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USER GUIDE AND SPECIFICATIONS
NI USB-9421

8-Channel, 24 V Logic, Sinking Digital Input 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 USB-9421
and lists the device specifications. In this user guide, the NI USB-9421 with
screw terminal and the NI USB-9421 with D-SUB are referred to
inclusively as the NI USB-9421.

Introduction

The NI USB-9421 data acquisition device provides a USB interface with
connections for eight digital input channels. The NI USB-9421 consists
of two components: an NI 9421 module and an NI USB-9162 carrier,
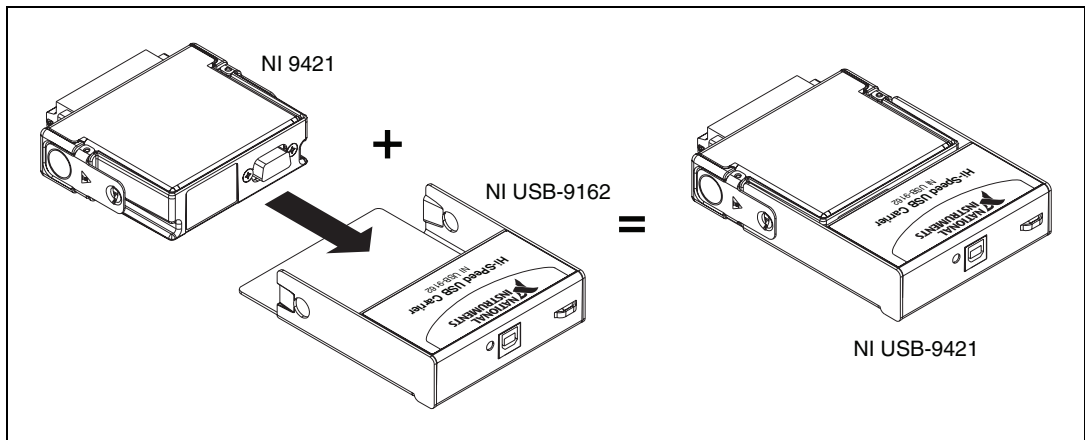as shown in Figure 1.

Figure 1. NI USB-9421 Components

Dimensions

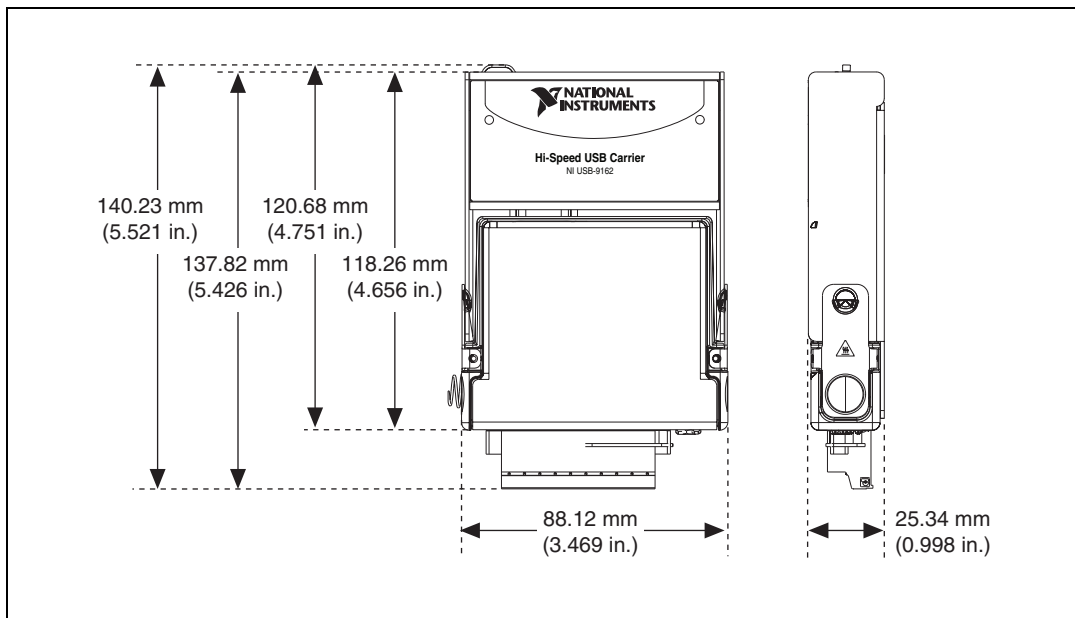Figures 2 and 3 show the NI USB-9421 device dimensions.

Figure 2. NI USB-9421 (Screw Terminal) Device in Millimeters (Inches)
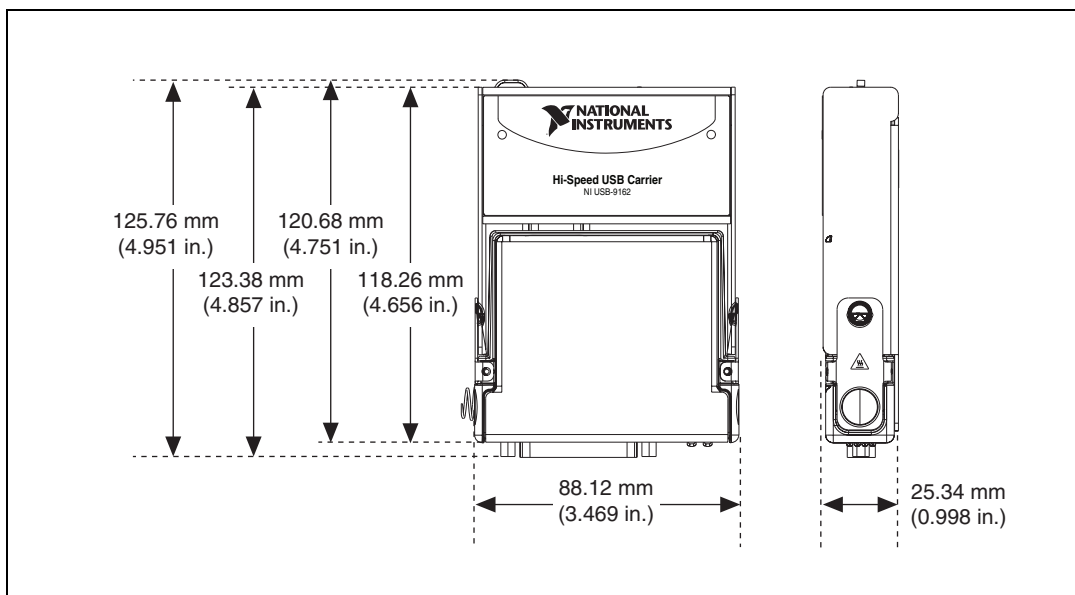

Figure 3. NI USB-9421 (D-SUB) Device in Millimeters (Inches)

Safety Guidelines

Operate the NI USB-9421 only as described in these operating instructions.

Note   Although the NI 9421 module may have more stringent certification standards than the NI USB-9421, 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-9421 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 *Assembling the High Voltage Screw Terminal Backshell* section for more information.

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.

- **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 *LabWindows/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.

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»National Instruments»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`.

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-9421 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-9421. 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.
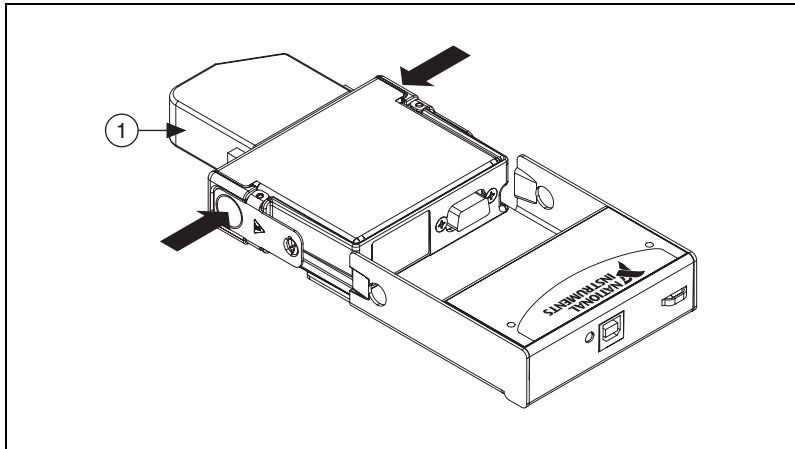
Installing the NI USB-9421 Device

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 9421 in the NI USB-9162 Carrier

The NI 9421 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 9421 module.
2. Remove the protective cover from the 15-pin D-SUB connector.

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 9421 module into the NI USB-9162 carrier.

5. Press firmly on the connector side of the NI 9421 module until the latches lock the module into place, as shown in Figure 5.
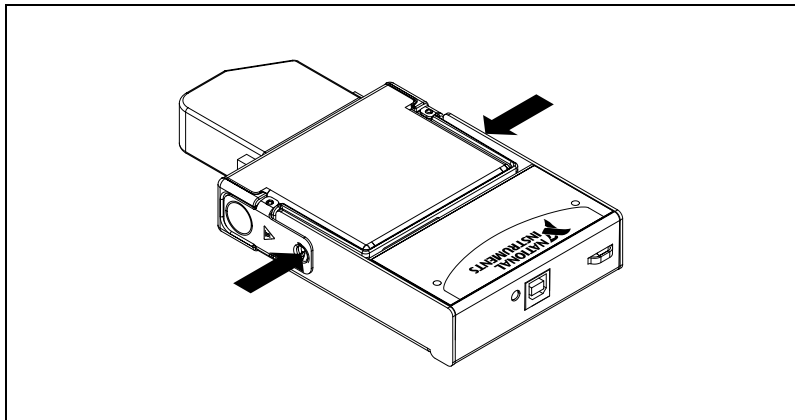

Figure 5. Locking Module into Place

Mounting the NI USB-9421 to a Panel

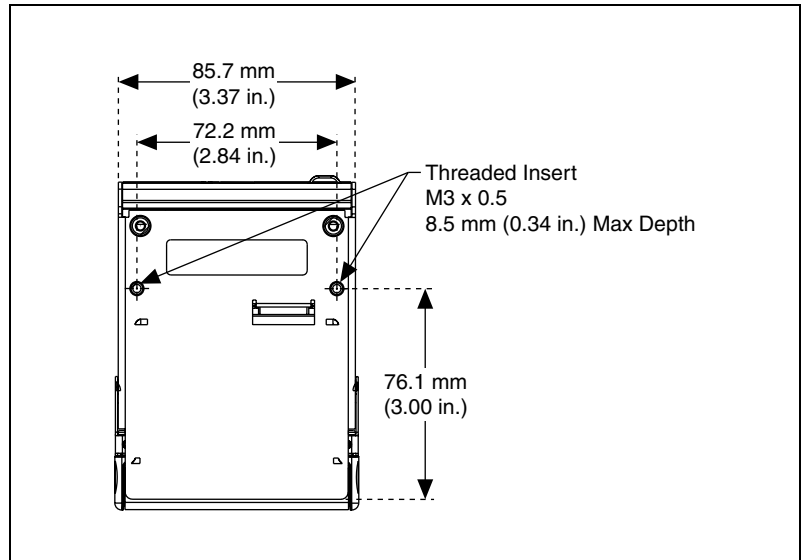Threaded inserts are located in the NI USB-9421 for mounting it to a panel. Refer to Figure 6 for dimensions.

Figure 6. Module Dimensions in Millimeters (Inches)

Connecting the NI USB-9421 to a Computer

Plug one end of the USB cable into the NI USB-9421 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-9421 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.

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-9421 Device

⚠ **Caution** A high voltage screw terminal backshell must be installed when using hazardous voltages (>42.4 V_{pk}, 60 VDC).
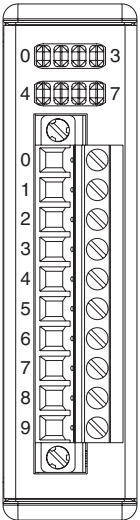
📝 **Note** Table 2 illustrates the accessories available from ni.com for use with the NI USB-9421.

Table 2. Accessories

Device	Accessory	Accessory Description
USB-9421 with Screw Terminal	NI 9932	10-terminal, detachable, high voltage, screw terminal backshell[1]
USB-9421 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-9421 has a terminal or pin, DI, to which you can connect voltage or current signals. The NI USB-9421 also has a common terminal or pin, COM, that is internally connected to the isolated reference of the module. Each digital input channel on the NI USB-9421 has an LED that indicates the state of that channel. Refer to Table 3 for the terminal assignments of the NI USB-9421 with screw terminal. Refer to Figure 7 for the pin assignments of the NI USB-9421 with D-SUB.

Table 3. Terminal Assignments

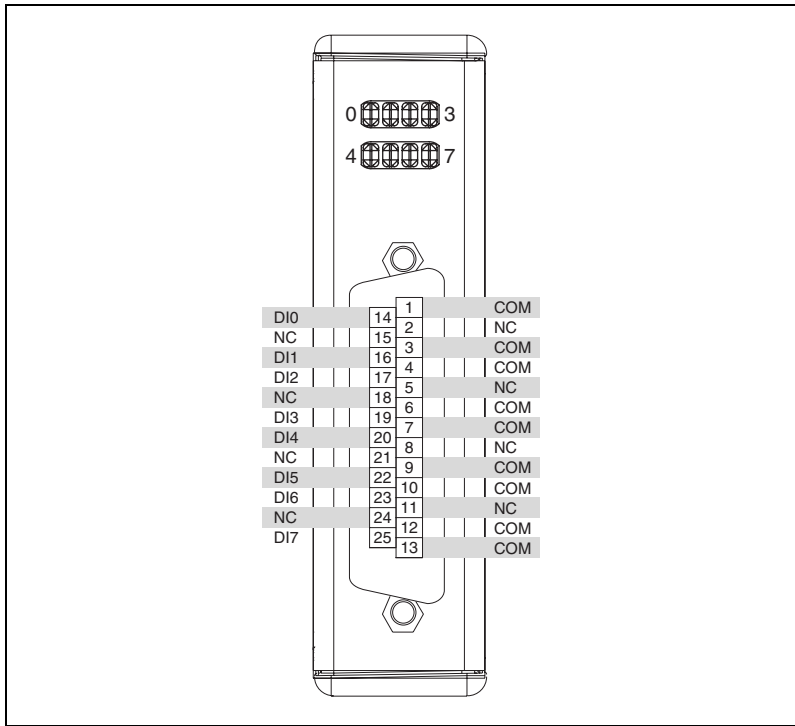| Module	Terminal	Signal
	0	DI0
	1	DI1
	2	DI2
	3	DI3
	4	DI4
	5	DI5
	6	DI6
	7	DI7
	8	No connection
	9	Common (COM)

Figure 7. Pin Assignments

Connecting Devices to the NI USB-9421

The NI USB-9421 has *sinking inputs*, meaning that when current goes through or voltage is applied to the DI terminal or pin, DI provides a path to ground for the current or voltage. The NI USB-9421 internally limits current signals connected to DI. For more information about input current protection, refer to the *Specifications* section.

You can connect 2-, 3-, and 4-wire *sourcing-output* devices to the NI USB-9421. A sourcing-output device drives current or applies voltage to DI. An example of a sourcing-output device is a PNP open collector.

Connect the output of the sourcing-output device to DI on the NI USB-9421. Connect the common of the external device to the COM terminal or pin. Figure 8 shows a possible configuration.
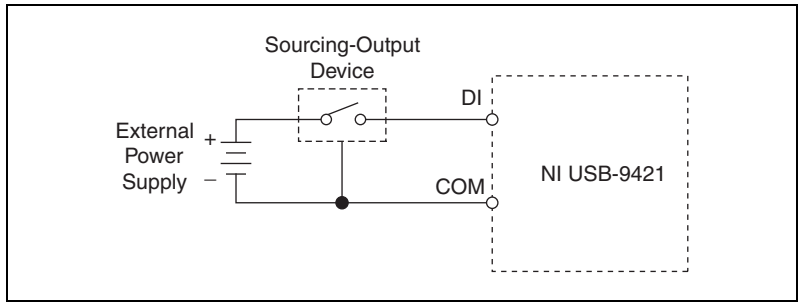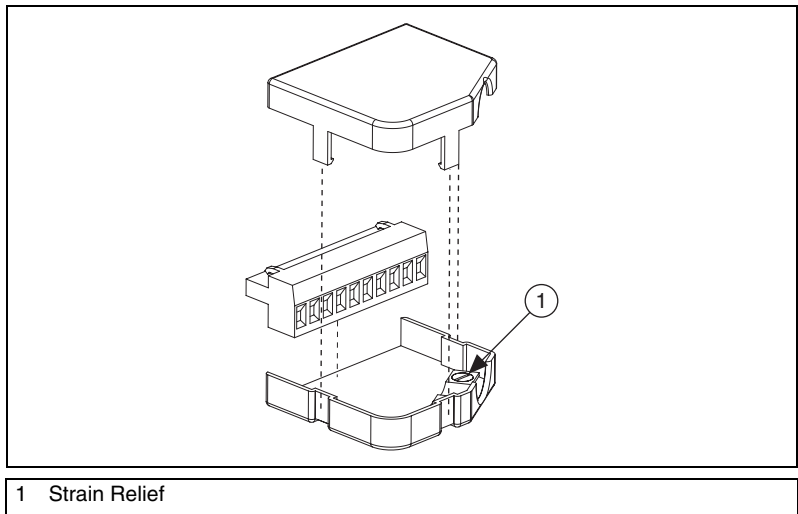
Figure 8. Connecting a Device to the NI USB-9421 (3-Wire Device Shown)

The NI USB-9421 channel registers as ON when the sourcing-output device applies a voltage or drives a current to DI that is in the input ON range. The channel registers as OFF when the device applies a voltage or drives a current to DI that is in the input OFF range. If no device is connected to DI, the channel registers as OFF. The channel LED turns on and off to indicate the state of the channel. Refer to the *Specifications* section for more information about ON and OFF ranges.

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

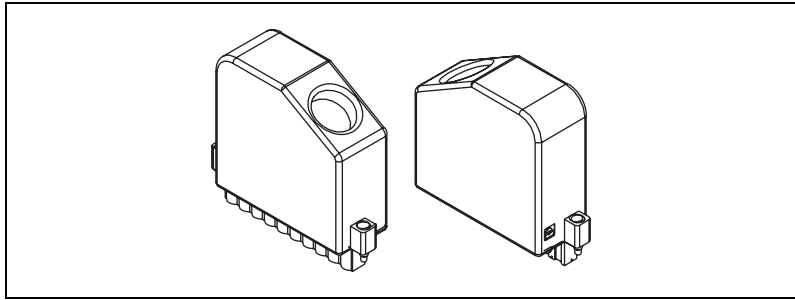**Figure 9.** High Voltage Screw Terminal Backshell

Figure 10. Assembled High Voltage Screw Terminal Backshell

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.

Input Characteristics

Number of channels 8

Input type .... Sinking

Digital logic levels
    OFF state
        Input voltage .... ≤5 V
        Input current .... ≤300 µA
    ON state
        Input voltage .... 11 to 30 V
        Input current .... ≥3 mA

I/O protection
    Input voltage .... 40 V max
    Reverse biased voltage .... –30 V max
    Input current .... 7 mA max, internally limited

Input delay time .... 100 µs max

Power Requirements

Power 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 screw terminal........................ 14.0 cm × 8.8 cm × 2.5 cm
    (5.52 in. × 3.47 in. × 1.00 in.)
    With 25-pin 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.)

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-9421 with Screw Terminal Safety Voltages

Connect only voltages that are within these limits.

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

Isolation

    Channel-to-channel........................ No isolation between channels
    Channel-to-earth ground
        Withstand................................ 2,300 V_{rms}, verified by a 5 second
        dielectric withstand test
        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-9421 with D-SUB Safety Voltages

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

Isolation

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

    Channel-to-earth ground

        Withstand ....1,000 V_{rms}, verified by a 5 second dielectric withstand test

        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.

Safety Standards

The NI USB-9421 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-9421 is *not* certified for use in hazardous locations.

Environmental

The NI USB-9421 is intended for indoor use only.

Operating temperature
(IEC60068-2-1, IEC 60068-2-2) ....0 to 60 °C

Storage temperature
(IEC60068-2-1, 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.

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.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee.htm`.

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`。
(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At `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` 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 43 662 457990-0,
Belgium 32 (0) 2 757 0020, Brazil 55 11 3262 3599,
Canada 800 433 3488, China 86 21 5050 9800,
Czech Republic 420 224 235 774, Denmark 45 45 76 26 00,
Finland 358 (0) 9 725 72511, France 01 57 66 24 24,
Germany 49 89 7413130, India 91 80 41190000, Israel 972 3 6393737,
Italy 39 02 41309277, Japan 0120-527196, Korea 82 02 3451 3400,
Lebanon 961 (0) 1 33 28 28, Malaysia 1800 887710,
Mexico 01 800 010 0793, Netherlands 31 (0) 348 433 466,
New Zealand 0800 553 322, Norway 47 (0) 66 90 76 60,
Poland 48 22 3390150, Portugal 351 210 311 210, Russia 7 495 783 6851,
Singapore 1800 226 5886, Slovenia 386 3 425 42 00,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
Sweden 46 (0) 8 587 895 00, Switzerland 41 56 2005151,
Taiwan 886 02 2377 2222, Thailand 662 278 6777,
Turkey 90 212 279 3031, United Kingdom 44 (0) 1635 52354

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