ARTISAN®
TECHNOLOGY GROUP

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

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *National Instruments NI 9211* at our website: ***Click HERE***

DATASHEET

NI 9211 Datasheet

4 TC, ±80 mV, 24 Bit, 14 S/s Aggregate



- Screw-terminal connectivity
- 50 Hz/60 Hz noise rejection
- 250 Vrms, CAT II, channel-to-earth isolation

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

Kit Contents	• NI 9211 • NI 9211 Getting Started Guide
Accessories	• NI 9932 Backshell Connector Kit

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C SERIES THERMOCOUPLE MODULE COMPARISON							
Product Name	Channels	Maximum Accuracy* (°C)	Sample Rate	Software Selectable OTD	Autozero	Connectivity	Isolation Continuous
NI 9211	4	2.11	14 S/s	No	Yes	Screw Terminal	250 Vrms Ch-Earth
NI 9212	8	1.29	95 S/s/ch	No	No	Isothermal Terminal Block	250 Vrms Ch-Ch
NI 9213	16	2.25	75 S/s	No	Yes	Spring Terminal	250 Vrms Ch-Earth
NI 9214	16	1.24	68 S/s	Yes	Yes	Isothermal Terminal Block	250 Vrms Ch-Earth

* For a J type thermocouple at 100 °C using high-resolution mode when applicable.

NI C Series Overview



NI provides more than 100 C Series modules for measurement, control, and communication applications. C Series modules can connect to any sensor or bus and allow for high-accuracy measurements that meet the demands of advanced data acquisition and control applications.

- Measurement-specific signal conditioning that connects to an array of sensors and signals
- Isolation options such as bank-to-bank, channel-to-channel, and channel-to-earth ground
- -40 °C to 70 °C temperature range to meet a variety of application and environmental needs
- Hot-swappable

The majority of C Series modules are supported in both CompactRIO and CompactDAQ platforms and you can move modules from one platform to the other with no modification.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

CompactRIO



CompactRIO combines an open-embedded architecture with small size, extreme ruggedness, and C Series modules in a platform powered by the NI LabVIEW reconfigurable I/O (RIO) architecture. Each system contains an FPGA for custom timing, triggering, and processing with a wide array of available modular I/O to meet any embedded application requirement.

CompactDAQ

CompactDAQ is a portable, rugged data acquisition platform that integrates connectivity, data acquisition, and signal conditioning into modular I/O for directly interfacing to any sensor or signal. Using CompactDAQ with LabVIEW, you can easily customize how you acquire, analyze, visualize, and manage your measurement data.



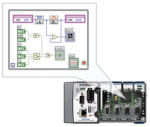
Software

LabVIEW Professional Development System for Windows



- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects
- Build DLLs, executables, and MSI installers

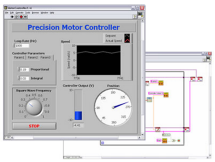
NI LabVIEW FPGA Module



- Design FPGA applications for NI RIO hardware
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing HDL code and third-party IP including Xilinx IP generator functions
- Purchase as part of the LabVIEW Embedded Control and Monitoring Suite

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

NI LabVIEW Real-Time Module

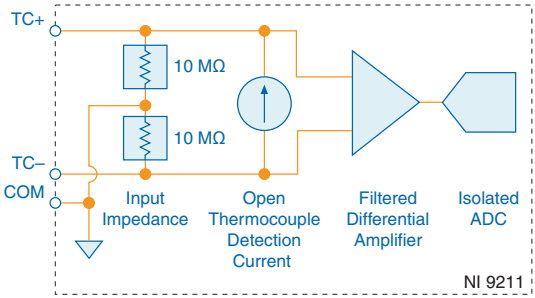


- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of multicore CPUs or set processor affinity manually
- Take advantage of real-time OS, development and debugging support, and board support
- Purchase individually or as part of a LabVIEW suite

Input Circuitry

The NI 9211 channels share a common ground isolated from other modules in the system. Each channel passes through a filter and then a 24-bit analog-to-digital converter (ADC) samples the channel.

Figure 1. Input Circuitry for One Channel of the NI 9211



Open Thermocouple Detection

Each channel has an open thermocouple detection (OTD) circuit, which consists of a current source between the TC+ and TC- terminals. If an open thermocouple is connected to the channel, the current source forces a full-scale voltage across the terminals.

Input Impedance

Each channel has a resistor that produces an input impedance between the TC and COM terminals. The gain and offset errors resulting from the source impedance of connected thermocouples are negligible for most applications. Thermocouples with a higher lead resistance can introduce more significant errors.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Thermocouple Measurement Accuracy

Thermocouple measurement errors depend partly on the following factors:

- the type of thermocouple
- the accuracy of the thermocouple
- the temperature that you are measuring
- the resistance of the thermocouple wires
- the cold-junction temperature

For the best accuracy performance, set up the NI 9211 according to the getting started guide on *ni.com/manuals* to minimize thermal gradients across the NI 9211 terminals.

Cold-Junction Accuracy

Heat dissipated by adjacent C Series modules or nearby heat sources can cause errors in thermocouple measurements by heating the NI 9211 terminals to a different temperature than the cold-junction compensation sensor. Thermal gradient across the terminals can cause the terminals of different NI 9211 channels to be at different temperatures, which creates accuracy errors and affects the relative accuracy between channels.

The temperature measurement accuracy specifications include errors caused by the thermal gradient across the NI 9211 terminals for configurations with the NI 9211 terminals facing forward or upward.

Autozero Channel

The NI 9211 has an internal autozero channel, which can be subtracted from each thermocouple reading to compensate for offset errors. Use the autozero channel if the ambient temperature is less than 15 °C or more than 35 °C. Refer to the documentation for the software that you are using for information about using the NI 9211 autozero channel.

NI 9211 Specifications

The following specifications are typical for the range -40 °C to 70 °C unless otherwise noted. Accuracy within typical use can vary based on chassis, mounting parameters, other modules present in the system, and installed accessories.

Caution The input terminals of this device are not protected for electromagnetic interference. As a result, this device may experience reduced measurement accuracy or other temporary performance degradation when connected cables are routed in an environment with radiated or conducted radio frequency electromagnetic interference. To limit radiated emissions and to ensure that this device functions within specifications in its operational electromagnetic environment, take precautions when designing, selecting, and installing measurement probes and cables.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 Hz to 60 Hz)	
Channel-to-COM	95 dB
COM-to-earth ground	>170 dB
Input bandwidth (-3 dB)	15 Hz
Noise rejection (at 50 Hz and 60 Hz)	85 dB minimum
Overvoltage protection	±30 V between any input and COM
Differential input impedance	20 MΩ
Input current	50 nA
Input noise	1 µVrms
Gain error (at -40 °C to 70 °C)	0.06% typical, 0.1% maximum
Offset error (with autozero channel on)	±15 µV typical, ±20 µV maximum
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 typical, ±0.07 µV maximum per Ω when source impedance >50 Ω

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

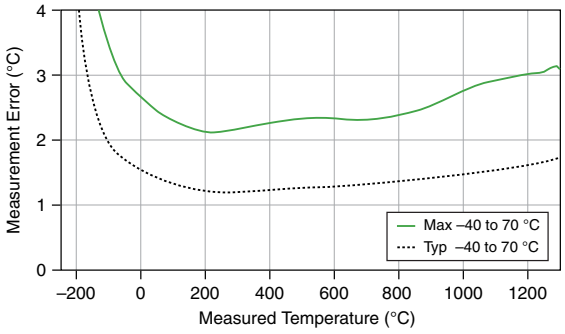
Cold-junction compensation sensor accuracy	
0 °C to 70 °C	±0.6 °C typical, ±1.3 °C maximum
-40 °C to 70 °C	±1.7 °C maximum
MTBF	633,012 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

Temperature Measurement Accuracy

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

Figure 2. Thermocouple Type J and N Errors



[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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Figure 3. Thermocouple Type K Errors

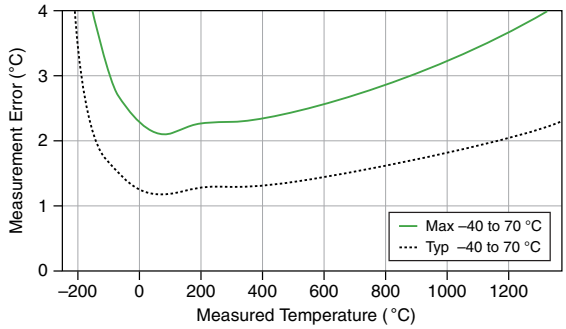


Figure 4. Thermocouple Type T and E Errors

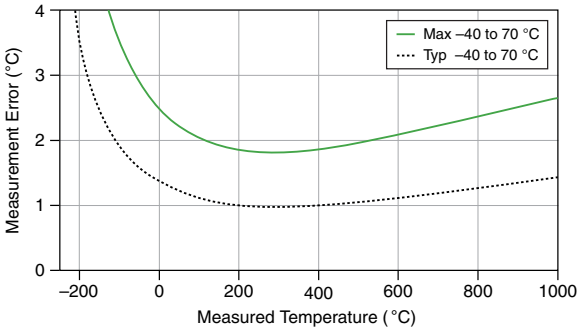
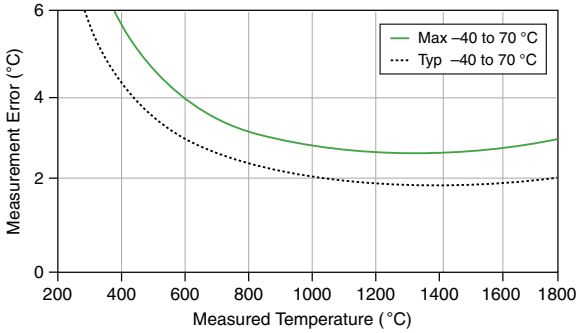
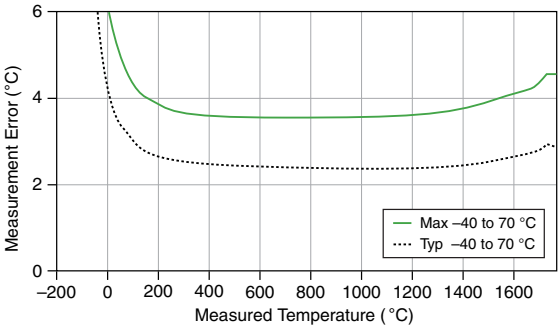


Figure 5. Thermocouple Type B Errors



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Figure 6. Thermocouple Type R and S Errors



Power Requirements

Power consumption from chassis	
Active mode	170 mW maximum
Sleep mode	4 mW maximum
Thermal dissipation (at 70 °C)	
Active mode	170 mW maximum
Sleep mode	4 mW maximum

Physical Characteristics

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

Tip 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	
Gauge	0.25 mm^2 to 2.5 mm^2 (24 AWG to 12 AWG) copper conductor wire
Wire strip length	7 mm (0.28 in.) of insulation stripped from the end
Temperature rating	90 °C minimum
Torque for screw terminals	0.3 N · m (2.66 lb · in.)
Wires per screw terminal	One wire per screw terminal
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Weight	150 g (5.3 oz)

Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±30 V maximum
Isolation	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 Vrms, Measurement Category II
Withstand	2,300 Vrms, 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 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 nA IIC T4
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA IIC T4
Europe (ATEX) and International (IECEx)	Ex nA IIC T4 Gc

Safety and Hazardous Locations Standards

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

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 5, UL 60079-15; Ed 3
- CSA 60079-0:2011, CSA 60079-15:2012

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for sensitive electrical equipment for measurement, control, and laboratory use:

- EN 61326-2-1 (IEC 61326-2-1): 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 In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note For EMC declarations and certifications, and additional information, refer to the *Online Product Certification* section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 94/9/EC; Potentially Explosive Atmospheres (ATEX)

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 model 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.

Operating vibration	
Random (IEC 60068-2-64)	5 g_{rms}, 10 Hz to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 Hz to 500 Hz

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Operating shock (IEC 60068-2-27)	30 g, 11 ms half sine; 50 g, 3 ms half sine; 18 shocks at 6 orientations

Environmental

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 °C to 70 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C
Ingress protection	IP40
Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
Storage humidity (IEC 60068-2-78)	5% RH to 95% RH, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m

Indoor use only.

Environmental Management

NI 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 *Minimize Our Environmental Impact* 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 product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

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`.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9211 at *ni.com/calibration*.

Calibration interval	1 year

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Refer to the *NI Trademarks and Logo Guidelines* at ni.com/trademarks for information on NI trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies. For patents covering NI products/technology, refer to the appropriate location: **Help**»**Patents** in your software, the patents.txt file on your media, or the *National Instruments Patent Notice* at ni.com/patents. You can find information about end-user license agreements (EULAs) and third-party legal notices in the readme file for your NI product. Refer to the *Export Compliance Information* at ni.com/legal/export-compliance for the NI global trade compliance policy and how to obtain relevant HTS codes, ECCNs, and other import/export data. NI MAKES NO EXPRESS OR IMPLIED WARRANTIES AS TO THE ACCURACY OF THE INFORMATION CONTAINED HEREIN AND SHALL NOT BE LIABLE FOR ANY ERRORS. U.S. Government Customers: The data contained in this manual was developed at private expense and is subject to the applicable limited rights and restricted data rights as set forth in FAR 52.227-14, DFAR 252.227-7014, and DFAR 252.227-7015.

© 2015 National Instruments. All rights reserved.

373466A-02 Dec15

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

ARTISAN® TECHNOLOGY GROUP