NI-9853 Getting Started

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NI-9853 Software Requirements

The NI-9853 module requires the latest CompactRIO and NI-RIO software to be installed.

The latest version of the CompactRIO and NI-RIO software is available at **ni.com/downloads**.

NI-9853 Block Diagram

The NI-9853 has two full-featured, independent CAN ports that are isolated from each other, and from the other modules in the system. Each port or the NI-9853 has a Philips SJA1000 controller that is CAN 2.0B-compatible and fully supports both 11-bit and 29-bit identifiers. The port also has a Philips TJA 1041 High-Speed CAN transceiver that is fully compatible with the ISO 11898 standard and supports baud rates up to 1 Mbps.

Figure 1. NI-9853 Block Diagram
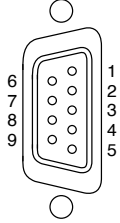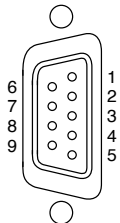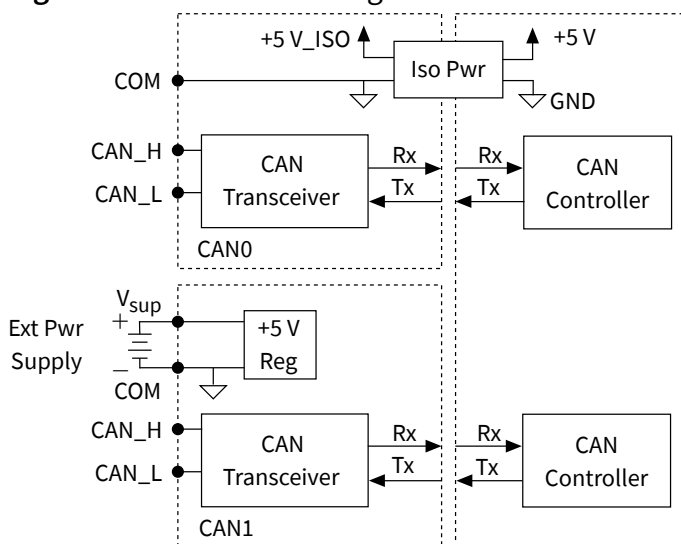
NI-9853 Pinout

Table 1. Pin Assignments for CAN0

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

Table 2. Pin Assignments for CAN1

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}

Wiring the NI-9853

The NI-9853 has two 9-pin male D-Sub connectors that provide connections to a CAN bus. Each port on the NI-9853 has pins for CAN_H and CAN_L, to which you connect

the CAN bus signals. Connect these signals using twisted-pair cable.

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

CAN0 of the NI-9853 is internally powered, and therefore requires no external power supply. CAN1 requires an external power supply of +8 V to +25 V to operate. Supply power to the V sup pin of CAN1 from the CAN bus.

> **Note** Although CAN0 of the NI-9853 does not require an external power supply to operate, it can be connected to a powered CAN bus without being damaged.

Cable Requirements for EMC Compliance

> **Notice** To ensure the specified EMC performance for the NI-9853, you must install a clamp-on ferrite bead for each cable as denoted in the ferrite installation instructions. Ferrite beads are included in the NI-9853 kit and available on ni.com (NI part number 781233-02).

Select and install cables for the NI-9853 in accordance with the following requirements:

- Install a clamp-on ferrite bead on the cable for each channel that you are connecting to on the NI-9853.
- The clamp-on ferrite must be connected to the cable as close to the module as possible as shown in the following figure. Placing the ferrite elsewhere on the cable noticeably impairs its effectiveness.

Figure 2. Installing a Ferrite
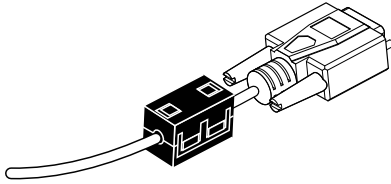

CAN Bus Topology and Termination

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. If the transmission line is not terminated, each signal change on the bus causes reflections that may cause communication errors. Because the CAN bus is bidirectional, both ends of the cable must be terminated. However, this requirement does not mean that every node on the bus should have a termination resistor; only the two nodes at the far end of the cable should have termination resistors.

The following figure shows a simplified diagram of a CAN bus with multiple CAN nodes and proper termination resistor (R_t) locations.

Figure 3. CAN Bus Topology and Termination Resistor Locations
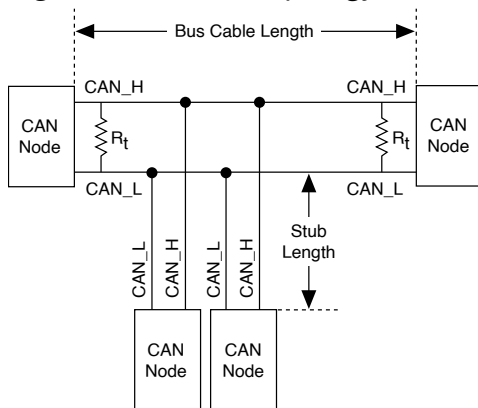
Connecting a CAN Bus to the NI-9853

You can connect each port of the NI-9853 to any location on a CAN bus. Figure 2 shows one example of connecting CAN0 of the NI-9853 directly to one CAN node, and CAN1 directly to another CAN node. CAN1 requires an external power supply on the CAN bus.

Figure 4. Connecting Both Ports of the NI-9853 to CAN Buses
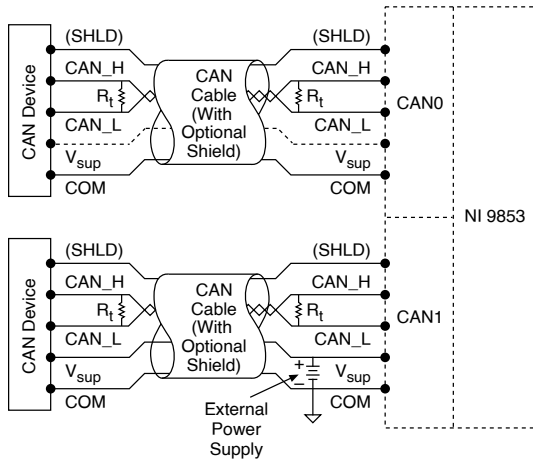
Cable Specifications

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

Table 3. ISO 11898 Specifications for Characteristics of a CAN_H and CAN_L Pair of Wires

Characteristic	Value
Impedance	95 Ω minimum
	120 Ω nominal
	140 Ω maximum
Length-related resistance	70 mΩ/m nominal
Specific line delay	5 ns/m nominal

Termination Resistor Requirements

The termination resistors (R_t) should match the nominal impedance of the CAN cable and therefore comply with the values in the following table.

Table 4. Termination Resistor Requirements

Characteristic	Value	Condition
Termination resistor, R_t	100 Ω minimum	Minimum power dissipation: 220 mW

Characteristic	Value	Condition
	120 Ω nominal 130 Ω maximum	

Cable Lengths

The cabling characteristics and desired bit transmission rates affect the allowable cable length. You can find detailed cable length recommendations in the ISO 11898, CiA DS 102, and DeviceNet specifications.

ISO 11898 specifies 40 m total cable length with a maximum stub length of 0.3 m for a bit rate of 1 Mb/s. The ISO 11898 specification says that significantly longer cable lengths may be allowed at lower bit rates, but you should analyze each node for signal integrity problems.

Number of CAN Nodes

The maximum number of nodes depends on the electrical characteristics of the nodes on the network. If all nodes meet the ISO 11898 requirements, you can connect up to at least 30 nodes to the bus. You can connect higher numbers of nodes if the nodes' electrical characteristics do not degrade signal quality below ISO 11898 signal level specifications.

The NI-9853 electrical characteristics allow up to at least 110 CAN ports on a network.

Conformal Coating

The NI-9853 is available with conformal coating for additional protection in corrosive and condensing environments, including environments with molds and dust.

In addition to the environmental specifications listed in the ***NI-9853 Safety, Environmental, and Regulatory Information***, the NI-9853 with conformal coating meets the following specification for the device temperature range. To meet this specification, you must follow the appropriate setup requirements for condensing environments. Refer to ***Conformal Coating and NI RIO Products*** for more

information about conformal coating and the setup requirements for condensing environments.

Operating humidity (IEC 60068-2-30 Test Db)	80 to 100% RH, condensing

Related information:

- Conformal Coating and NI RIO Products