NI-9213 Getting Started

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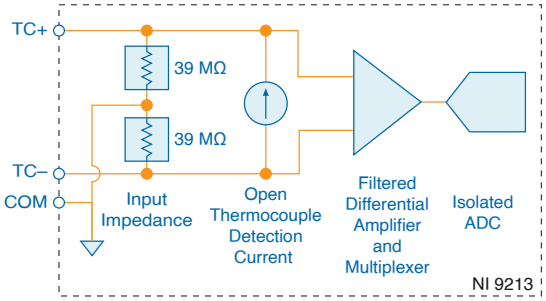
Connector Types

The NI-9213 is available in two types: push-in spring terminal and spring terminal. The push-in type spring terminal connector is black and orange. The spring terminal connector is black. NI-9213 refers to both types unless the two types are specified. Differences between the two types of spring terminal connectors are noted by the connector color.

NI-9213 Block Diagram

Each channel passes through a differential filter and then is multiplexed and sampled by a 24-bit analog-to-digital converter (ADC). The channels share a common ground, COM, that is isolated from other modules in the system.

Figure 1. Input Circuitry for One Channel of the NI-9213



NI-9213 (Black Connector) Pinout

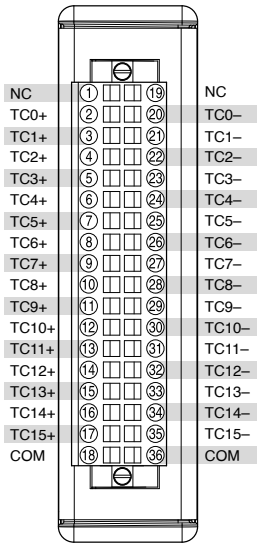


Table 1. Signal Descriptions

Signal	Description
COM	Common reference connection
NC	No connection
TC+	Positive thermocouple connection
TC-	Negative thermocouple connection

NI-9213 (Black/Orange Connector) Pinout

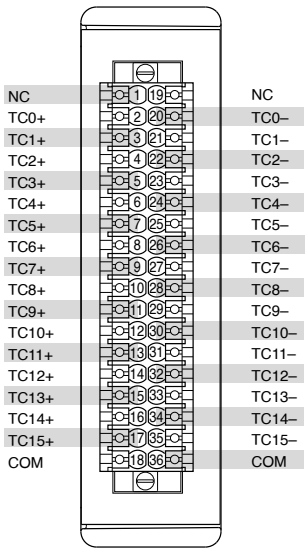


Table 2. Signal Descriptions

Signal	Description
COM	Common reference connection
NC	No connection
TC+	Positive thermocouple connection
TC-	Negative thermocouple connection

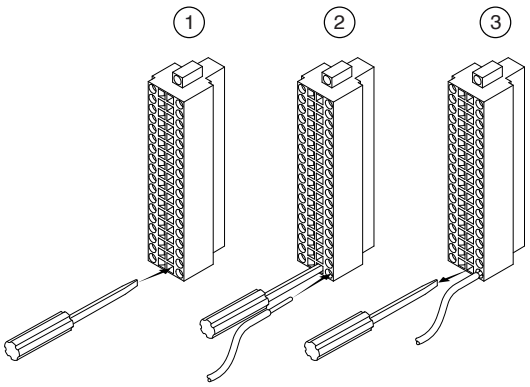
Connecting Wires to the NI-9213 (Black Connector)

What to Use

- NI-9213 spring-terminal connector
- 0.08 mm to 1.0 mm (28 AWG to 18 AWG) copper conductor wire with 7 mm (0.28 in) of insulation stripped from the end
- Flathead screwdriver with a 2.3 mm x 1.0 mm (0.09 in. x 0.04 in.) blade, included with the NI-9213

What to Do

Complete the following steps to connect wires to the spring-terminal connector.



1. Insert the screwdriver into a spring clamp activation slot to open the corresponding connector terminal.
2. Press a wire into the open connector terminal.
3. Remove the screwdriver from the activation slot to clamp the wire into place.

Connecting Wires to the NI-9213 with Push-in Style Spring Terminal (Black/Orange Connector)

What to Use

- NI-9213 (black/orange connector)
- 0.14 mm to 1.5 mm (26 AWG to 16 AWG) copper conductor wire with 10 mm (0.394 in.) of insulation stripped from the end
- Ferules (optional)

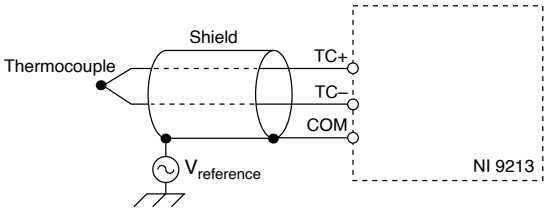
What to Do

Refer to the following table for how to insert a wire into a terminal depending on what type of wire you are using or if you are using a ferrule.

Option	Description
When using a solid wire or stranded wire with a ferrule	Push the wire into the terminal when using a solid wire or stranded wire with a ferrule
When using a stranded wire without a ferrule	Press the push button and then push the wire into the terminal

Note You must use 2-wire ferrules to create a secure connection when connecting more than one wire to a single terminal.

Connecting a Thermocouple



Connect the shield to a common-mode voltage reference on the thermocouple. A valid common-mode voltage reference is a voltage that is within ±1.2 V of the common-mode voltage of all the connected thermocouples

High-Vibration Application Connections

If your application is subject to high vibration, NI recommends that you use the NI-9940 backshell kit to protect connections to the NI-9213.

Common-Mode Voltage

The NI-9213 common-mode range is the maximum voltage between any channel and COM. If COM is not connected, then the common-mode voltage range is the maximum voltage between any two channels. The NI-9213 measures the common-mode voltage level of each channel and returns a warning in the software if the signal is outside the common-mode voltage range.

Open Thermocouple Detection

Each channel has an open thermocouple detection (OTD) circuit, which consists of a current source between the TC+ and TC- terminals. If an open thermocouple is connected to the channel, the current source forces a full-scale voltage across the terminals.

Input Impedance

Each channel has a resistor that produces an input impedance between the TC and COM terminals. The gain and offset errors resulting from the source impedance of

connected thermocouples are negligible for most applications. Thermocouples with a higher lead resistance can introduce more significant errors.

Minimizing Thermal Gradients

Changes in the ambient air temperature near the front connector or a thermocouple wire conducting heat directly to terminal junctions can cause thermal gradients. Observe the following guidelines to minimize thermal gradients and improve the system accuracy.

- Use small-gauge thermocouple wire. Smaller wire transfers less heat to or from the terminal junction.
- Avoid running thermocouple wires near hot or cold objects.
- Minimize adjacent heat sources and air flow across the terminals.
- Keep the ambient temperature as stable as possible.
- Make sure the NI-9213 terminals are facing forward or upward.
- Keep the NI-9213 in a stable and consistent orientation.
- Allow the thermal gradients to settle after a change in system power or in ambient temperature. A change in system power can happen when the system powers on, the system comes out of sleep mode, or you insert/remove modules.
- Run thermocouple wiring together near the spring-terminal connector to keep the wires at the same temperature.
- If you connect any extension wires to thermocouple wires, use wires made of the same conductive material as the thermocouple wires.
- Use the NI-9440 backshell kit.

Thermocouple Measurement Accuracy

Thermocouple measurement errors depend partly on the following factors.

- Type of thermocouple
- Accuracy of the thermocouple

- Temperature that you are measuring
- Resistance of the thermocouple wires
- Cold-junction temperature

Note Use the autozero channel to compensate for offset errors.

Cold-Junction Accuracy

Heat dissipated by adjacent C Series modules or nearby heat sources can cause errors in thermocouple measurements by heating the NI-9213 terminals to a different temperature than the cold-junction compensation sensor. Thermal gradient across the terminals can cause the terminals of different NI-9213 channels to be at different temperatures, which creates accuracy errors and affects the relative accuracy between channels.

The temperature measurement accuracy specifications include errors caused by the thermal gradient across the NI-9213 terminals for configurations with the NI-9213 terminals facing forward or upward.

Autozero Channel

The NI-9213 has an internal autozero channel, which can be subtracted from each thermocouple reading to compensate for offset errors. Use of the autozero channel is optional, however the NI-9213 specifications assume that autozero is applied to every sample. Refer to the documentation for the software that you are using with the NI-9213 for information about using the autozero channel.

Timing Modes

The NI-9213 supports high-resolution and high-speed timing modes. High-resolution timing mode optimizes accuracy and noise and rejects power line frequencies. High-speed timing mode optimizes sample rate and signal bandwidth.