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4-Channel, 100 kS/s, 16-Bit, 0 to 20 mA Analog Output Module

NI 9265





- 0 to 20 mA output range, 16-bit resolution
- Open-loop detection with interrupt, 0.0 mA power-on
- Hot-swappable operation
- 4 analog outputs, 100 kS/s, simultaneously updated
- -40 to 70 °C operating range
- NIST-traceable calibration

Overview

High-performance analog output modules for NI CompactRIO embedded systems, NI R Series expansion chassis, and NI CompactDAQ hardware provide accurate signal generation. Each module incorporates built-in signal conditioning and an integrated connector with screw-terminal or cable options for flexible and low-cost signal wiring. All modules feature the NI CompactRIO Extreme Industrial Certifications and Ratings.

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Requirements and Compatibility

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Software Compatibility

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Comparison Tables

Product	NI CompactRIO Compatibility	NI CompactDAQ Compatibility	Signal Type	Channels	Resolution (bits)	Max Update Rate (S/s)	Range	Current Drive	Simultaneous Updating
9263	yes	yes	Voltage	4	16	100 k/ch	±10 V	1 mA/ch	yes
9264	yes	yes	Voltage	16	16	25 kS/s	±10 V	4 mA/ch	yes

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Product	NI CompactRIO Compatibility	NI CompactDAQ Compatibility	Signal Type	Channels	Resolution (bits)	Max Update Rate (S/s)	Range	Current Drive	Simultaneous Updating
9265	yes	no	Current	4	16	100 k/ch	0 to 20 mA	20 mA/ch	yes
9269	yes	yes	Voltage	4	16	100 k/ch	±10 V	10 mA/ch	yes

Application and Technology

System Compatibility

You can use NI C Series modules in multiple system types depending on the software available. See the table above for CompactRIO and NI CompactDAQ module compatibility because not all modules work with both systems. Many of the advanced features described apply only to reconfigurable I/O systems and not to NI CompactDAQ.

Advanced Features

Advanced features include ±30 V overvoltage protection and short-circuit protection, simultaneous 16-bit per-channel digital-to-analog converters (DACs), high-speed settling, excellent monotonicity, and NIST-traceable calibration. NI 926x modules include a channel-to-earth ground double isolation barrier for safety and noise immunity. The NI 9265 provides high-performance, 0 to 20 mA analog outputs ideal for controlling industrial pressure, flow, and position actuators. It requires a 9 to 36 V external power supply for driving the output current of the module.

When used in CompactRIO, C Series analog output modules connect directly to reconfigurable I/O (RIO) field-programmable gate array (FPGA) hardware to create high-performance embedded systems that deliver the optimization and flexibility of a custom electrical circuit completely dedicated to your input/output application. The reconfigurable FPGA hardware within CompactRIO provides a variety of options for timing, triggering, synchronization, change detection, digital pattern matching, or digital communication. For instance, with CompactRIO, you can implement a circuit to generate complex arbitrary waveforms; perform filtering or splining to generate a smooth output signal based on a choppy, low-speed output command; simulate a nonlinear sensor; or implement amplitude/phase modulation.

Key Features

- High-performance analog output signal generation for CompactRIO embedded systems, R Series expansion chassis, or NI CompactDAQ hardware
- Screw terminals, strain relief, high-voltage, and cable options
- NI CompactRIO Extreme Industrial Certifications and Ratings
- Channel-to-earth ground double isolation barrier for safety and noise immunity

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

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 to provide secure and safe connections to your CompactRIO or NI CompactDAQ system. The table below 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)

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

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Figure 1. cRIO-9937 Power Supply Plugs



Figure 2. cRIO-9932 Strain Relief and High-Voltage Connector Kit



Figure 3. cRIO-9936 10-Position Screw-Terminal Plugs

The table below lists the recommended connector block accessories for each CompactRIO analog output module.

C Series Analog Output Module	Recommended Module Accessory
NI 9263	NI 9932, NI 9936
NI 9264	NI 9940, NI 9974
NI 9265	NI 9932, NI 9936
NI 9269	NI 9971, NI 9976

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



Figure 4. NI 9932 10-Position Strain Relief and High-Voltage Screw-Terminal Connector Kit

The NI 9933 includes a screw-terminal connector with strain relief as well as a D-Sub solder-cup backshell for creating custom cable assemblies for any module with a 37-pin D-Sub connector.

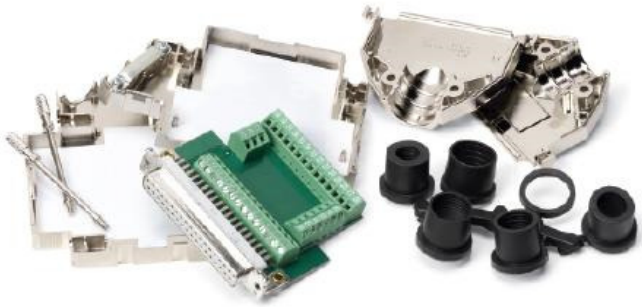


Figure 5. NI 9933 37-Pin D-Sub Connector Kit with Strain Relief and D-Sub Shell

The NI 9934 includes a screw-terminal connector with strain relief as well as a D-Sub solder-cup backshell for creating custom cable assemblies for any module with a 25-pin D-Sub connector.

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Figure 6. NI 9934 25-Pin D-Sub Connector Kit with Strain Relief and D-Sub Shell

The NI 9935 includes a screw-terminal connector with strain relief as well as a D-Sub solder-cup backshell for creating custom cable assemblies for any module with a 15-pin D-Sub connector.



Figure 7. NI 9935 15-Pin D-Sub Connector Kit with Strain Relief and D-Sub Shell

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



Figure 8. NI 9936 10-Position Screw-Terminal Plugs

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

Ordering Information

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

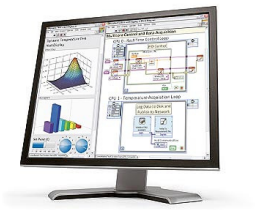
Products	Part Number	Recommended Accessories	Part Number
NI 9265			
NI 9265 Each NI 9265 requires: 1 Connectivity Accessory	779334-01	**Connectivity Accessory:** Screw Terminals - NI 9932 Backshell with 10-pos connector block (qty 1)	779017-01

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NI 9265 CC Each NI 9265 CC requires: 1 Connectivity Accessory	779334-02	**Connectivity Accessory:** Screw Terminals - NI 9932 Backshell with 10-pos connector block (qty 1)	779017-01

Software Recommendations

NI LabVIEW Professional Development System for Windows



Easy-to-use graphical development environment
Tight integration with a wide range of measurement hardware
Rapid user interface development for displaying live data
Extensive signal processing, analysis, and math functionality
Source code control integration and code complexity metrics
Support for Windows XP/Vista/7 (32-bit) and Windows Vista/7 (64-bit)

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. NI offers a number of calibration services to help maintain the ongoing accuracy of your measurement hardware. These services allow you to be completely confident in your measurements, and help you maintain compliance to standards like ISO 9001, ANSI/NCSL Z540-1 and ISO/IEC 17025. 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.

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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 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

Detailed Specifications

View Detailed Specifications Table of Contents

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

Output Characteristics

Number of channels	4 analog output channels
DAC resolution	16 bits
Type of DAC	String
Power-on output state	0
Startup current	0.0 mA
Power-down current	0.0 mA
Full-scale output current	
Minimum	20.1 mA
Typical	20.6 mA
Maximum	21.0 mA
Output range	0 to 20 mA
Compliance voltage	12 VDC max
Maximum load	600 Ω

Accuracy		
Measurement Conditions	**Percent of Reading (Gain Error)**	**Percent of Range [1] (Offset Error)**
Calibrated, typ (25 °C, ±5 °C)	0.11%	0.19%
Calibrated, max (–40 to 70 °C)	0.25%	0.4%
Uncalibrated, typ (25 °C, ±5 °C)	0.35%	1.4%
Uncalibrated, max (–40 to 70 °C)	0.85%	2.5%

Stability	
Gain drift	30 ppm/°C
Offset drift	45 ppm/°C
External power supply voltage range (V_{sup})	9–36 VDC
Protection (AO, V_{sup})	
Overvoltage	±40 V
Short-circuit	Indefinitely

Update time		
Number of Channels	**Update Time for R Series Expansion Chassis**	**Update Time for Any Other Chassis**
One	3.5 µs	3 µs

Update time		
Number of Channels	**Update Time for R Series Expansion Chassis**	**Update Time for Any Other Chassis**
Two	6.5 µs	5 µs
Three	9 µs	7.5 µs
Four	12 µs	9.5 µs

Noise	600 nA_{rms}
Crosstalk	–90 dB
Settling time (to 1 LSB)	
Full-scale step	10 µs
1 mA step	5 µs
Glitch energy	Unmeasurable
Monotonicity	16 bits
DNL	1 LSB max
INL	±16 LSB
MTBF	1,014,487 hours at 25 °C; Bellcore Issue 6, 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

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Power consumption from chassis	
Active mode	230 mW max
Sleep mode	25 µW max
Thermal dissipation (at 70 °C)	
Active mode	1.5 W max
Sleep mode	10 mW max
Power consumption from external power supply	
Active mode	1.4 W max
Sleep mode	10 mW

Physical Characteristics

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Screw-terminal wiring	12 to 24 AWG copper conductor wire with 10 mm (0.39 in.) of insulation stripped from the end
Ferrules	0.25 mm^2 to 2.5 mm^2
Torque for screw terminals	0.5 to 0.6 N · m (4.4 to 5.3 lb · in.)
Weight	136 g (4.8 oz)

Safety

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

Maximum Voltage [2]

Connect only voltages that are within the following limits.

Channel-to-COM or V_{sup}-to-COM	±40 V max

Isolation Voltages

Channel-to-channel	No isolation between channels
Channel-to-earth ground, V_{sup}-to-earth ground, or COM-to-earth ground	
Continuous	250 V_{rms}, Measurement Category II
Withstand	2,300 V_{rms}, verified by a 5 s dielectric withstand test

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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 9265 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

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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

Shock and Vibration

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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

Electromagnetic Compatibility

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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

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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

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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

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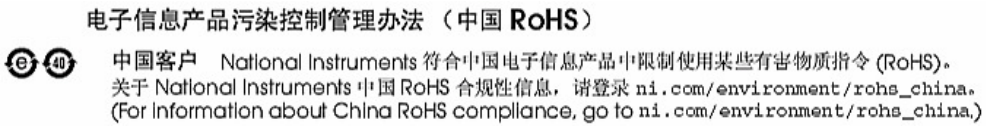
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National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to 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.



Calibration

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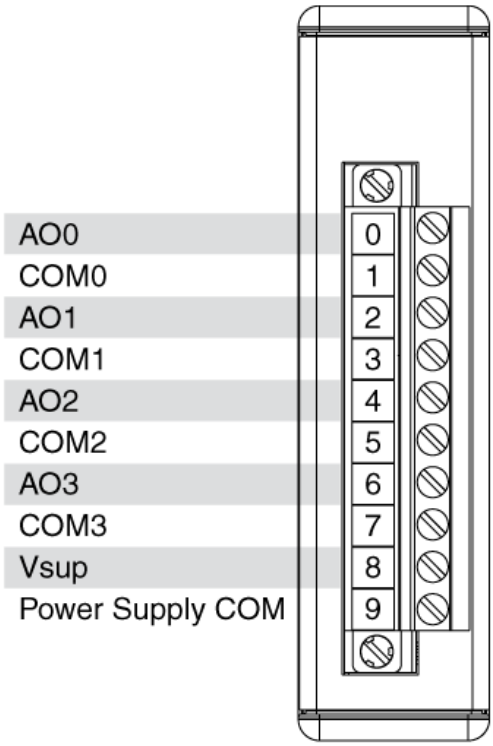
You can obtain the calibration certificate for this device at ni.com/calibration.

Calibration interval	1 year

[1] Range equals 0 to 20.6 mA

[2] The maximum voltage that can be applied betwqeen any channel or V_{sup} terminal and a COM terminal without damaging the module or other devices.

Pinouts/Front Panel Connections



NI 9265 Terminal Assignments

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