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NI 9411

6 Ch, 500 ns, ±5 to 24 V C Series Digital Input Module

- 6-channel, 500 ns digital input
- ±5 to 24 V, differential/single-ended digital input
- -40 to 70 °C operating range
- Extreme industrial certifications/ratings
- Hot-swappable operation

Overview

The NI 9411 is a C Series module designed for 6-channel, 500 ns differential/single-ended digital inputs. Each channel is compatible with ±5 to 24 V signals. The NI 9411 works with industrial logic levels and signals for direct connection to a wide array of industrial switches, transducers, and devices. It requires a 15-pin D-SUB cable or connector kit. NI recommends the NI 9935 15-pin connector kit with strain relief for use with the NI 9411. The NI 9411 is a correlated digital module, so it can perform correlated measurements, triggering, and synchronization when installed in an NI CompactDAQ chassis.

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Requirements and Compatibility

OS Information

Real-Time OS
Windows

Driver Information

NI-DAQmx
NI-RIO

Software Compatibility

LabVIEW
LabWindows/CVI
SignalExpress
Visual Studio
Visual Studio .NET

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Comparison Tables

Product Name	Signal Levels	Number of Channels	Connectivity	Speed	Special Features
9411	±5 to 24 V	6	15-pin D-SUB	500 ns	Differential/single-ended digital input, differential quad encoder
9421	12 to 24 V	8	Screw-terminal, D-SUB	100 µs	Sinking digital input
9422	24 to 60 V	8	Screw-terminal	250 µs	Sinking/sourcing digital input
9423	11 to 30 V	8	Screw-terminal	1 µs	Sinking digital input
9425	12, 24 V	32	37-pin D-SUB	7 µs	Sinking digital input
9426	24 V	32	37-pin D-SUB	7 µs	Sourcing digital input

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Application and Technology

High-performance digital input and counter/timer modules for NI CompactDAQ systems, CompactRIO embedded systems, and C Series expansion chassis provide extended voltage ranges and update rates to measure a wide array of industrial sensors and encoders. Each module features an integrated connector junction box with screw/spring-terminal or cable options for flexible, low-cost signal wiring. All modules feature CompactRIO extreme industrial certifications and ratings including -40 to 70 °C operating temperatures and 50 g shock.

When used in CompactRIO, C Series digital 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 timing, triggering, synchronization, digital waveform measurements, or digital communication. For instance, with CompactRIO, you can implement a circuit to read PWM inputs from motors, heaters, or fans as well as reading quadrature encoders while calculating position and velocity.

C Series Compatibility

The NI 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 WiFi 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 DAQ 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 an FPGA that you can program with NI LabVIEW software to achieve silicon-speed processing on I/O data from C Series modules.

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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 9411 Counter			
NI 9411 Requires: 1 Connectivity Accessories ;	779005-01	**Connectivity Accessories:** screwTerminal - NI 9935 15pin D-Sub connector kit	779016-01

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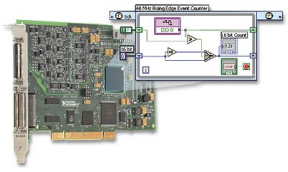
Software Recommendations

LabVIEW Professional Development System for Windows

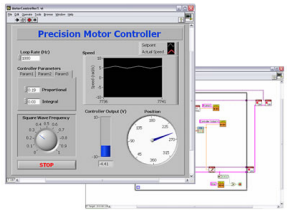
Advanced software tools for large project development
Automatic code generation using DAQ Assistant and Instrument I/O Assistant
Tight integration with a wide range of hardware
Advanced measurement analysis and digital signal processing
Open connectivity with DLLs, ActiveX, and .NET objects
Capability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

NI LabVIEW FPGA Module



Create your own I/O hardware without VHDL coding or board design
Graphically configure FPGAs on NI reconfigurable I/O (RIO) hardware targets
Define your own control algorithms with loop rates up to 300 MHz
Execute multiple tasks simultaneously and deterministically
Implement custom timing and triggering logic, digital protocols, and DSP algorithms
Incorporate existing HDL code and third-party IP including Xilinx CORE Generator functions

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
Includes real-time operating system (RTOS), development and debugging support, and board support
Purchase individually or as part of an NI Developer Suite bundle

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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	6
Input type	Differential or single-ended
Digital logic levels	
Single-ended	
Input high range	2 to 24 V
Input low range	0 to 0.8 V
Differential (DIa–DIb)	
Input high range	300 mV to 24 V
Input low range	–300 mV to –24 V
Common-mode voltage[1]	–7 to 12 V
Input current	

At 5 V	±1 mA
At 24 V	±4 mA
I/O protection	
Input voltage (input to COM)	30 V max
Input current	±4 mA, internally limited
Input delay time	500 ns max
MTBF	800,319 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

Power consumption from chassis	
Active mode	340 mW max
Sleep mode	1.1 mW max
Thermal dissipation (at 70 °C)	
Active mode	1.4 W max
Sleep mode	1.1 W max

External Power Supply

Input voltage range (V_{sup})	5 to 30 VDC, user-provided
5 V regulated output	
Voltage tolerance	5 V ± 3%, V_{sup} ≥ 6 V
Current	200 mA
Short-circuit protection	400 mA

Physical Characteristics

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

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.)
Weight	Approx. 136 g (4.8 oz)

Safety

Safety Voltages

Connect only voltages that are within these limits.

Channel-to-COM	30 V max, Measurement Category I
V_{sup}-to-COM	30 V max, Measurement Category I

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS[2] voltage. 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.

Isolation Voltages

Channel-to-channel	No isolation between channels
Channel-to-earth ground	
Continuous	30 V_{rms}, 42.4 V_{pk}, 60 VDC
Withstand	400 V_{rms}, verified by a 5 s dielectric withstand test

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
- CAN/CSA-C22.2 No. 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 installation instructions for the chassis you are using for more information about meeting these specifications.

Operating temperature	– 40 to 70 °C
Storage temperature	– 40 to 85 °C
Ingress protection	IP 40
Humidity	10 to 90% RH, noncondensing
Maximum altitude	2,000 m
Pollution Degree (IEC 60664)	2

Shock and Vibration

To meet these specifications, you must panel mount your system and affix ferrules to the ends of the terminal wires.

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

Electromagnetic Compatibility

Emissions	EN 55011 Class A at 10 m FCC Part 15A above 1 GHz
Immunity	Industrial levels per EN 61326-1:1997 + A2:2001, Table A.1
EMC/EMI	CE, C-Tick, and FCC Part 15 (Class A) Compliant

Note For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- Low-Voltage Directive (safety); 73/23/EEC
- Electromagnetic Compatibility Directive (EMC); 89/336/EEC

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.

[1] Common-mode voltage is the average of DIa and DIb.

[2] MAINS is defined as the (hazardous live) electrical supply system to which equipment is designed to be connected for the purpose of powering the equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

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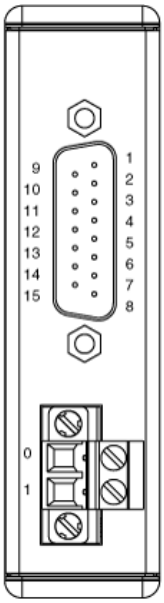
Pinouts/Front Panel Connections



NI-9411 Pin Assignments

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