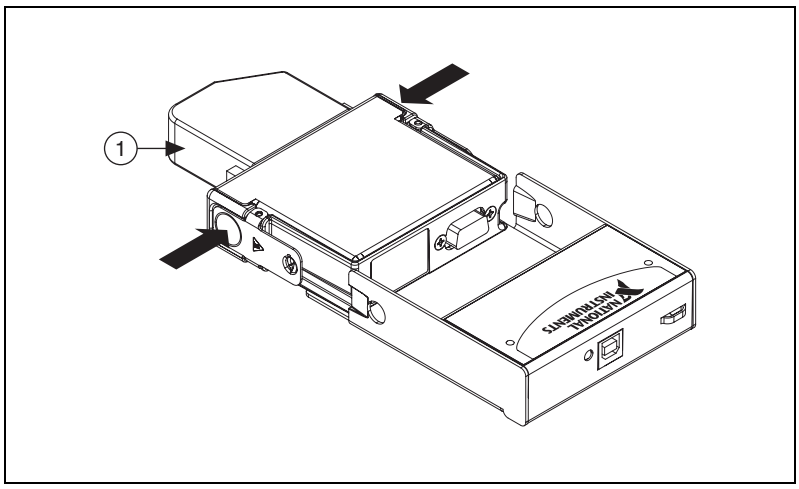
Installing the NI 9472 Device into the NI USB-9162 Carrier

The NI 9472 module and NI USB-9162 carrier are packaged separately. Refer to Figure 4, while completing the following assembly steps:

1. Make sure that no signals are connected to the NI 9472 module.
2. Remove the protective cover from the 15-pin D-SUB connector.

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3. Align the I/O module with the carrier, as shown in Figure 4.



1 High Voltage Screw Terminal Backshell

Figure 4. Module Installation

4. Squeeze the latches and insert the NI 9472 module into the NI USB-9162 carrier.
5. Press firmly on the connector side of the NI 9472 module until the latches lock the module into place, as shown in Figure 5.

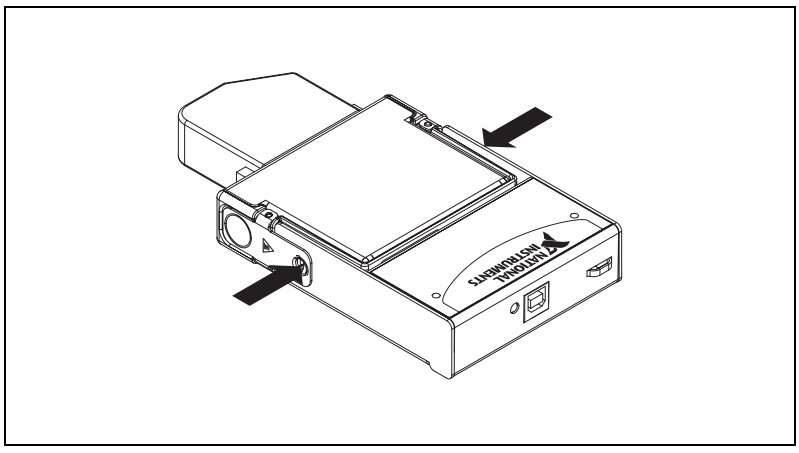


Figure 5. Locking Module into Place

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Mounting the NI USB-9472 to a Panel

Threaded inserts are located in the NI USB-9472 for mounting it to a panel. Refer to Figure 6 for dimensions.

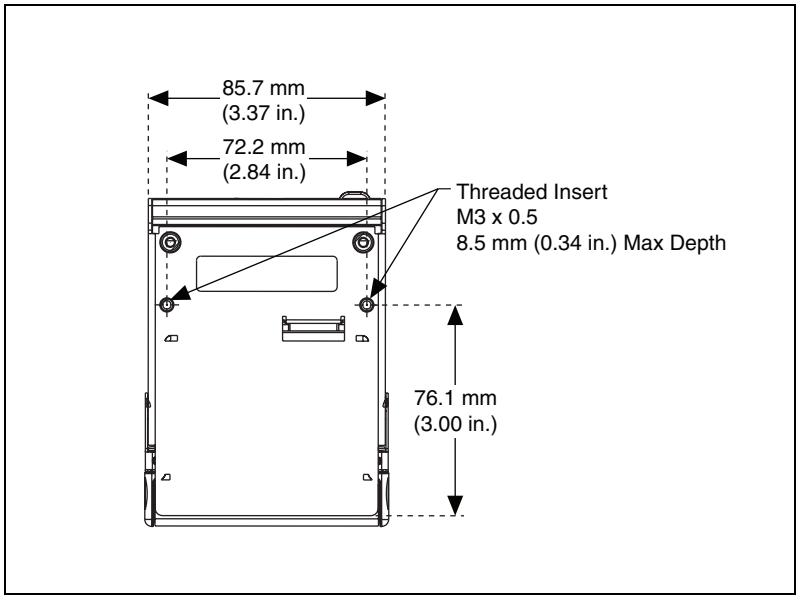


Figure 6. Module Dimensions in Millimeters (Inches)

Connecting the NI USB-9472 to a Computer

Plug one end of the USB cable into the NI USB-9472 and the other end into an available USB port on the computer. Refer to the *NI-DAQmx for USB Devices Getting Started Guide* that shipped with your device, and is also accessible from **Start»All Programs»National Instruments»NI-DAQ**, for more information.

LED Indicator

The NI USB-9472 device has a green LED next to the USB connector. The LED indicator indicates device status, as listed in Table 1. When the device is connected to a USB port, the LED blinks steadily to indicate that the device is initialized and is receiving power from the connection.

If the LED is not blinking, it may mean that the device is not initialized or the computer is in standby mode. In order for the device to be recognized, the device must be connected to a computer that has NI-DAQmx installed on it. If your device is not blinking, make sure your computer has the latest version of NI-DAQmx installed on it, and the computer is not in standby mode.

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Table 1. LED State/Device Status

LED State	Device Status
Not lit	Device not connected or in suspend.
On, not blinking	Device connected, but no module installed.
Single-blink	Operating normally.
Double-blink	Operating normally.
Quadruple-blink	Device error. Refer to `ni.com/support`.

Wiring the NI USB-9472 Device

The NI USB-9472 provides connections for eight digital output channels.

Caution A high voltage screw terminal backshell must be installed when using hazardous voltages (>42.4 V_{pk}, 60 VDC).

Note Table 2 illustrates the accessories available from `ni.com` for use with the NI USB-9472.

Table 2. Accessories

Device	Accessory	Accessory Description
USB-9472 with Screw Terminal	NI 9932	10-terminal, detachable, high voltage, screw terminal backshell[1]
USB-9472 with 25-pin D-SUB	NI 9934	25-pin D-SUB connector

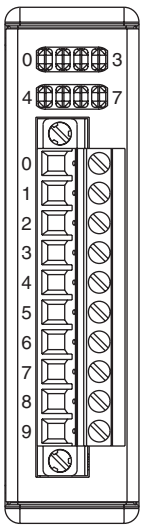
[1] For more information about installing the backshell, refer to the *Assembling the High Voltage Screw Terminal Backshell* section.

Each channel of the NI USB-9472 has a terminal or pin, DO, to which you can connect your device. Each channel has an LED that indicates the state of the channel.

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You must connect an external power supply to the NI USB-9472. This power supply provides the current for the devices you connect to the module. Connect the positive lead of the power supply to the supply terminal or pin, V_{sup}, and the negative lead of the power supply to the common terminal or pin, COM. The eight digital output channels are internally referenced to COM. Refer to Table 3 for the terminal assignments of the NI USB-9472 with screw terminal. Refer to Figure 7 for the pin assignments of the NI USB-9472 with D-SUB.

Table 3. Terminal Assignments

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

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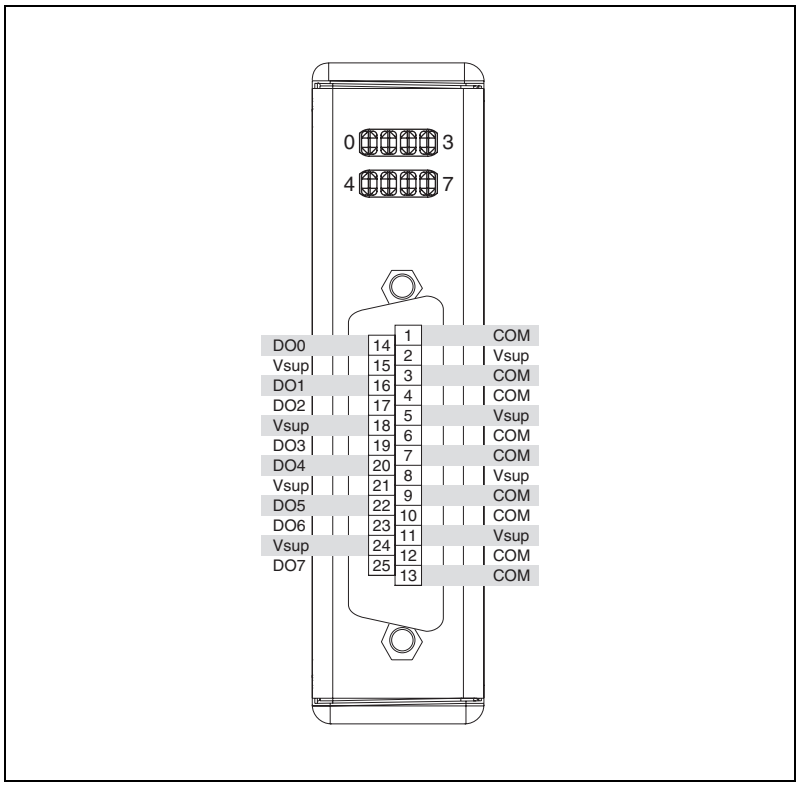


Figure 7. Pin Assignments

Connecting Devices to the NI USB-9472

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

You can connect *sinking-input* devices, such as NPN, open collectors, normally high, IEC negative logic, or other DC devices to the NI USB-9472. A sinking-input device provides a path to ground for current or voltage. Make sure the device you connect to the NI USB-9472 meets the module specifications. Refer to the *Specifications* section for more information about the output specifications of the module.

Connect the device to DO on the NI USB-9472. Connect the common of the device to COM. Figure 8 shows a possible configuration.

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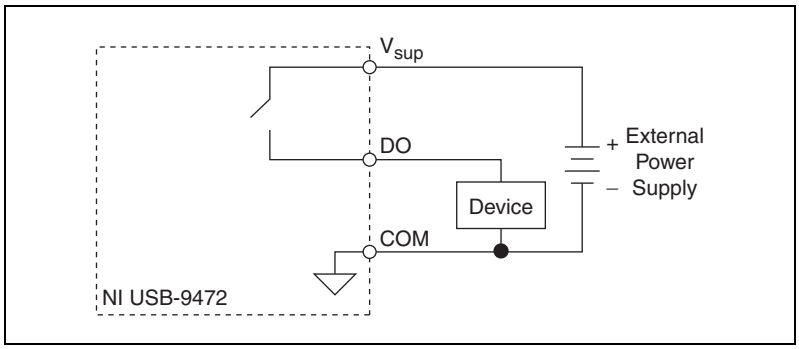


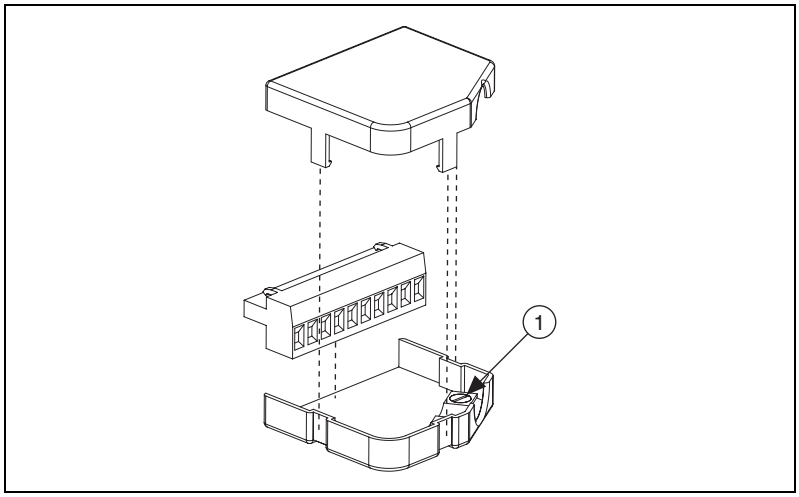
Figure 8. Connecting a Device to the NI USB-9472

When the channel is on, the channel LED is on and the terminal or pin 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 or pin does not drive current or apply voltage to the device.

Assembling the High Voltage Screw Terminal Backshell

The NI 9932 high voltage screw terminal backshell must be installed when using hazardous voltages (>42.4 V_{pk}, 60 VDC). Refer to Figure 9 while completing the following steps to assemble the backshell:

1. Connect the leads to the screw terminal and secure with the strain relief.
2. Finish by snapping the backshell around the connector.



1 Strain Relief

Figure 9. High Voltage Screw Terminal Backshell

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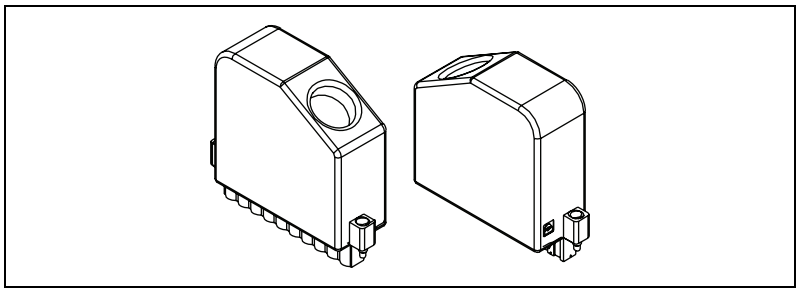


Figure 10. Assembled High Voltage Screw Terminal Backshell

I/O Protection

The NI USB-9472 is short-circuit-proof in accordance with IEC 1131-2 and provides overcurrent protection.

Understanding Short-Circuit-Proof Devices

Each channel on the NI USB-9472 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 or pin 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 DO 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.

Tip Because the NI USB-9472 includes internal flyback diodes, you do not need to add external diodes when connecting to switching energy storing devices.

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Power Supplies and Overcurrent Conditions

If a short-circuit occurs, the current through DO can exceed the current rating for the power supply and the maximum continuous output current for the NI USB-9472.

If the power supply you are using with the NI USB-9472 cannot supply more than the guaranteed trip current, the module may be damaged if a short-circuit condition occurs.

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 an overcurrent condition occurs. 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 DO and V_{sup}. 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 by turning it off. 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 0 to 60 °C unless otherwise noted. All voltages are relative to COM unless otherwise noted.

Output Characteristics

Number of channels ..... 8 digital output channels

Output type..... Sourcing

Supply voltage range (V_{sup})..... 6 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) ..... 0.75 A max per channel

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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	Channel State	Module State
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 µs at 13 A

Output delay time (full load) .....100 µs max

Power Requirements

Current consumption from USB .....500 mA, max

Suspend mode.....2.5 mA, max

Bus Interface

USB specification .....USB 2.0 Hi-Speed

Physical Characteristics

Dimensions

With combicon .....14.0 cm × 8.8 cm × 2.5 cm (5.52 in. × 3.47 in. × 1.00 in.)

With D-SUB .....12.6 cm × 8.8 cm × 2.5 cm (4.95 in. × 3.47 in. × 1.00 in.)

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.....0.5–0.6 N · m (4.4–5.3 lb · in.)

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Weight

With screw terminal ..... Approx. 250 g (8.8 oz)

With D-SUB ..... Approx. 245 g (8.6 oz)

Safety

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

Safety Voltages

NI USB-9472 with Screw Terminal

Channel-to-COM ..... 30 V max

Isolation

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

Channel-to-earth ground

Withstand ..... 2,300 V_{rms}, 5 seconds max

Continuous ..... 250 V_{rms}, Measurement Category II

Measurement 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).

NI USB-9472 with D-SUB

Channel-to-COM ..... 30 V max

Isolation

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

Channel-to-earth ground

Withstand ..... 1,000 V_{rms}, 5 seconds max

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

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.

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Safety Standards

The NI USB-9472 product 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, CSA 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

The NI USB-9472 is not certified for use in hazardous locations.

Environmental

The NI USB-9472 is intended for indoor use only.

Operating temperature
(IEC 60068-2-1, IEC 60068-2-2) .....0 to 60 °C

Storage temperature
(IEC 60068-2-1, IEC 60068-2-2) .....–40 to 85 °C

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

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

Note For EMC compliance, operate this device with double-shielded cables.

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CE Compliance

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

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

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.

Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `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.

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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)。
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371570D-01 Dec07

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