Your **definitive** source for quality pre-owned equipment.

**Artisan Technology Group**
(217) 352-9330 | sales@artisantg.com | artisantg.com

**Full-service, independent repair center**
with experienced engineers and technicians on staff.

**We buy your excess, underutilized, and idle equipment**
along with credit for buybacks and trade-ins.

**Custom engineering**
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

**Expert team | Trust guarantee | 100% satisfaction**

Find the National Instruments NI 9201 at our website: Click HERE
This document describes how to use the National Instruments 9201 and National Instruments 9221 and includes specifications and terminal assignments for the NI 9201/9221. In this document, the NI 9201/9221 with screw terminal and NI 9201/9221 with DSUB are referred to inclusively as the NI 9201/9221. Visit ni.com/info and enter rdsoftwareversion to determine which software you need for the modules you are using. For information about installing, configuring, and programming the system, refer to the system documentation. Visit ni.com/info and enter cseriesdoc for information about C Series documentation.

**Note** The safety guidelines and specifications in this document are specific to the NI 9201/9221. 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 and enter cseriesdoc for information about C Series documentation.
Safety Guidelines
Operate the NI 9201/9221 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 Voltages
You can connect hazardous voltages only to the NI 9201/9221 with screw terminal. Do not connect hazardous voltages to the NI 9201/9221 with DSUB.

If hazardous voltages are connected to the module, take the following precautions. A hazardous voltage is a voltage greater than 42.4 Vpk 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 hazardous voltage LIVE (>42.4 Vp/p/60 VDC), you must ensure that devices and circuits connected to the module are properly insulated from human contact. You must use the NI 9932 connector backshell kit to ensure that the terminals are not accessible.

Figure 1 shows the NI 9932 connector backshell.

Note You can use the NI 9932 connector backshell only with the NI 9201/9221 with screw terminal.
Safety Guidelines for Hazardous Locations

The NI 9201/9221 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nC IIC T4, and Ex nC IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI 9201/9221 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 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 Zone 2 applications, install a protection device between the input signal and the NI 9201/9221 input terminal. The device must prevent the channel-to-COM voltage from exceeding 85 V if there is a transient overvoltage condition.

**Special Conditions for Hazardous Locations Use in Europe**

This equipment has been evaluated as EEx nC IIC T4 equipment under DEMKO Certificate No. 03 ATEX 0324020X. Each module is marked II 3G and is suitable for use in Zone 2 hazardous locations.
locations, in ambient temperatures of $-40 \, ^\circ C \leq T_a \leq 70 \, ^\circ C$. If you are using the NI 9201/9221 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.

**Special Conditions for Marine Applications**

Some modules are Lloyd’s Register (LR) Type Approved for marine applications. To verify Lloyd’s Register certification, visit [ni.com/certification](http://ni.com/certification) and search for the LR certificate, or look for the Lloyd’s Register mark on the module.

⚠️ **Caution** To meet radio frequency emission requirements for marine applications, use shielded cables and install the system in a metal enclosure. Suppression ferrites must be installed on power supply inputs near power entries to modules and controllers. Power supply and module cables must be separated on opposite sides of the enclosure and must enter and exit through opposing enclosure walls.
Connecting the NI 9201/9221

The NI 9201/9221 provides connections for eight analog input channels.

Figure 2. NI 9201/9221 Terminal and Pin Assignments
The NI 9201/9221 with screw terminal has a 10-terminal, detachable screw-terminal connector. The NI 9201/9221 with DSUB has a 25-pin DSUB connector. Each channel has an AI terminal or pin to which you can connect a voltage signal. COM, the common terminal or pin, is internally connected to the isolated ground reference of the module.

The NI 9201/9221 channels are isolated from other modules in the system. The module protects each channel from overvoltages. Refer to the Specifications section for more information about overvoltage protection. The input signals are scanned, buffered, conditioned, and then sampled by a single 12-bit ADC. Refer to Figure 3 for an illustration of the input circuitry on the NI 9201/9221.

Figure 3. Input Circuitry on the NI 9201/9221
You can connect single-ended voltage signals to the NI 9201/9221. Connect the positive lead of the voltage signal to AI. Connect the ground signal to COM. Refer to Figure 3 for an illustration of connecting a single-ended voltage signal to the NI 9201/9221.

![Diagram of connecting a single-ended voltage signal to the NI 9201/9221]

**Note** You must use 2-wire ferrules to create a secure connection when connecting more than one wire to a single terminal on the NI 9201/9221 with screw terminal.
Wiring for High-Vibration Applications

If an application using the NI 9201/9221 with screw terminal is subject to high vibration, National Instruments recommends that you either use ferrules to terminate wires to the detachable screw-terminal connector or use the NI 9932 backshell kit to protect the connections. Refer to Figure 5 for an illustration of using ferrules. Refer to Figure 1 for an illustration of the NI 9932 connector backshell.

![Figure 5. 10-Terminal Detachable Screw-Terminal Connector with Ferrule](image-url)
Sleep Mode

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 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

The following specifications are typical for the range –40 to 70 °C unless otherwise noted. All voltages are relative to COM unless otherwise noted. The specifications are the same for the NI 9201 and the NI 9221 unless otherwise noted.

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

Sample rate (aggregate)

<table>
<thead>
<tr>
<th>Module</th>
<th>Maximum Sample Rate (R Series Expansion Chassis)</th>
<th>Maximum Sample Rate (All Other Chassis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NI 9201, single channel</td>
<td>475 kS/s</td>
<td>800 kS/s</td>
</tr>
<tr>
<td>NI 9201, scanning</td>
<td>475 kS/s</td>
<td>500 kS/s</td>
</tr>
<tr>
<td>NI 9221</td>
<td>475 kS/s</td>
<td>800 kS/s</td>
</tr>
</tbody>
</table>

© National Instruments Corp.
Input range
NI 9201 ....................................... ±10 V
NI 9221 ....................................... ±60 V

Operating voltage ranges¹

<table>
<thead>
<tr>
<th>Module</th>
<th>Measurement Voltage, Channel-to-COM</th>
<th>Maximum Voltage, Channel-to-Earth Ground or COM-to-Earth Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min (V)</td>
<td>Typ (V)</td>
</tr>
<tr>
<td>NI 9201</td>
<td>±10.3</td>
<td>±10.53</td>
</tr>
<tr>
<td>NI 9221</td>
<td>±61.4</td>
<td>±62.50</td>
</tr>
</tbody>
</table>

Overvoltage protection
(channel-to-COM) ......................... ±100 V

¹ Refer to the Safety Guidelines section for more information about safe operating voltages.
<table>
<thead>
<tr>
<th>Measurement Conditions</th>
<th>Percent of Reading (Gain Error)</th>
<th>Percent of Range* (Offset Error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibrated typ (25 °C, ±5 °C)</td>
<td>±0.04%</td>
<td>±0.07%</td>
</tr>
<tr>
<td>Calibrated max (–40 to 70 °C)</td>
<td>±0.25%</td>
<td>±0.25%</td>
</tr>
<tr>
<td>Uncalibrated typ (25 °C, ±5 °C)</td>
<td>±0.26%</td>
<td>±0.46%</td>
</tr>
<tr>
<td>Uncalibrated max (–40 to 70 °C)</td>
<td>±0.67%</td>
<td>±1.25%</td>
</tr>
</tbody>
</table>

* Range equals 10.53 V
NI 9221 accuracy (excludes noise)

<table>
<thead>
<tr>
<th>Measurement Conditions</th>
<th>Percent of Reading (Gain Error)</th>
<th>Percent of Range* (Offset Error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibrated typ (25 °C, ±5 °C)</td>
<td>±0.04%</td>
<td>±0.07%</td>
</tr>
<tr>
<td>Calibrated max (–40 to 70 °C)</td>
<td>±0.25%</td>
<td>±0.25%</td>
</tr>
<tr>
<td>Uncalibrated typ (25 °C, ±5 °C)</td>
<td>±0.26%</td>
<td>±0.43%</td>
</tr>
<tr>
<td>Uncalibrated max (–40 to 70 °C)</td>
<td>±0.67%</td>
<td>±1.06%</td>
</tr>
</tbody>
</table>

* Range equals 62.50 V

Stability

Gain drift .................................... ±34 ppm/°C
Offset drift
NI 9201 ................................ ±100 μV/°C
NI 9221 ................................ ±580 μV/°C

Input bandwidth (–3 dB)
NI 9201 ....................................... 690 kHz min
NI 9221 ....................................... 950 kHz min
Input impedance
  Resistance ................................... 1 MΩ
  Capacitance .................................. 5 pF

Input noise (code-centered)
  RMS ........................................... 0.7 LSB_{rms}
  Peak-to-peak ................................ 5 LSB

No missing codes .............................. 12 bits
DNL ........................................... –0.9 to 1.5 LSB
INL ........................................... ±1.5 LSB
Crosstalk (at 10 kHz) ......................... –75 dB

Settling time (to 1 LSB)
  NI 9201 ....................................... 2 μs
  NI 9221 ....................................... 1.25 μs

MTBF ........................................... 1,092,512 hours at 25 °C;
  Bellcore Issue 2, Method 1,
  Case 3, Limited Part Stress
  Method
Note  Contact NI for Bellcore MTBF specifications at other temperatures or for MIL-HDBK-217F specifications.

**Power Requirements**

Power consumption from chassis
- Active mode ......................... 1 W max
- Sleep mode .......................... 1 mW max

Thermal dissipation (at 70 °C)
- Active mode ......................... 1 W max
- Sleep mode .......................... 32 mW max

**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 and search by module number.
Screw-terminal wiring ...................... 12 to 24 AWG copper conductor wire with 10 mm (0.39 in.) of insulation stripped from the end

Torque for screw terminals ............... 0.5 to 0.6 N · m (4.4 to 5.3 lb · in.)

Ferrules ............................................. 0.25 mm² to 2.5 mm²

Weight
NI 9201/9221 with screw terminal .............. 150 g (5.3 oz)
NI 9201/9221 with DSUB........ 145 g (5.1 oz)

Safety

Safety Voltages
Connect only voltages that are within the following limits.
Channel-to-COM .............................. ±60 VDC max

NI 9201/9221 with Screw Terminal Isolation Voltages
Channel-to-channel......................... None
Channel-to-earth ground

Continuous .......................................................... 250 V_{rms},
Measurement Category II
Withstand.......................................................... 2,300 V_{rms} verified by a 5 s
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.

⚠️ **Caution**  Do not connect the NI 9201/9221 with screw
terminal to signals or use for measurements within
Measurement Categories III or IV.

**NI 9201/9221 with DSUB Isolation Voltages**

Channel-to-channel................................................. None

Channel-to-earth ground

Continuous .......................................................... 60 VDC,
Measurement Category I
Withstand.......................................................... 1,000 V_{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 9201/9221 with DSUB 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 nC IIC T4

Canada (C-UL) ....................... Class I, Division 2,
Groups A, B, C, D, T4;
Class I, Zone 2,
Ex nC IIC T4

Europe (DEMKO)....................... EEx nC 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 (IEC 61326): 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 the standards applied to assess the EMC of this product, refer to the Online Product Certification section.

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

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
Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit 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. If you are using the NI 9201/9221 with screw terminal, you also must either affix ferrules to the ends of the terminal wires or use the NI 9932 backshell kit to protect the connections.

Operating vibration
- Random (IEC 60068-2-64)........ 5 g_{rms}, 10 to 500 Hz
- Sinusoidal (IEC 60068-2-6) ...... 5 g, 10 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
National Instruments C Series modules are intended for indoor use only but may be used outdoors if installed in a suitable enclosure. 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 to 70 °C
Storage temperature
(IEC 60068-2-1, IEC 60068-2-2) ..... –40 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
Maximum altitude.......................... 2,000 m
Pollution Degree ............................ 2

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 to the environment and 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 the 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.

電子信息產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.)
Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9201/9221 at ni.com/calibration.

Calibration interval ....................... 1 year

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 22 328 90 10, Portugal 351 210 311 210, Russia 7 495 783 6851, Singapore 1800 226 5886, Slovenia 386 3 425 42 00, South Africa 27 011 805 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 523545

National Instruments, NI, ni.com, and LabVIEW are trademarks of National Instruments Corporation. Refer to the Terms of Use section on ni.com/legal for more information about National Instruments trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies. For patents covering National Instruments products/technology, refer to the appropriate location: Help»Patents in your software, the patent.txt file on your media, or the National Instruments Patent Notice at ni.com/patents.© 2004–2009 National Instruments Corp. All rights reserved.

373783G-01 May09
Artisan Technology Group is an independent supplier of quality pre-owned equipment.

**Gold-standard solutions**
Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

**We buy equipment**
Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

**Learn more!**
Visit us at artisantg.com for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We’re here to make your life easier. How can we help you today?
(217) 352-9330 | sales@artisantg.com | artisantg.com