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NI-9260

CALIBRATION PROCEDURE

NI 9260

2-Channel, 3 Vrms, 24-Bit Analog Output Module

This document contains the verification and adjustment procedures for the NI 9260. For more information on calibration solutions, visit *ni.com/calibration*.

Contents

Software

Calibrating the NI 9260 requires the installation of NI-DAQmx 15.1 or later on the calibration system.

You can download NI-DAQmx from *ni.com/downloads*. NI-DAQmx supports LabVIEW, LabWindows™/CVI™, ANSI C, and .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 9260, 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 9260 Getting Started Guide

NI 9260 connection information

NI 9260 Datasheet

NI 9260 circuitry and specifications

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

NI recommends that you use equipment in the following table for calibrating the NI 9260. If the recommended equipment is not available, select a substitute from the requirements column.

Equipment	Recommended Model	Requirements
DMM	NI 4070 DMM	Use a multiranging 6 1/2 digit DMM with voltage measurement accuracy of ±40 ppm.
Chassis	NI cDAQ-9178	—

Test Conditions

The following setup and environmental conditions are required to ensure the NI 9260 meets calibration specifications.

- Keep connections to the NI 9260 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 NI 9260 are secure.
- Use shielded copper wire for all cable connections to the NI 9260. Use twisted-pairs wire to eliminate noise and thermal offsets.
- Maintain an ambient temperature of 23 °C ± 5 °C. The NI 9260 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 9260 measurement circuitry is at a stable operating temperature.

Initial Setup

Complete the following steps to set up the NI 9260.

1. Install NI-DAQmx.
2. Make sure that the NI cDAQ-9178 power source is not connected to the chassis.
3. Connect the NI cDAQ-9178 chassis to the system safety ground.
   a) Attach a ring lug to a 14 AWG (1.6 mm) wire.
   b) Connect the ring lug to the ground terminal on the side of the NI cDAQ-9178 using the ground screw.
   c) Attach the other end of the wire to the system safety ground.
4. Install the module in slot 8 of the NI cDAQ-9178 chassis. Leave slots 1 through 7 of the NI cDAQ-9178 chassis empty.
5. Connect the NI cDAQ-9178 chassis to your host computer.
6. Connect the power source to the NI cDAQ-9178 chassis.
7. Launch Measurement & Automation Explorer (MAX).
8. Right-click the device name and select **Self-Test** to ensure that the module is working properly.
9. Ensure that the ambient temperature of your test environment is 23 °C ± 5 °C.

Accuracy Verification

The following performance verification procedure describes the sequence of operation and provides test points required to verify the NI 9260. The verification procedure assumes that adequate traceable uncertainties are available for the calibration references.

Complete the following procedure to determine the As-Found status of the NI 9260.

1. Set the DMM to Standby mode (STBY).
2. Connect the DMM to the NI 9260 as shown in the following figure.

Figure 1. Accuracy Verification Connections
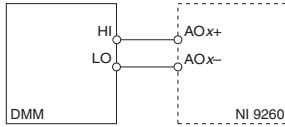
3. Set the DMM to read DC voltage in the minimum range required to cover the NI 9260 output range of 3 Vrms (±4.24 Vpk).
4. Acquire a sample.
   a) Create and configure an AO voltage channel according to the following table.

Table 1. NI 9260 AO Voltage Channel Configuration

Variant	Min	Max	Scaled Units	Terminal Configuration
NI 9260 with BNC	-4.24	4.24	Volts	Pseudo-differential
NI 9260 with mini XLR	-4.24	4.24	Volts	Differential

   b) Configure the AO Voltage task timing according to Table 2.

Table 2. AO Timing Configuration

Variant	Sample Mode	Samples Per Channel	Rate
NI 9260 with BNC	Continuous Mode	512	51.2 kHz
NI 9260 with mini XLR	Continuous Mode	512	51.2 kHz

   c) Create an array of 512 points and fill every value with a test point indicated in Table 3.
   d) Write the array to the AO using the DAQmx Write VI.
   e) Start the task.
   f) Read the NI 9260 output voltage measurement from the DMM.
   g) Stop and clear the task.
5. Compare the DMM measurement to the test limits in Table 3.
6. Repeat steps 3 through 5 for each test point in Table 3.
7. Disconnect the DMM from the NI 9260.
8. Repeat steps 1 through 7 for each channel on the NI 9260.

Table 3. NI 9260 Test Limits

Range (V)		Test Point		1-Year Limits	
Minimum	**Maximum**	**Location**	**Value (V)**	**Lower Limit (V)**	**Upper Limit (V)**
-4.24	4.24	Max	4	3.99503	4.00497
-4.24	4.24	Mid	0	-0.002249	0.002249
-4.24	4.24	Min	-4	-4.00497	-3.99503

Accuracy Adjustment

The following performance adjustment procedure describes the sequence of operation required to adjust the NI 9260.

Complete the following procedure to adjust the accuracy performance of the NI 9260.

1. Set the DMM to Standy Mode.
2. Connect the DMM to the NI 9260 as shown in Figure 1.
3. Adjust the NI 9260.
   a) Initialize a calibration session on the NI 9260. The default password is `NI`.
   b) Input the external temperature in degrees Celsius using the DAQmx Set Temperature C Series Calibration function.
   c) Call the DAQmx Get NI 9260 C Series Adjustment Points (VI) function to obtain an array of recommended calibration voltages for the NI 9260.
   d) Set the DMM to read DC voltage in the minimum range required to cover the NI 9260 output range of 3 Vrms (±4.24 Vpk).
   e) Call and configure the NI 9260 setup calibration function according to the following table.

Physical Channel	DAC Values
cDAQMod8/ao$x$	The recommended NI 9260 adjustment points

   f) Read the NI 9260 output voltage measurement from the DMM.
   g) Call and configure the NI 9260 adjustment function according to the following table.

Physical Channel	Reference Value
cDAQMod8/ao$x$	The NI 9260 output voltage measured from the DMM.

   h) Repeat steps e through h for each calibration voltage in the array.
   i) Close and commit the calibration session.
4. Disconnect the DMM from the NI 9260.
5. Repeat steps 1 through 4 for each channel on the NI 9260.

EEPROM Update

When an adjustment procedure is completed, the NI 9260 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 *Accuracy 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 values in the following table are based on calibrated scaling coefficients, which are stored in the onboard EEPROM.

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

- Ambient temperature 23 °C ± 5 °C
- NI 9260 installed in slot 8 of an NI cDAQ-9178 chassis
- Slots 1 through 7 of the NI cDAQ-9178 chassis are empty

Table 4. NI 9260 Accuracy

Device	Percent of Reading (Gain Error)	Percent of Range[1]
NI 9260	±0.068%	±0.053%

> **Note** For operational specifications, refer to the most recent *NI 9260 Datasheet* online at *ni.com/manuals*.

Worldwide Support and Services

The NI 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.

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[1] Range equals 4.243 V.

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

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

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