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4-Channel, 100 Ω RTD, 24-Bit Analog Input Module

NI 9217



- 24-bit resolution; 50/60 Hz noise rejection
- Four 100 Ω RTD analog inputs
- NIST-traceable calibration certificate for guaranteed accuracy
- Up to 400 S/s sampling rate
- 3- and 4-wire RTDs; built-in excitation and automatic detection

Overview

The NI 9217 RTD analog input C Series module features four channels and 24 bits of resolution for 100 Ω RTD measurements. You can configure the NI 9217 for two different sampling rate modes. With the high-sampling-rate mode, you can sample at up to 400 S/s (100 S/s per channel). Using the high-resolution mode, you can sample at 5 S/s (1.25 S/s per channel) with built-in 50/60 Hz noise rejection. The NI 9217, compatible with 3- and 4-wire RTD measurements, automatically detects the type of RTD (3- or 4-wire) connected to the channel and configures each channel for the appropriate mode. The module can provide 1 mA of current excitation per channel and has less than a 1 °C accuracy error over its entire operating temperature range. The NI 9217 contains NIST-traceable calibration and includes a channel-to-earth ground double isolation barrier for safety, noise immunity, and high common-mode voltage range. For channel-to-channel isolated RTD measurements, see the NI 9219 universal analog input module.

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OS Information

Real-Time OS
Windows

Driver Information

NI-DAQmx
NI-RIO

Software Compatibility

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

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Comparison Tables

Module	Signal Type	Channels	Sample Rate	Resolution (bits)
9201	Voltage	8	500 kS/s	12
9203	Current	8	200 kS/s	16
9205	Voltage	32 SE/16 DI	250 kS/s	16
9206	CAT I isolated voltage	16 DI	250 kS/s	16
9215	Voltage	4	100 kS/s per channel	16

Module	Signal Type	Channels	Sample Rate	Resolution (bits)
9217	RTD	4	400 S/s	24
9221	Voltage	8	800 kS/s	12
9227	Current	4	50 kS/s per channel	24
9233	IEPE	4	50 kS/s per channel	24
9235/9236	Quarter-bridge	8	10 kS/s per channel	24
9237	Bridge	4	50 kS/s per channel	24

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Application and Technology

High-accuracy NI 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 recommends the NI 9939 strain-relief connector accessory for use with the NI 9217. CompactRIO and NI CompactDAQ 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 9939 connector kit provides strain relief and operator protection from high-voltage signals for any 16-position screw terminal module. It is a backshell kit for use with the NI 9975 16-position connector, and it is not shipped with the module kit. The 9939 kit includes one backshell only.



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Ordering Information

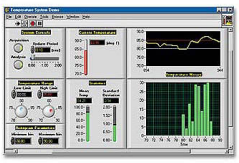
For a complete list of accessories, visit the product page on ni.com.

Products	Part Number	Recommended Accessories	Part Number
NI 9217 Thermocouple Input Module			
NI 9217 Requires: 1 Connectivity Accessories ;	779592-01	**Connectivity Accessories:** screwTerminal - NI 9939 Strain relief, operator protection (qty 1)	192692-01

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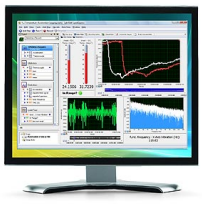
Software Recommendations

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

NI LabVIEW SignalExpress for Windows



Quickly configure projects without programming
Control over 400 PC-based and stand-alone instruments
Log data from more than 250 data acquisition devices
Perform basic signal processing, analysis, and file I/O
Scale your application with automatic LabVIEW code generation
Create custom reports or easily export data to LabVIEW, DIAdem or Microsoft Excel

NI LabWindows™/CVI for Windows

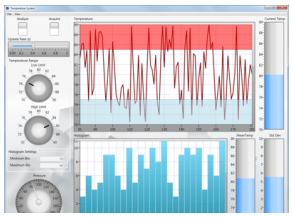
Real-time advanced 2D graphs and charts
Complete hardware compatibility with IVI, VISA, DAQ, GPIB, and serial
Analysis tools for array manipulation, signal processing statistics, and curve fitting
Simplified cross-platform communication with network variables
Measurement Studio .NET tools (included in LabWindows/CVI Full only)

NI Measurement Studio Professional Edition

Customizable graphs and charts for WPF, Windows Forms, and ASP.NET Web Forms UI design
Analysis libraries for array operations, signal generation, windowing, filters, signal processing
Hardware integration support with native .NET data acquisition and instrument control libraries
Automatic code generation for all NI-DAQmx data acquisition hardware
Intelligent and efficient data-logging libraries for streaming measurement data to disk



The mark LabWindows is used under a license from Microsoft Corporation.



Support for Microsoft Visual Studio .NET 2012/2010/2008

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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. All voltages are relative to COM unless otherwise noted.

All specifications given in °C are specific to 100 Ω platinum RTDs.

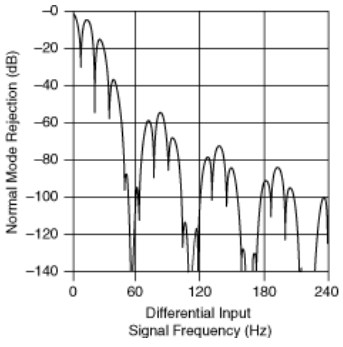
Input Characteristics	
Number of channels	4 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-sigma
Sampling mode	Scanned
Measurement range	
Temperature	–200 to 850 °C
Resistance	0 to 400 Ω
Common-mode range	
COM-to-earth ground	±250 V_{rms}
Channel-to-COM	50 mV
Conversion time	
High-resolution mode	200 ms per channel, 800 ms total for all channels
High-speed mode	2.5 ms per channel, 10 ms total for all channels

Temperature accuracy (including noise) [1], 4-wire mode		
Measured Value	**Typical (25 °C)**	**Maximum (–40 to 70 °C)**
–200 to 150 °C	0.15 °C	0.35 °C
150 to 850 °C	0.20 °C	1.0 °C

Temperature accuracy (including noise) [1], 3-wire mode		
Measured Value	**Typical (25 °C)**	**Maximum (–40 to 70 °C)**
–200 to 150 °C	0.20 °C	0.50 °C
150 to 850 °C	0.30 °C	1.0 °C

Noise	
High-resolution mode	0.003 °C
High-speed mode	0.02 °C
Excitation current	1 mA per channel
Noise rejection	
Normal mode (50/60 Hz)	
High-resolution mode	85 dB min
High-speed mode	None
Common-mode rejection, channel to earth ground (50/60 Hz)	
High-resolution mode	170 dB min
High-speed mode	155 dB
Input bandwidth (high-resolution mode)	3.3 Hz

High-resolution filter response [2] [3]



Overvoltage protection	±30 V between inputs
MTBF	891,597 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	350 mW max
Sleep mode	1 mW max
Thermal dissipation (at 70 °C)	
Active mode	350 mW max
Sleep mode	1 mW max

Physical Characteristics

Screw-terminal wiring	16 to 28 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end
Torque for screw terminals	0.22 to 0.25 N · m (1.95 to 2.21 lb · in.)
Ferrules	0.25 mm^2 to 0.5 mm^2
Weight	142 g (5.0 oz)

Safety

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

Maximum Voltage [4]

Connect only voltages that are within the following limits.

All terminals-to-COM	±30 V

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 (e.g., 115 V for U.S. or 230 V for Europe). Examples of Measurement Category II are measurements performed on household appliances, portable tools, and similar products.

Caution Do *not* connect the NI 9203 to signals or use for measurements within Measurement Categories III or IV.

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.

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

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

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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 9939 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

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; Industrial 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 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.

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

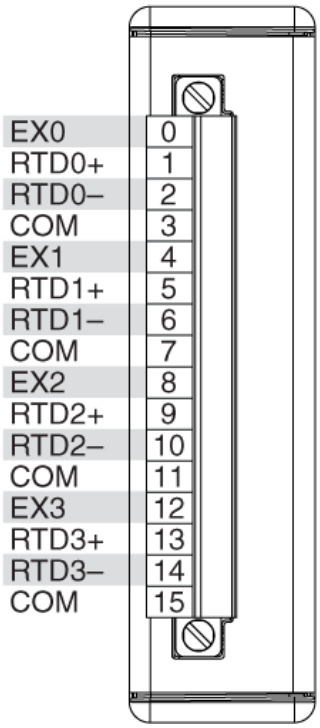
You can obtain the calibration certificate for this device at ni.com/calibration.

Calibration interval	1 year

[1] For high-speed mode, add a 0.1 °C error.
[2] This image is provided courtesy of Linear Technology Corp.
[3] High-speed filter response has the same characteristics as the high-resolution filter response except that the first notch is at 14 kHz.
[4] The maximum voltage that can be applied between any channel or V_{sup} terminal and a COM terminal without damaging the module or other devices.

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Pinouts/Front Panel Connections



NI 9217 Terminal Assignments

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