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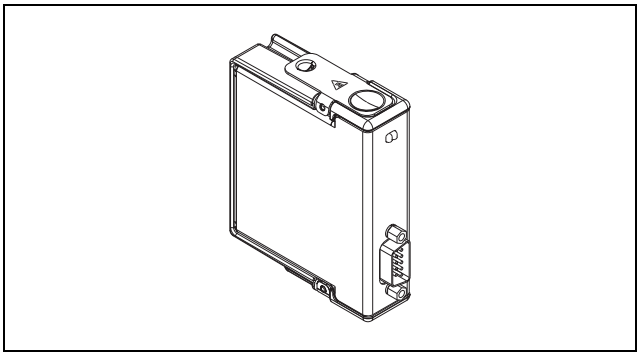
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Find the *National Instruments NI 9861* at our website: ***Click HERE***

OPERATING INSTRUCTIONS

NI 9861

1-Port, Low-Speed/Fault Tolerant CAN Module



NATIONAL INSTRUMENTS

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These operating instructions describe how to use the National Instruments (NI) 9861 module. For information about installing, configuring, and programming your system, refer to your system documentation. The NI 9861 module requires the latest NI-XNET software to be installed. The latest version of the NI-XNET software is at `ni.com/downloads`.

Note The safety guidelines and specifications in this document are specific to the NI 9861. The other components in your system may not meet the same safety ratings and specifications. Refer to the documentation for each component in your system to determine the safety ratings and specifications for the entire system.

Safety Guidelines

Caution Do *not* operate the NI 9861 in a manner not specified in the user manual or operating instructions. 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 National Instruments for repair.

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Hot Surface This icon denotes that the component may be hot. Touching this component may result in bodily injury.

Safety Guidelines for Hazardous Locations

The NI 9861 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 9861 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 Zone 2 applications, install the CompactRIO system in an enclosure rated to at least IP 54 as defined by IEC 60529 and EN 60529.

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Caution For Zone 2 applications, install a protection device between the CAN signals and the NI 9861 CAN pins. The device must prevent the CAN Port-to-COM voltage from exceeding 55 V if there is a transient overvoltage condition.

Special Conditions for Safe Use in Europe

This equipment has been evaluated as Ex nA IIC T4 equipment under DEMKO Certificate No. 07 ATEX 0626664X. Each module is marked ⟨Ex⟩ II 3G and is suitable for use in Zone 2 hazardous locations.

Wiring the NI 9861

The NI 9861 has one 9-pin male D-Sub connector that provides connections to a CAN bus. The NI 9861 has pins for CAN_H and CAN_L, to which you connect the CAN bus signals. Connect these signals using twisted-pair cable.

The port has two common pins (COM) that are internally connected to the module's isolated reference and serve as the reference ground for CAN_H and CAN_L. You can connect the CAN bus reference ground (sometimes referred to as CAN_V–) to one or both COM pins. The port also has an optional shield pin,

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SHLD, that you can connect to a shielded CAN cable. Connecting SHLD may improve signal integrity and EMC performance in a noisy environment.

Caution You must use a UL listed ITE power supply marked LPS with the NI 9861.

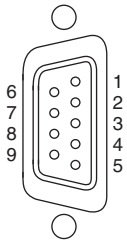
The NI 9861 requires an external power supply of +9 to +30 V to operate. Supply power to the NI 9861 V_{SUP} pin from the CAN bus.

Note Power on V_{SUP} is required for CAN operation.

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The NI 9861 pinout is listed in Table 1.

Table 1. Pin Assignments for the NI 9861

Connector	Pin	Signal
	1	No Connection (NC)
	2	CAN_L
	3	COM
	4	NC
	5	SHLD
	6	COM
	7	CAN_H
	8	NC
	9	V_{SUP}

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CAN Bus Topology and Termination

A CAN bus consists of two or more CAN nodes cabled together. The CAN_H and CAN_L pins of each node are connected to the main CAN bus cable through a short connection known as a "stub." The pair of signal wires, CAN_H and CAN_L, constitutes a transmission line. Every device on a low-speed/fault tolerant CAN network requires a termination resistor for each CAN data line: R_{RTH} for CAN_H and R_{RTL} for CAN_L.

Figure 1 shows a simplified diagram of a CAN bus with multiple CAN nodes and proper termination resistor (R_t) locations.

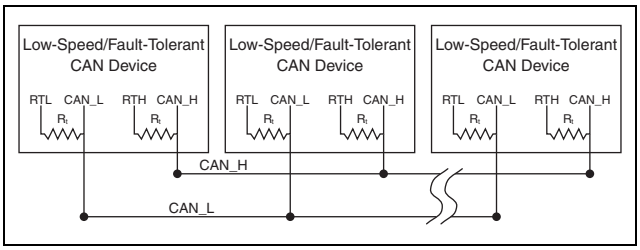


Figure 1. CAN Bus Topology and Termination Resistor Locations

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Connecting a CAN Bus to the NI 9861

You can connect the NI 9861 to any location on a CAN bus. Figure 2 shows one example of connecting the NI 9861 directly to one CAN node.

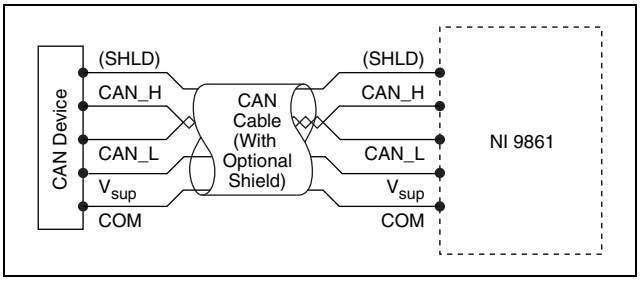


Figure 2. Connecting the NI 9861 to a CAN Device

Cabling Requirements for the NI 9861

This section deals with cabling specifications, termination resistors, cable lengths, and the number of CAN nodes that can exist in a system.

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Cable Specifications

Cables should meet the physical medium requirements specified in ISO 11898, shown in Table 2. Belden cable (3084A) meets all these requirements and should be suitable for most applications.

Table 2. Specifications for Characteristics of a CAN_H and CAN_L Pair of Wires

Characteristic	Value
Length-related resistance	90 mΩ/m nominal
Length-related capacitance: CAN_L and ground, CAN_H and ground, CAN_L and CAN_H	30 pF/m nominal

Termination Resistors

Unlike High-Speed CAN, Low-Speed/Fault Tolerant CAN requires termination at the Low-Speed/Fault Tolerant CAN transceiver instead of on the cable itself. Termination requires two resistors, RTH for CAN_H and RTL for CAN_L. This configuration allows the NXP Fault-Tolerant CAN transceiver to detect and recover from bus faults. It is important to determine the existing network's overall termination, or the individual device's termination, before connecting it to a Low-Speed/Fault Tolerant

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port. NXP recommends an overall RTH and RTL termination of 100 to 500 Ω (each) for a properly terminated low-speed network.

Termination on the low-speed/fault-tolerant port of the NI 9861 is set through the NI-XNET software to either 1 kΩ or 5 kΩ.

Cable Lengths

ISO 11898-3 (Low-Speed/Fault Tolerant) defines data rates up to 125 kbits/s with the maximum bus length depending on the data rate used and the busload. To provide a maximum communication speed of 125 kbits/s, the overall network length should not exceed 40 m. However, you can increase the overall network length by reducing the actual communication speed. Detailed cable length recommendations are in the ISO 11898-3 specifications.

Number of CAN Nodes

The maximum number of nodes depends on the electrical characteristics of the nodes on the network. If all of the nodes meet the requirements of Low-Speed/Fault-Tolerant CAN, up to 32 nodes may be connected to the bus.

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NI 9861 Hardware Overview

The NI 9861 has one full-featured CAN port that is isolated from the other modules in the system. The port has a Bosch DCAN CAN controller that is CAN 2.0B-compatible and fully supports both 11-bit and 29-bit identifiers. The port also has an NXP TJA1054AT Low-Speed/Fault Tolerant CAN transceiver that is fully compatible with the ISO 11898 standard and supports baud rates up to 125 kbits/s.

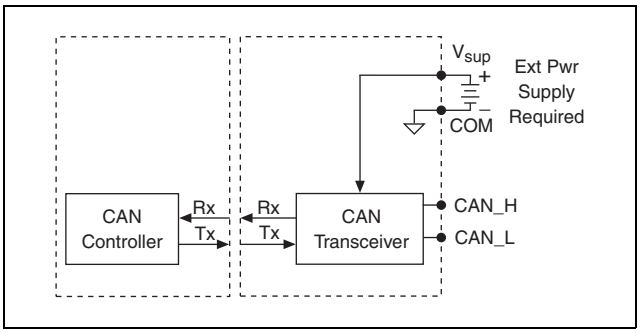


Figure 3. NI 9861 Hardware Overview

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Specifications

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

Low-Speed/Fault Tolerant CAN Characteristics

Transceiver..... NXP TJA1054AT

Max baud rate ..... 125 kbits/s

CAN_H, CAN_L bus lines voltage.... –27 to +40 VDC

Supply voltage range (V_{SUP})

CAN ..... +9 to +30 VDC

MTBF ..... Contact NI for Bellcore MTBF or MIL-HDBK-217F specifications.

Power Requirements

Power consumption from chassis ..... 1 W max (active mode)

Thermal dissipation (at 70 °C)..... 1.25 W max (active mode)

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Physical Characteristics

Caution If you need to clean your NI 9861, wipe it with a dry towel. The product must be completely dry and free from contaminants before you return it to service.

Weight..... Approx. 144 g (5.0 oz)

Safety

Maximum Voltage[1]

Connect only voltages that are within these limits.

Port-to-COM..... –27 to +40 VDC 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* 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

[1] The maximum voltage that can be applied or output between any port or V_{SUP} terminal and a COM terminal without creating a safety hazard.

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equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

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

Isolation Voltages

Port-to-earth ground

Withstand	1000 V_{rms}, verified by a 5 s dielectric withstand test
Continuous	60 VDC, Measurement Category I

Safety Standards

This product meets 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

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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 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 (DEMKO)	Ex nA IIC T4

Environmental

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

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Operating humidity ..... 10 to 90% RH, noncondensing

Storage humidity ..... 5 to 95% RH, noncondensing

Pollution Degree (IEC 60664) 2

Maximum altitude ..... 2,000 m

Indoor use only.

Shock and Vibration

To meet these specifications, you must panel mount the CompactRIO system.

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

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Electromagnetic Compatibility

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

- EN 61326 (IEC 61326): Class A emissions; Basic 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 For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.



Note For EMC compliance, operate this product according to the documentation.

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CE Compliance CE

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

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

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.

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.

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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 the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit ni.com/environment/weee.

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Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At `ni.com/support` you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at `ni.com/support` and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

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