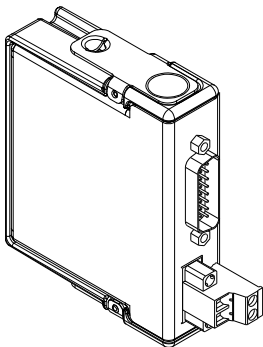


GETTING STARTED GUIDE

NI 9411

6 DI, ± 5 V to 24 V, Differential/Single-Ended,
500 ns



This document explains how to connect to the NI 9411.



Note Before you begin, complete the software and hardware installation procedures in your chassis documentation.



Note The guidelines in this document are specific to the NI 9411. The other components in the system might not meet the same safety ratings. Refer to the documentation for each component in the system to determine the safety and EMC ratings for the entire system.

Safety Guidelines

Operate the NI 9411 only as described in this document.



Caution Do not operate the NI 9411 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM or V_{sup} -to-COM	30 V maximum, Measurement Category I
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Isolation

Channel-to-channel	None
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Channel-to-earth ground

Continuous	30 V _{rms} , 42.4 V _{pk} , 60 VDC
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Withstand	400 V _{rms} , verified by a 5 s dielectric withstand test
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Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as *MAINS* voltage. *MAINS* is a hazardous live electrical supply system that powers equipment. 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.



Caution Do not connect the NI 9411 to signals or use for measurements within Measurement Categories II, III, or IV.



Note Measurement Categories CAT I and CAT O are equivalent. These test and measurement circuits are not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

Safety Guidelines for Hazardous Locations

The NI 9411 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nA IIC T4 and Ex nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the NI 9411 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.



Caution Do not disconnect I/O-side wires or connectors unless power has been switched off or the area is known to be nonhazardous.



Caution Do not remove modules unless power has been switched off or the area is known to be nonhazardous.



Caution Substitution of components may impair suitability for Class I, Division 2.




Caution For Division 2 and Zone 2 applications, install the system in an enclosure rated to at least IP54 as defined by IEC/EN 60079-15.



Caution For Zone 2 applications, install a protection device between the V_{sup} and COM terminals on the NI 9411. The device must prevent the input V_{sup}-to-COM voltage from exceeding 42 V if a transient overvoltage condition occurs.

Special Conditions for Hazardous Locations Use in Europe and Internationally

The NI 9411 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 03 ATEX 0324020X and is IECEx UL 14.0089X certified. Each NI 9411 is marked  II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of $-40\text{ }^{\circ}\text{C} \leq T_a \leq 70\text{ }^{\circ}\text{C}$. If you are using the NI 9411

in Gas Group IIC hazardous locations, you must use the device in an NI chassis that has been evaluated as Ex nC IIC T4, Ex IIC T4, Ex nA IIC T4, or Ex nL IIC T4 equipment.



Caution You must make sure that transient disturbances do not exceed 140% of the rated voltage.



Caution The system shall only be used in an area of not more than Pollution Degree 2, as defined in IEC 60664-1.



Caution The system shall be mounted in an ATEX/IECEX-certified enclosure with a minimum ingress protection rating of at least IP54 as defined in IEC/EN 60079-15.



Caution The enclosure must have a door or cover accessible only by the use of a tool.

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference

when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

Special Conditions for Marine Applications

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit [ni.com/certification](https://www.lloydregister.com/certification) and search for the LR certificate, or look for the Lloyd's Register mark on the product.



Caution In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained.

Preparing the Environment

Ensure that the environment in which you are using the NI 9411 meets the following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 70 °C
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Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
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Pollution Degree	2
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Maximum altitude	2,000 m
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Indoor use only.

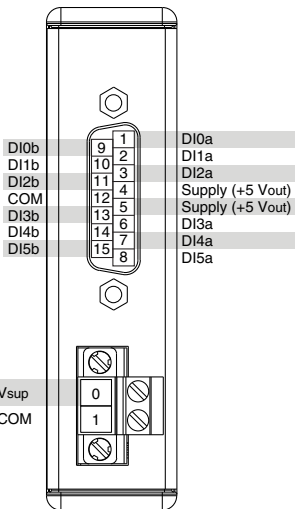


Note Refer to the device datasheet on ni.com/manuals for complete specifications.

Connecting the NI 9411

The NI 9411 provides connections for 6 digital input channels.

Figure 1. NI 9411 Pinout





Note You must use 2-wire ferrules to create a secure connection when connecting more than one wire to a single terminal on the NI 9411 screw-terminal connector.

NI 9411 Signals

Table 1. DSUB Connector Signal Descriptions

Signal	Description
COM	Common reference connection to isolated ground
D1a and D1b	Digital input signal connections
Supply (+5 Vout)	5 V power output connection for external devices

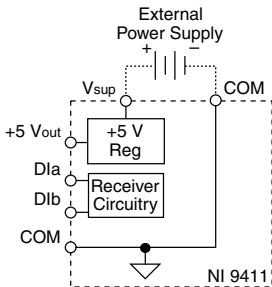
Table 2. Screw-Terminal Connector Signal Descriptions

Signal	Description
COM	Common reference connection to isolated ground
Vsup	Voltage supply connection

Connecting an External Power Supply to the NI 9411

You can connect an external power supply to the NI 9411. The external power supply provides power for external devices through the NI 9411 +5 V_{out} terminal. Connecting an external power supply to the NI 9411 is optional, depending on your application.

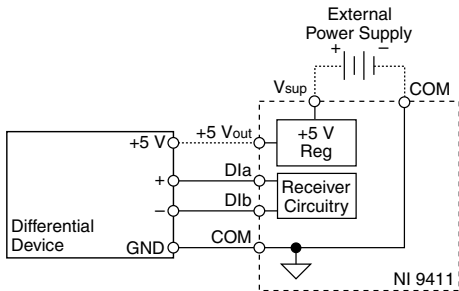
Figure 2. Connecting an External Power Supply



Connecting a Differential Device to the NI 9411

You can connect differential devices to the NI 9411.

Figure 3. Connecting a Differential Device to the NI 9411



The NI 9411 compares the difference between DIa and DIb to the digital logic levels to determine if the signal is in the high range or low range.

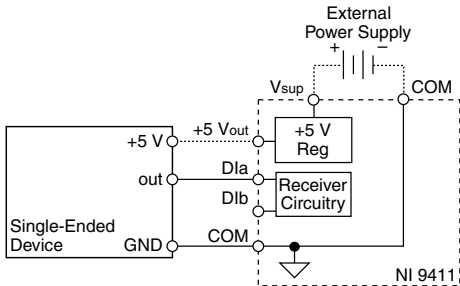


Tip Refer to the device datasheet at ni.com/manuals for the digital logic levels.

Connecting a Single-Ended Device to the NI 9411

You can connect single-ended (TTL) devices to the NI 9411.

Figure 4. Connecting a Single-Ended Device to the NI 9411



The NI 9411 compares the difference between DIa and COM to the digital logic levels to determine if the signal is in the high range or low range.



Tip Refer to the device datasheet at ni.com/manuals for the digital logic levels.

Connecting an Encoder to the NI 9411

An encoder has phase A, phase B, and index signals. Use the phase A signals to measure rotational speed. Use the phase B signals to measure direction. Use the index signals to measure the number of rotations. You can connect differential and single-ended encoders to the NI 9411.

Figure 5. Connecting a Differential Encoder to the NI 9411

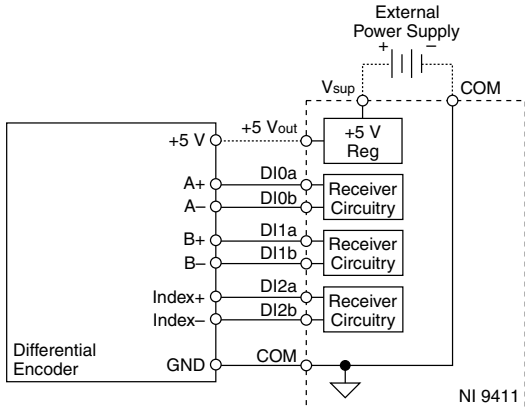
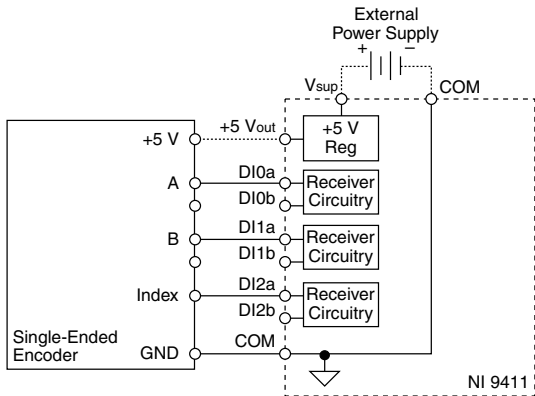


Figure 6. Connecting a Single-Ended Encoder to the NI 9411



I/O Protection

The NI 9411 provides I/O protection for each channel.



Note Refer to the device datasheet on ni.com/manuals for more information about I/O protection.

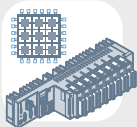
High-Vibration Application Connections

If your application is subject to high vibration, NI recommends that you follow these guidelines to protect connections to the NI 9411:

- Use ferrules to terminate wires to the detachable connector.
- Use the NI 9948 backshell kit.

Where to Go Next

CompactRIO



NI 9411 Datasheet



NI-RIO Help



LabVIEW FPGA Help

NI CompactDAQ



NI 9411 Datasheet



NI-DAQmx Help



LabVIEW Help

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Visit ni.com/register to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

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