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cDAQ-9178

CALIBRATION PROCEDURE

NI 9208

16-channel, ± 20 mA, 24-Bit Analog Input Module

Français Deutsch 日本語 한국어 简体中文
ni.com/manuals

This document contains the verification and adjustment procedures for the National Instruments 9208. For more information on calibration, visit ni.com/calibration.

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Software

Calibrating the NI 9208 requires the installation of NI-DAQmx 9.1 or later on the calibration system. You can download NI-DAQmx from ni.com/downloads. NI-DAQmx supports LabVIEW, LabWindows™/CVI™, C/C++, C#, and Visual Basic .NET. When you install NI-DAQmx you only need to install support for the application software that you intend to use.

Documentation

Consult the following documents for information about the NI 9208, NI-DAQmx, and your application software. All documents are available on ni.com and help files install with the software.



NI cDAQ-9174/9178 USB Chassis Quick Start

NI-DAQmx installation and hardware setup



NI 9208 Operating Instructions and Specifications

NI 9208 specific information, specifications, and calibration interval



NI-DAQmx Readme

Operating system and application software support in NI-DAQmx



LabVIEW Help

LabVIEW programming concepts and reference information about NI-DAQmx VIs and functions



NI-DAQmx C Reference Help

Reference information for NI-DAQmx C functions and NI-DAQmx C properties



NI-DAQmx .NET Help Support for Visual Studio

Reference information for NI-DAQmx .NET methods and NI-DAQmx .NET properties, key concepts, and a C enum to .NET enum mapping table

Test Equipment

Table 1 lists the equipment recommended for the performance verification and adjustment procedures. If the recommended equipment is not available, select a substitute using the requirements listed in Table 1.

Table 1. Recommended Equipment

Equipment	Recommended Model	Minimum Requirements
Source	Fluke 5700A	Use a high-precision current source with an accuracy ≤ 100 ppm.
cDAQ Chassis	NI cDAQ-9178	—
Connection Accessory	NI 9923	—

Test Conditions

The following setup and environmental conditions are required to ensure the NI 9208 meets published specifications.

- Keep connections to the device as short as possible. Long cables and wires act as antennas, picking up extra noise that can affect measurements.
- Verify that all connections to the device are secure.
- Use shielded copper wire for all cable connections to the device. Use twisted-pairs wire to eliminate noise and thermal offsets.
- Maintain an ambient temperature of 23 ± 5 °C. The device temperature will be greater than the ambient temperature.
- Keep relative humidity below 80%.
- Allow a warm-up time of at least 10 minutes to ensure that the NI 9208 measurement circuitry is at a stable operating temperature.

Initial Setup

Complete the following steps to set up the NI 9208.

1. Install the NI-DAQmx driver software.
2. Make sure the NI cDAQ-9178 power source is not connected.
3. Install the NI 9208 in slot 8 of the NI cDAQ-9178 chassis. Leave slots 1 through 7 of the NI cDAQ-9178 chassis empty.
4. Connect the NI cDAQ-9178 chassis to your host computer.
5. Connect the power source to the NI cDAQ-9178 chassis.
6. Launch Measurement & Automation Explorer (MAX).
7. Right-click the device name and select **Self-Test** to ensure that the device is working properly.

Verification

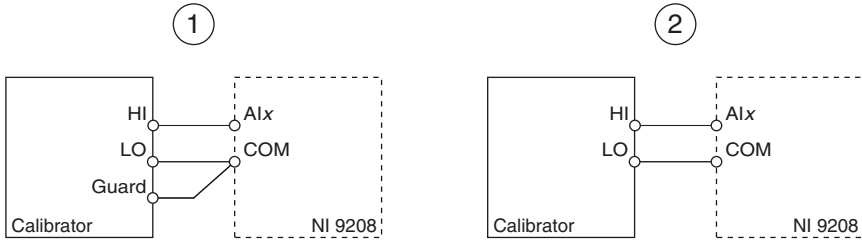
The following performance verification procedure describes the sequence of operation and provides test points required to verify the NI 9208. The verification procedure assumes that adequate traceable uncertainties are available for the calibration references.

Accuracy Verification

Complete the following procedure to determine the As-Found status of the NI 9208.

1. Set the calibrator to Standby mode (STBY).
2. Connect the NI 9208 to the calibrator as shown in Figure 1.

Figure 1. NI 9208 Pin Assignments



- 1 Connections when using a calibrator with a guard connection.
- 2 Connections when using a calibrator with no guard connection.



Note If the calibrator outputs are truly floating, connect the negative output to a quiet earth ground as well as COM to give the entire system a ground reference.

3. Set the calibrator current to a Test Point value indicated in Table 4.
4. Set the calibrator to Operate mode (OPR).
5. Acquire and average samples.
 - a. Create an AI current task on the NI 9208 according to Table 2.

Table 2. NI 9208 Configuration for Current Accuracy Verification

Input Range		Scaled Units	Terminal Configuration
Min	Max		
-0.02	0.02	Amps	RSE

- b. Configure the AI current task timing according to Table 3. Set the ADC timing mode to high-resolution.

Table 3. NI 9208 Current Timing Configuration

ADC Timing Mode	Sample Mode	Samples to Read
High-Resolution	N Samples	5
High-Speed	N Samples	75

- c. Start the task.
 - d. Average the readings.
 - e. Clear the task.
6. Compare the average to the limits in Table 4.

Table 4. NI 9208 Test Limits for Current Accuracy Verification

Range (A)		Test Point		1-Year Limits	
Minimum	Maximum	Location	Value (A)	Lower Limit (A)	Upper Limit (A)
-0.022000	0.022000	Positive FS	0.021000	0.020968	0.021032
-0.022000	0.022000	Mid	0.000000	-0.000004	0.000004
-0.022000	0.022000	Negative FS	-0.021000	-0.021032	-0.020968

7. Set the calibrator to Standby mode (STBY).
8. Repeat steps 5 through 7 with the ADC timing mode on the NI 9208 set to high-speed.
9. Repeat steps 3 through 8 for each test point in Table 4.
10. Disconnect the calibrator from the device.
11. Repeat steps 2 through 10 for each channel on the NI 9208.

Adjustment

The following performance adjustment procedure describes the sequence of operation required to adjust the NI 9208.

Current Accuracy Adjustment

Complete the following steps to adjust the current accuracy of the NI 9208.

1. Set the calibrator to Standby mode (STBY).
2. Connect the NI 9208 to the calibrator as shown in Figure 1.
3. Adjust the NI 9208 current accuracy.
 - a. Initialize a calibration session on the NI 9208. The default password is NI.
 - b. Input the external temperature in degrees Celsius.

- c. Call the NI 9208 get C Series adjustment points function to obtain an array of recommended calibration currents for the NI 9208.
- d. Set the calibrator to a reference value determined by the array of recommended calibration currents.
- e. Set the calibrator to Operate mode (OPR).
- f. Call and configure the NI 9208 gain instance of the adjustment function according to Table 5.

Table 5. Gain Adjustment Configuration

Physical Channel	Reference Value
cDAQMod8/aix	The reference value from the array of adjustment points

- g. Set the calibrator to Standby mode (STBY).
 - h. Repeat steps d through g for each calibration current in the array.
 - i. Disconnect the calibrator from the NI 9208.
 - j. Call and configure the NI 9208 offset instance of the adjustment function for the current channel.
 - k. Close the calibration session.
4. Repeat steps 1 through 3 for each channel on the NI 9208.

EEPROM Update

When an adjustment procedure is completed, the NI 9208 internal calibration memory (EEPROM) is immediately updated.

If you do not want to perform an adjustment, you can update the calibration date and onboard calibration temperature without making any adjustments by initializing an external calibration, setting the C Series calibration temperature, and closing the external calibration.

Reverification

Repeat the *Verification* section to determine the As-Left status of the device.



Note If any test fails Reverification after performing an adjustment, verify that you have met the *Test Conditions* before returning your device to NI. Refer to *Worldwide Support and Services* for assistance in returning the device to NI.

Accuracy Under Calibration Conditions

The following accuracy table is valid for calibration under the following conditions:

- Ambient temperature of 23 ± 5 °C
- NI 9208 installed in slot 8 of an NI cDAQ-9178 chassis
- Slots 1 through 7 of the NI cDAQ-9178 chassis are empty



Note The test limits listed in Table 4 are derived using the values in Table 6.

Table 6. NI 9208 Accuracy Under Calibration Conditions

Percentage of Reading	Percentage of Range*
0.132%	0.010%
* Range equals 22 mA.	



Note For operational specifications, refer to the most recent *NI 9208 Operating Instructions and Specifications* online at ni.com/manuals.

Worldwide Support and Services

The National Instruments website 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.

Visit ni.com/services for NI Factory Installation Services, repairs, extended warranty, and other services.

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

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