Technical Sales

(866) 531-6285
orders@ni.com

Requirements and Compatibility | Ordering Information | Detailed Specifications
For user manuals and dimensional drawings, visit the product page resources tab on ni.com.

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NI 9211

±80 mV Thermocouple Input, 14 S/s, 4 Ch Module

- 4 thermocouple or ±80 mV analog inputs
- -40 to 70 °C operating range
- 24-bit resolution; 50/60 Hz noise rejection
- Hot-swappable operation
- NIST-traceable calibration

Overview

The NI 9211 C Series thermocouple input module for use with NI CompactDAQ and CompactRIO chassis includes a 24-bit delta-sigma ADC, antialiasing filters, open-thermocouple detection, and cold-junction compensation for high-accuracy thermocouple measurements. It contains NIST-traceable calibration and a channel-to-earth ground double-isolation barrier for safety, noise immunity, and high common-mode voltage range.

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Requirements and Compatibility

OS Information

- Real-Time OS
- Windows

Driver Information

- NI-DAQmx
- NI-RIO

Software Compatibility

- LabVIEW
- LabWindows/CVI
- Measurement Studio
- SignalExpress
- Visual Basic
- Visual C#
- Visual C++
- Visual Studio
- Visual Studio .NET

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Comparison Tables

Thermocouple Module	Channels	Sample Rate	Resolution	Feature
NI 9213	16	1,200 S/s	24-bit	Lowest cost/channel
NI 9219	4	50 S/s/ch	24-bit	Channel-to-channel isolation
NI 9211	4	14 S/s	24-bit	Low-channel count

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Application and Technology

High-accuracy C Series analog input modules for NI CompactDAQ and CompactRIO provide high-performance measurements for a wide variety of industrial, in-vehicle, and laboratory sensors and signal types. Each module includes built-in signal conditioning and an integrated connector with screw terminal or cable options for flexible and low-cost signal wiring. All modules feature CompactRIO Extreme Industrial Certifications and Ratings.

C Series Compatibility

The C Series hardware family features more than 50 measurement modules and several chassis and carriers for deployment. With this variety of modules, you can mix and match measurements such as temperature, acceleration, flow, pressure, strain, acoustic, voltage, current, digital, and more to create a custom system. Install the modules in one of several carriers to create a single module USB, Ethernet, or Wi-Fi system, or combine them in chassis such as NI CompactDAQ and CompactRIO to create a mixed-measurement system with synchronized measurements. You can install up to eight modules in a simple, complete NI CompactDAQ USB data acquisition system to synchronize all of the analog output, analog input, and digital I/O from the modules. For a system without a PC, CompactRIO holds up to eight modules and features a built-in processor, RAM, and storage for an embedded data logger or control unit. For higher-speed control, CompactRIO chassis incorporate a field-programmable gate array (FPGA) that you can program with NI LabVIEW software to achieve silicon-speed processing on I/O data from C Series modules.

Advanced Features

When used with CompactRIO, C Series analog input modules connect directly to reconfigurable I/O (RIO) FPGA hardware to create high-performance embedded systems. The reconfigurable FPGA hardware within CompactRIO provides a variety of options for custom timing, triggering, synchronization, filtering, signal processing, and high-speed decision making for all C Series analog modules. For instance, with CompactRIO, you can implement custom triggering for any analog sensor type on a per-channel basis using the flexibility and performance of the FPGA and the numerous arithmetic and comparison function blocks built into the LabVIEW FPGA Module.

Key Features

- High-accuracy, high-performance analog measurements for any CompactRIO embedded system, R Series expansion chassis, or NI CompactDAQ chassis
- Screw terminals, BNC, D-Sub, spring terminals, strain relief, high voltage, cable, solder cup backshell, and other connectivity options
- Available channel-to-earth ground double-isolation barrier for safety, noise immunity, and high common-mode voltage range
- CompactRIO Extreme Industrial Certifications and Ratings
- Built-in signal conditioning for direct connection to sensors and industrial devices

Visit ni.com/compactrio or ni.com/compactdaq for up-to-date information on module availability, example programs, application notes, and other developer tools.

Connectivity Accessories

NI CompactDAQ and CompactRIO systems are designed to provide flexible options for low-cost field wiring and cabling. Most C Series modules have a unique connector block option that offers secure connections to your C Series system. Table 2 contains all of the connector blocks available for C Series I/O modules.

Accessory	Description
NI 9932	10-position strain relief and high-voltage screw-terminal connector kit
NI 9933	37-pin D-Sub connector kit with strain relief and D-Sub shell
NI 9934	25-pin D-Sub connector kit with strain relief and D-Sub shell
NI 9935	15-pin D-Sub connector kit with strain relief and D-Sub shell
NI 9936	10-position screw-terminal plugs (quantity 10)
NI 9939	16-position connector kit with strain relief

Note: To meet shock and vibration requirements, you must affix ferrules to the ends of the wires on all screw-terminal connectors.

Table 2. Connector Blocks for C Series I/O Modules

Table 3 lists the recommended connector block accessories for each C Series analog input module.

C Series Analog Input Module	Recommended Module Accessory
NI 9201	NI 9932, NI 9936
NI 9201 with D-Sub	NI 9934[1]
NI 9211	NI 9932, NI 9936
NI 9215	NI 9932, NI 9936
NI 9217	NI 9939
NI 9221	NI 9932, NI 9936
NI 9221 with D-Sub	NI 9934[1]

[1]Requires a 25-pin D-Sub connector such as the NI 9934 accessory kit.

Table 3. Recommended Connector Block Accessories

The NI 9932 kit provides strain relief and operator protection from high-voltage signals for any 10-position screw-terminal module.

Figure 1. NI 9932 10-Position Strain Relief and High-Voltage Screw-Terminal Connector Kit

The NI 9936 consists of 10-position screw-terminal plugs for any 10-position screw-terminal module.

Figure 5. NI 9936 10-Position Screw-Terminal Plugs

Visit ni.com/compactrio or ni.com/compactdaq for up-to-date information on accessories.

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Ordering Information

For a complete list of accessories, visit the product page on ni.com.

Products	Part Number	Recommended Accessories	Part Number
		No accessories required.	

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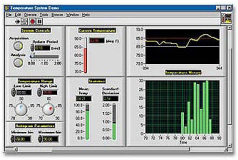
Software Recommendations

LabVIEW Professional Development System for Windows



- Advanced software tools for large project development
- Automatic code generation using DAQ Assistant and Instrument I/O Assistant
- Tight integration with a wide range of hardware
- Advanced measurement analysis and digital signal processing
- Open connectivity with DLLs, ActiveX, and .NET objects
- Capability to build DLLs, executables, and MSI installers

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Support and Services

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration

NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

Technical Support

Get answers to your technical questions using the following National Instruments resources.

- **Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.
- **Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

- **Classroom training in cities worldwide** - the most comprehensive hands-on training taught by engineers.
- **On-site training at your facility** - an excellent option to train multiple employees at the same time.
- **Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.
- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
- **Training memberships** and training credits - to buy now and schedule training later.

Visit ni.com/training for more information.

Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit ni.com/warranty.

OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

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Detailed Specifications

The following specifications are typical for the range –40 to 70 °C unless otherwise noted.

Input Characteristics	
Number of channels	4 thermocouple channels, 1 internal autozero channel, 1 internal cold-junction compensation channel
ADC resolution	24 bits
Type of ADC	Delta-Sigma
Sampling mode	Scanned
Voltage measurement range	±80 mV
Temperature measurement ranges	Works over temperature ranges defined by NIST (J, K, T, E, N, B, R, S thermocouple types)
Conversion time	70 ms per channel; 420 ms total for all channels including the autozero and cold-junction channels
Common-mode voltage range	
Channel-to-COM	±1.5 V
COM-to-earth ground	±250 V
Common-mode rejection ratio (0 to 60 Hz)	
Channel-to-COM	95 dB

COM-to-earth ground	>170 dB
Input bandwidth (–3 dB)	15 Hz
Noise rejection (at 50 and 60 Hz)	85 dB min
Overvoltage protection	±30 V between any input and COM
Differential input impedance	20 MΩ
Input current	50 nA
Input noise	1 μV_{rms}
Gain error	0.05% max at 25 °C, 0.06% typ at –40 to 70 °C, 0.1% max at –40 to 70 °C
Offset error (with autozero channel on)	15 µV typ, 20 µV max
Gain error from source impedance	Add 0.05 ppm per Ω when source impedance >50 Ω
Offset error from source impedance	Add 0.05 µV typ, 0.07 µV max per Ω source impedance >50 Ω
Cold-junction compensation sensor accuracy	
0 to 70 °C	0.6 °C typ, 1.3 °C max
–40 to 70 °C	1.7 °C max
MTBF	633,012 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

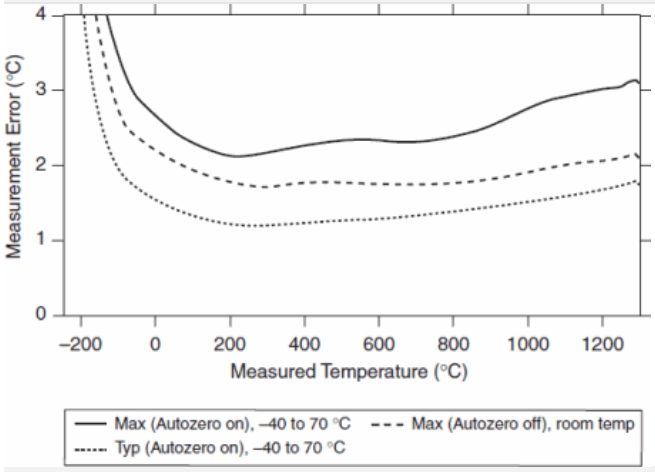
Note Contact NI for Bellcore MTBF specifications at other temperatures or for MIL-HDBK-217F specifications.

Temperature Measurement Accuracy

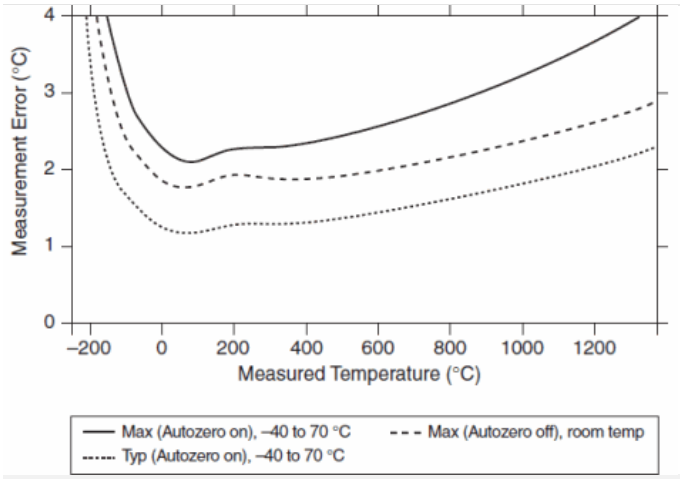
Measurement sensitivity [1]	
With autozero channel on	
Types J, K, T, E, N	<0.07 °C
Types B	<0.25 °C
Types R, S	<0.60 °C
With autozero channel off	
Types J, K, T, E, N	<0.05 °C
Types B	<0.20 °C
Types R, S	<0.45 °C

The following figures show the typical and maximum errors for each thermocouple type when used with the NI 9211 over the full temperature range. The figures also display the maximum errors for the thermocouple types with the NI 9211 at room temperature, which is 15 to 35 °C. The figures account for gain errors, offset errors, differential and integral nonlinearity, quantization errors, noise errors, and isothermal errors. The figures do not account for the accuracy of the thermocouple itself.

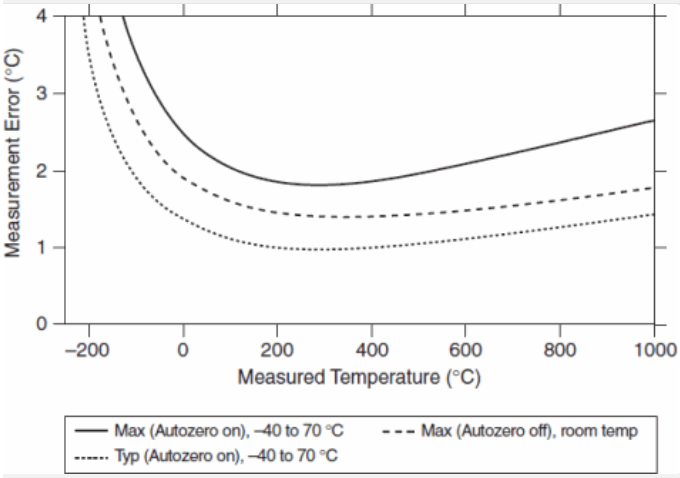
Thermocouple Types J and N Errors



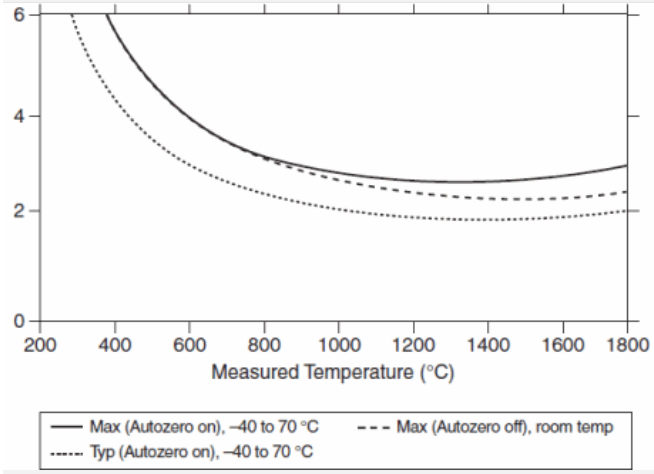
Thermocouple Type K Errors



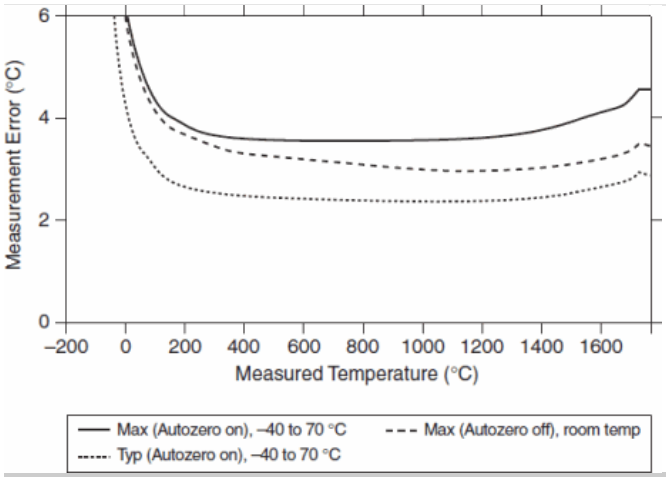
Thermocouple Types T and E Errors



Thermocouple Type B Errors



Thermocouple Types R and S Errors



Power Requirements

Power consumption from chassis	
Active mode	170 mW max
Sleep mode	4 mW max
Thermal dissipation (at 70 °C)	
Active mode	170 mW max
Sleep mode	4 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 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 mm^2 to 2.5 mm^2
Weight	150 g (5.3 oz)

Safety

Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±30 V max
Isolation	
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 (MAINS [2]). This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (for example, 115 AC voltage for U.S. or 230 AC voltage for Europe). Examples of Measurement Category II are measurements performed on household appliances, portable tools, and similar hardware.

Caution Do *not* connect the NI 9211 to signals or use for measurements within Measurement Categories 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 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 the *Online Product Certification* section.

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 (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 amended for CE marking, as follows:

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

Note For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

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 and 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 (IEC 60664)	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 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.)

Calibration

You can obtain the calibration certificate for this device at ni.com/calibration.

Calibration interval	1 year

[1] Measurement sensitivity represents the smallest change in temperature that a sensor can detect. It is a function of noise. The values assume the full measurement range of the standard thermocouple sensor according to ASTM E230-87.

[2] MAINS is defined as a hazardous live electrical supply system that powers hardware. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

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