

USER GUIDE AND SPECIFICATIONS

USB-9201/9221

8-Channel, 12-Bit Analog Input Devices

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

This user guide describes how to use the National Instruments USB-9201/9221 devices and lists the specifications.

Introduction

This user guide describes how to use the National Instruments USB-9201/9221. In this document, the USB-9201/9221 with screw terminal and USB-9201/9221 with DSUB are referred to inclusively as the USB-9201/9221. For information about installing, configuring, and programming your system, refer to your system documentation.

The USB-9210/9221 data acquisition device provides a USB interface for eight channels of 12-bit analog inputs with integrated signal conditioning. The USB-9201/9211 consists of two components: an NI 9201/9221 module and a USB-9162 carrier, as shown in Figure 1.

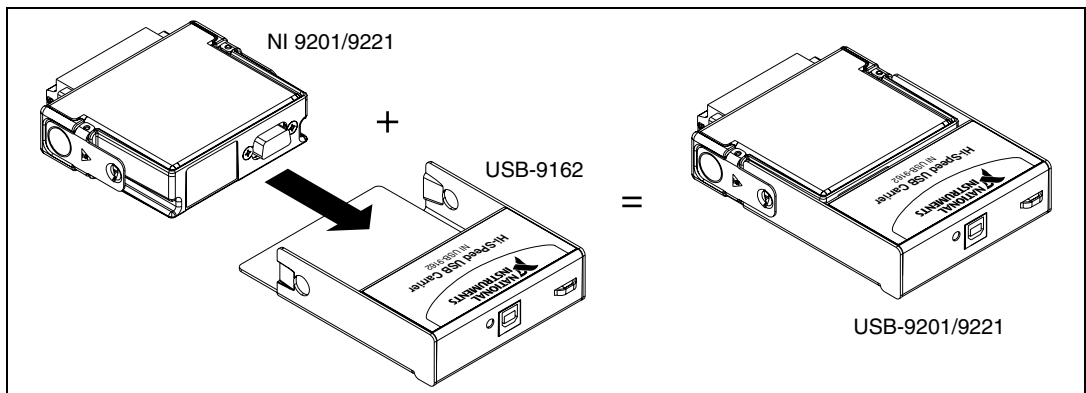


Figure 1. USB-9201/9221 Components

Dimensions

Figures 2 and 3 show the USB-9201/9221 device dimensions.

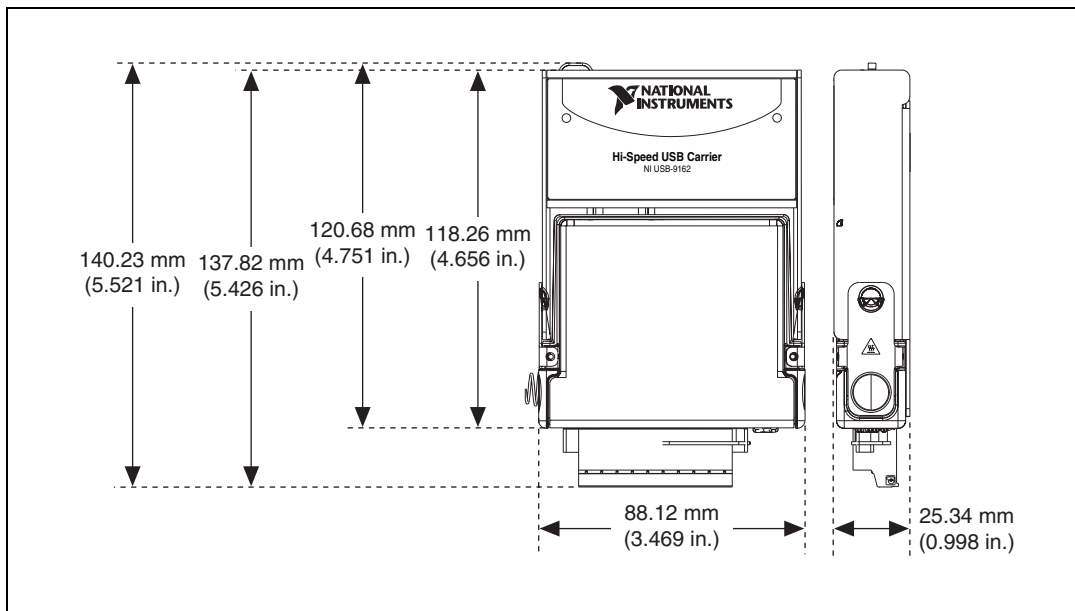


Figure 2. USB-9201/9221 Devices in Inches (Millimeters)

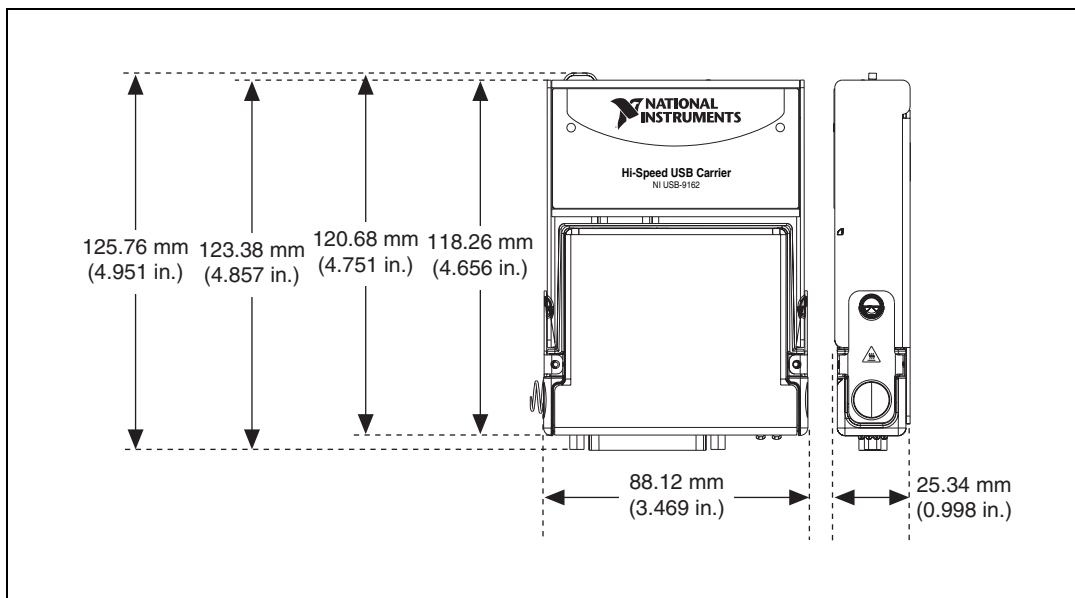


Figure 3. USB-9201/9221 (DSUB) Devices in Inches (Millimeters)

Safety Guidelines

Operate the USB-9201/9221 only as described in these operating instructions.



Caution Although the NI 9201/9221 might have more stringent certification standards than the USB-9201/9221, when used with the USB-9162 carrier, the combined system might be limited. Refer to the [Specifications](#) section for more information.



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 and the area is known to be nonhazardous.



Caution The USB-9201/9221 is *not* certified for use in hazardous locations.

Safety Guidelines for Hazardous Voltages

You can connect hazardous voltages to the USB-9201/9221 with the screw terminal only. Do *not* connect hazardous voltages to the USB-9201/9221 with DSUB.

If *hazardous voltages* are connected to the module, take the following precautions. A hazardous voltage is a voltage $>42.4 V_{pk}$ 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.

Software

Software support for the USB-9201/9221 is provided by NI-DAQmx.

The NI-DAQmx CD contains example programs that you can use to get started programming with the USB-9201/9221. 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 USB-9201/9221

Installing the Software

Before installing the device, you must install the software you plan to use with the device. Refer to the *Software* section of this guide and 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 9201/9221 in the USB-9162 Carrier

The NI 9201/9221 module and the USB-9162 carrier are packaged separately. Refer to Figure 2, while completing the following assembly steps:

1. Make sure that no signals are connected to the NI 9201/9221 module and that the USB cable is not connected to the device.
2. Remove the protective cover from the 15-pin DSUB connector.
3. Align the I/O module with the carrier, as shown in Figure 4.

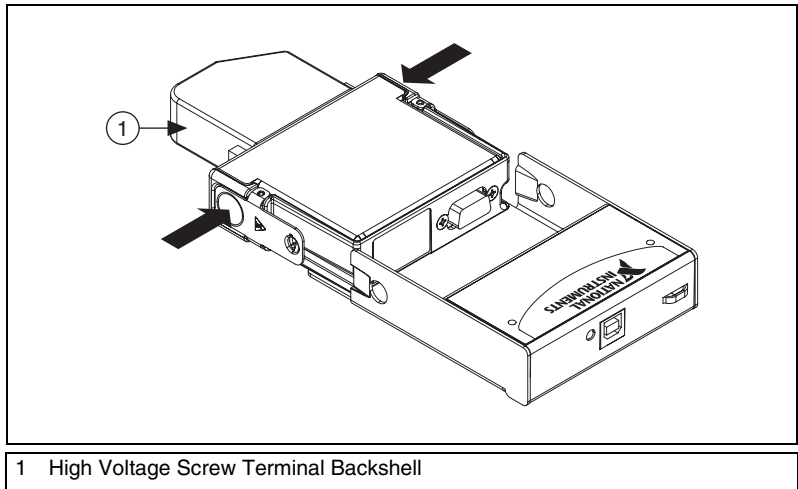


Figure 4. Module Installation

4. Squeeze the latches and insert the NI 9201/9221 module into the USB-9162 carrier.
5. Press firmly on the connector side of the NI 9201/9221 module until the latches lock the module into place, as shown in Figure 5.

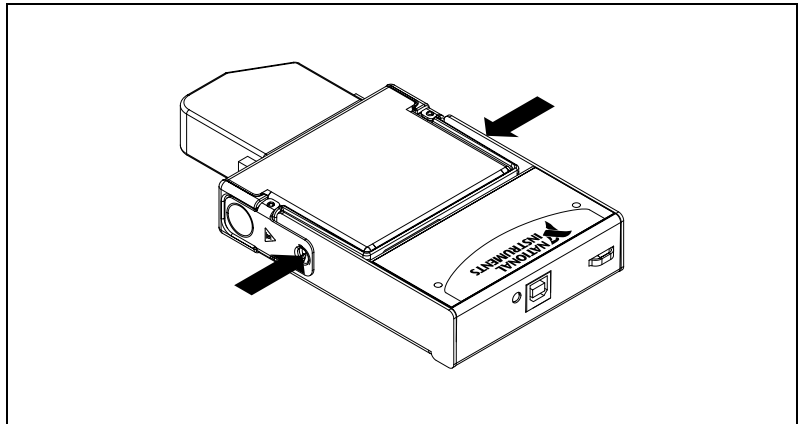


Figure 5. Locking Module into Place

6. Connect the USB cable to the assembled USB-9201/9221.

Mounting the USB-9201/9221 to a Panel

Threaded inserts are located in the USB-9201/9221 for mounting it to a panel. Refer to Figure 6 for dimensions.

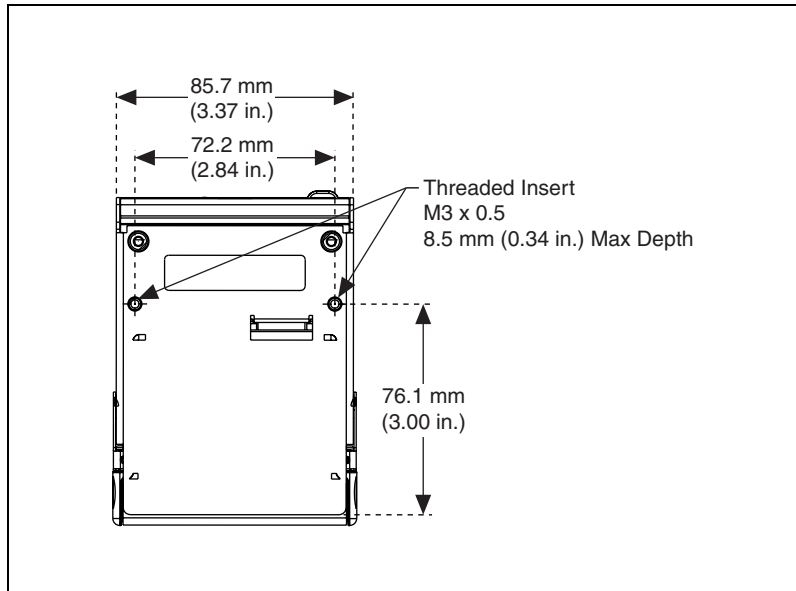


Figure 6. Module Dimensions

Connecting the USB-9201/9221 to a Computer

Plug one end of the USB cable into the USB-9201/9221 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 LED indicator indicates device status.

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.

Table 1. LED State/Device Status (Continued)

LED State	Device Status
Double-blink	Connected to USB full speed port. Device performance might be affected. Refer to the Specifications section for more information.
Quadruple-blink	Device error. Refer to ni.com/support .

Wiring the USB-9201/9221

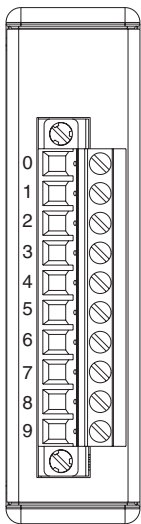
The USB-9201/9221 provides connections for eight analog input channels. The USB-9201/9221 with screw terminal has a 10-terminal, detachable high voltage screw-terminal backshell. The USB-9201/9221 with DSUB has a 25-pin DSUB connector.

Each channel has a terminal or pin, AI, to which you can connect a voltage signal. The USB-9201/9221 also has a common terminal or pin, COM, that is internally connected to the isolated ground reference of the module. Refer to Table 2 for the terminal assignments of the USB-9201/9221 with screw terminal. Refer to Figure 7 for the pin assignments of the USB-9201/9221 with DSUB.



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

Table 2. Terminal Assignments

Module	Terminal	Signal
	0	AI 0
	1	AI 1
	2	AI 2
	3	AI 3
	4	AI 4
	5	AI 5
	6	AI 6
	7	AI 7
	8	No connection
	9	Common (COM)

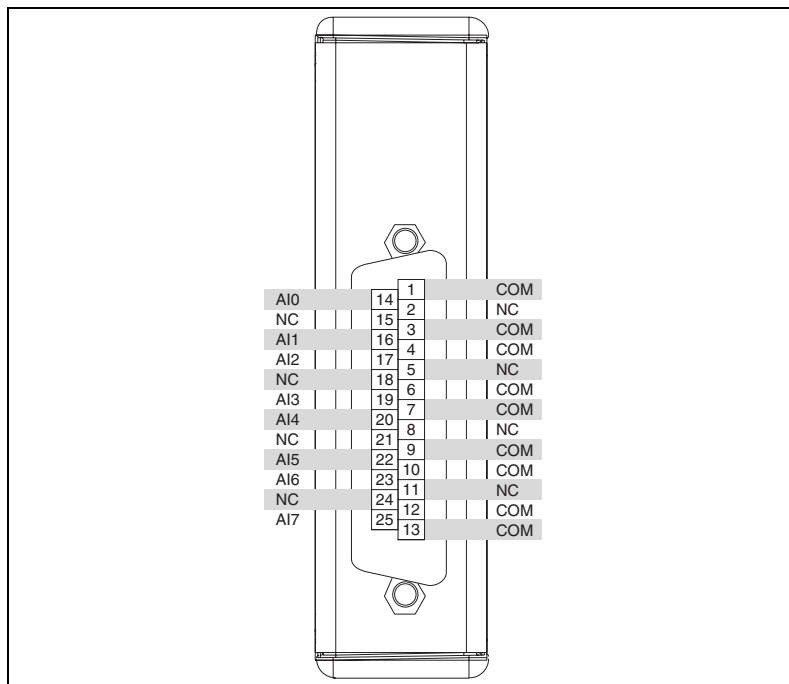


Figure 7. Pin Assignments

Assembling the High Voltage Screw Terminal Backshell

The high voltage screw terminal backshell must be installed when using hazardous voltages ($>42.4 V_{pk}$, 60 VDC). Refer to Figure 8 while completing the following steps:

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

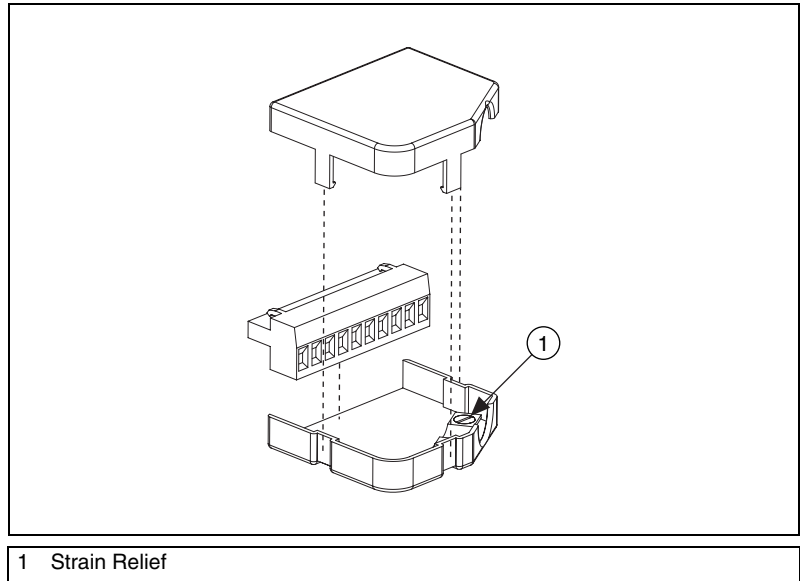


Figure 8. High Voltage Screw Terminal Backshell

Connecting Single-Ended Voltage Signals to the USB-9201/9221

You can connect single-ended voltage signals to the USB-9201/9221. Connect the positive lead of the voltage signal to AI. Connect the ground signal to COM.

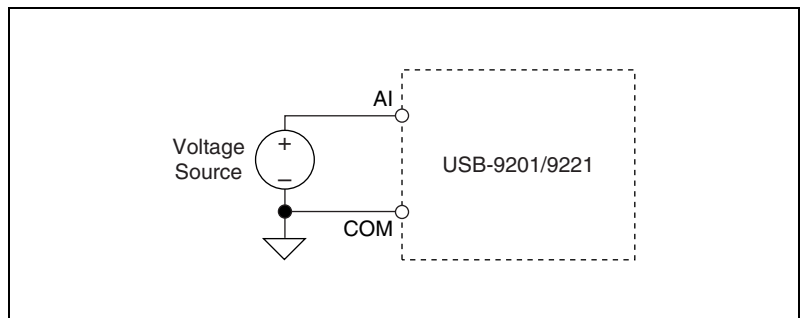


Figure 9. Connecting a Single-Ended Voltage Signal to the USB-9201/9221

Refer to your software documentation, accessible from **Start» All Programs»National Instruments»NI-DAQ**, for information about different methods of reading USB-9201/9221 data.

USB-9201/9221 Circuitry

The USB-9201/9221 channels are isolated, and the device protects each channel from overvoltages. The input signals are scanned, buffered, conditioned, and then sampled by a single 12-bit ADC. For more information about overvoltage protection, refer to the *Specifications* section.

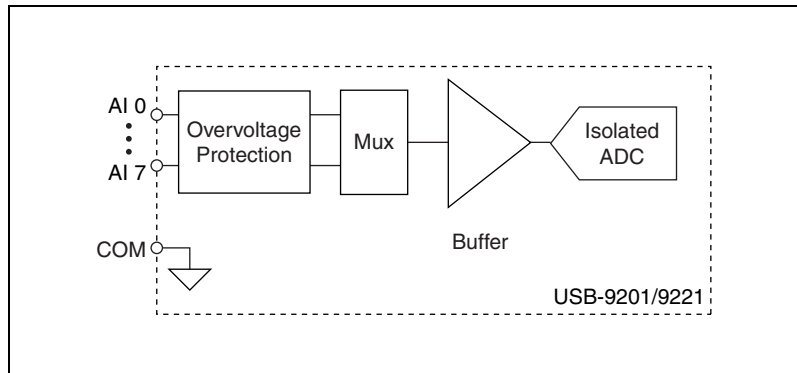


Figure 10. Input Circuitry for One Channel

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.

Input Characteristics

Number of channels.....	8
ADC resolution.....	12 bits
Type of ADC	Successive approximation register (SAR)

Sample rate (aggregate)¹

USB-9201

Single channel..... 800 kS/s max

Scanning 500 kS/s

USB-9221 800 kS/s max

Operating voltage ranges²

USB-9201 ±10 V (not software selectable)

USB-9221 ±60 V (not software selectable)

Maximum voltage, (AI or COM to earth ground, verified by a dielectric withstand test)

Screw terminal 250 V_{rms}

DSUB ±60 VDC

Isolation voltage (AI or COM to earth ground, verified by a dielectric withstand test)

Screw terminal 2,300 V_{rms}

DSUB 1,000 V_{rms}

Overvoltage protection

(AI to COM)..... ±100 V

Accuracy³

Error	Percent of Reading	Percent of Range*
USB-9201		
Calibrated typ (25 °C, ±5 °C)	±0.04%	±0.07%
Calibrated max (0 to 60 °C)	±0.25%	±0.25%
Uncalibrated typ (25 °C, ±5 °C)	±0.26%	±0.46%
Uncalibrated max (0 to 60 °C)	±0.67%	±1.25%
USB-9221		
Calibrated typ (25 °C, ±5 °C)	±0.04%	±0.07%
Calibrated max (0 to 60 °C)	±0.25%	±0.25%

¹ Full performance requires the use of a USB 2.0 high-speed host controller and USB 2.0 hubs.

² Refer to the [Safety](#) section for details about safe operating voltages.

³ Excludes noise.

Error	Percent of Reading	Percent of Range*
Uncalibrated typ (25 °C, ±5 °C)	±0.26%	±0.43%
Uncalibrated max (0 to 60 °C)	±0.67%	±1.06%
* Range equals 10.53 V for the USB-9201, 62.50 V for the USB-9221.		

Stability

Offset drift

USB-9201±100 µV/°C

USB-9221±580 µV/°C

Gain drift±34 ppm/°C

Input bandwidth (–3 dB)

USB-9201690 kHz min

USB-9221950 kHz min

Input impedance

Resistance1 MΩ

Capacitance.....5 pF

Input noise (code-centered)

RMS.....0.7 LSB_{rms}

Peak-to-peak5 LSB

No missing codes12 bits

DNL–0.9 to 1.5 LSB

INL.....±1.5 LSB

Crosstalk–75 dB, 10 kHz

Settling time (to 1 LSB)

USB-92012 µs

USB-92211.25 µs

Power Requirements

Power consumption from USB500 mA, max

Suspend mode.....2.5 mA, max

Bus Interface

USB specificationUSB 2.0 high speed

Physical Characteristics

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

Dimensions

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

25-pin DSUB 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

USB-9201/9221 with combicon Approx. 250 g (8.8 oz)

USB-9201/9221 with DSUB Approx. 245 g (8.6 oz)

Safety

Maximum Voltage

Connect only voltages that are within these limits.

AI to COM ±60 VDC

Isolation Voltages for USB-9201/9221 with Screw Terminals

Channel-to-channel isolation None

Channel-to-earth ground isolation

Continuous 250 V_{rms}, Measurement
Category II

Withstand 2,300 V_{rms}, verified by a
dielectric withstand test

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). Do *not* use this module with Measurement Category III or IV voltages.

Isolation Voltages for USB-9201/9221 with DSUB

Channel-to-channel.....None

Channel-to-earth ground

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

Withstand.....1,000 V_{rms}, verified by a
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. *Do not* use this module with Measurement Category II, III, or IV voltages.

Safety Standards

The USB-9201/9221 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 61010-1
- CAN/CSA-C22.2 No. 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 USB-9201/9221 is *not* certified for use in hazardous locations.

Environmental

The USB-9201/9221 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

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/certification, search by model number or product line, and click the appropriate link in the Certification column.

Calibration

You can obtain the calibration certificate for the USB-9201/9221 at ni.com/calibration.

Calibration interval	1 year
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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:

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Belgium 32 0 2 757 00 20, Brazil 55 11 3262 3599,
Canada 800 433 3488, China 86 21 6555 7838,
Czech Republic 420 224 235 774, 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, India 91 80 41190000,
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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 68 51,
Singapore 1800 226 5886, Slovenia 386 3 425 42 00,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
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