NI-9211 Getting Started

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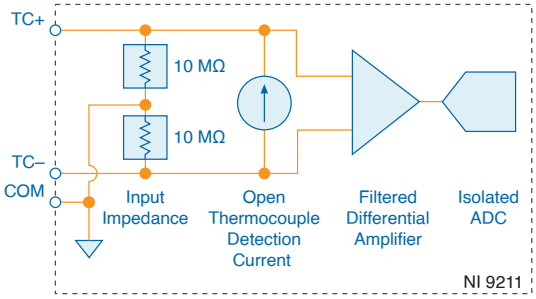
NI-9211 Block Diagram

The NI-9211 channels share a common ground isolated from other modules in the system. Each channel passes through a filter, and then a 24-bit analog-to-digital converter (ADC) samples the channel.

Figure 1. Block Diagram for One Channel of the NI-9211



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.

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

Related tasks:

- Guidelines for Minimizing Thermal Gradients

Cold-Junction Accuracy

Heat dissipated by adjacent C Series modules or nearby heat sources can cause errors in thermocouple measurements by heating the NI-9211 terminals to a different temperature than the cold-junction compensation sensor. Thermal gradient across the terminals can cause the terminals of different NI-9211 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-9211 terminals for configurations with the NI-9211 terminals facing forward or upward.

Autozero Channel

The NI-9211 has an internal autozero channel, which can be subtracted from each thermocouple reading to compensate for offset errors. Use the autozero channel if the ambient temperature is less than 15 °C or more than 35 °C. Refer to the documentation for the software that you are using for information about using the NI-9211 autozero channel.

NI-9211 Pinout

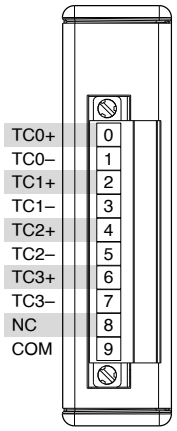


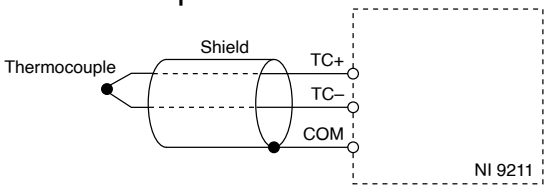
Table 1. Signal Descriptions

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

Making NI-9211 Thermocouple Connections

You can connect a shielded thermocouple to the NI-9211.

Connect the COM terminal to a common-mode voltage reference on the thermocouple.



A valid common-mode voltage reference is a voltage that is within ±1.5 V of the common-mode voltage of the thermocouple.

Guidelines for 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.
- Run thermocouple wiring together near the screw-terminal connector to keep the wires at the same temperature.
- 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-9211 terminals are facing forward or upward.
- Keep the NI-9211 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.
- If you connect any extension wires to thermocouple wires, use wires made of the same conductive material as the thermocouple wires.
- Use the cRIO-9932 backshell kit.

Related concepts:

- Thermocouple Measurement Accuracy

High-Vibration Application Connections

If your application is subject to high vibration, NI recommends that you use the cRIO-9932 backshell kit to protect connections to the NI-9211.