

# CALIBRATION PROCEDURE

# NI 9263

## 4-Channel, $\pm 10$ V, 16-Bit Analog Voltage Output Module

This document contains the verification and adjustment procedures for the National Instruments 9263. For more information on calibration solutions, visit [ni.com/calibration](http://ni.com/calibration).

## Contents

---

|  |   |
|--|---|
| Software.....                              | 1 |
| Documentation.....                         | 2 |
| Test Equipment.....                        | 3 |
| Test Conditions.....                       | 3 |
| Initial Setup.....                         | 3 |
| Verification.....                          | 4 |
| Accuracy Verification.....                 | 4 |
| Adjustment.....                            | 6 |
| Accuracy Adjustment.....                   | 6 |
| EEPROM Update.....                         | 6 |
| Reverification.....                        | 7 |
| Accuracy Under Calibration Conditions..... | 7 |
| Worldwide Support and Services.....        | 8 |

## Software

---

Calibrating the NI 9263 requires the installation of NI-DAQmx 9.6 or later on the calibration system. You can download NI-DAQmx from [ni.com/downloads](http://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 9263, NI-DAQmx, and your application software. All documents are available on [ni.com](http://ni.com) and help files install with the software.



*NI cDAQ-9174/9178 USB Chassis Quick Start*

NI-DAQmx installation and hardware setup



*NI 9263 Operating Instructions and Specifications*

NI 9263 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

---

National Instruments recommends that you use equipment in Table 1 for calibrating the NI 9263. If the recommended equipment is not available, select a substitute using the requirements listed in Table 1.

**Table 1.** Recommended Equipment

| Equipment            | Recommended Model | Requirements  |
|----------------------|-------------------|---|
| DMM                  | NI 4070 DMM       | Use a multiranging 6 1/2 digit DMM with voltage measurement accuracy of $\pm 40$ ppm. |
| Chassis              | NI cDAQ-9178      | —   |
| Connection Accessory | NI 9932           | —   |

## Test Conditions

---

The following setup and environmental conditions are required to ensure the NI 9263 meets published specifications.

- Keep connections to the NI 9263 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 9263 are secure.
- Use shielded copper wire for all cable connections to the NI 9263. Use twisted-pair wire to eliminate noise and thermal offsets.
- Maintain an ambient temperature of  $23 \pm 5$  °C. The NI 9263 board 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 9263 measurement circuitry is at a stable operating temperature.

## Initial Setup

---

Complete the following steps to set up the NI 9263.

1. Install NI-DAQmx.
2. Make sure that the NI cDAQ-9178 power source is not connected.
3. Insert the module into 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

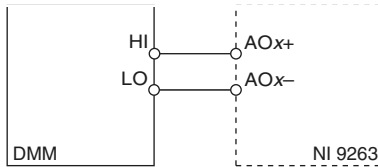
The following performance verification procedure describes the sequence of operation and provides test points required to verify the NI 9263. The verification procedure assumes that adequate traceable uncertainties are available for the calibration references.

## Accuracy Verification

Complete the following procedure to determine the As-Found status of the NI 9263.

1. Set the DMM to Standby mode (STBY).
2. Connect the DMM to the NI 9263 as shown in Figure 1.

**Figure 1. Accuracy Verification Connections**



3. Set the DMM to read DC voltage in the minimum range required to cover the NI 9263 output range of  $\pm 10$  V.
4. Acquire a sample
  - a. Create and configure an AO voltage channel according to Table 2.

**Table 2. NI 9263 AO Voltage Channel Configuration**

| Input Range |     | Scaled Units | Terminal Configuration |
|-------------|-----|--------------|------------------------|
| Min         | Max |              |                        |
| -10         | 10  | Volts        | Single Ended           |

- b. Start the task.
  - c. Generate a voltage output according to Table 3.

**Table 3. NI 9263 Output Configuration**

| Samples Per Channel | Timeout | Data  |
|---------------------|---------|---|
| 1                   | 10.0    | A Test Point value indicated in Table 4 or Table 5. |

- d. Wait the appropriate time for the DMM measurement to settle.
  - e. Read the NI 9263 output voltage measurement from the DMM.
  - f. Clear the task.

5. Compare the DMM measurement to the test limits in Table 4.
6. Repeat steps 3 through 5 for each test point in Table 4.
7. Disconnect the DMM from the NI 9263.
8. Repeat steps 1 through 7 for each channel on the NI 9263.



**Note** The accuracy and test limits of the NI 9263 vary depending on which revision of the module you are using. If the module was purchased after 2007 use the Revision E limits. If the module was purchased before 2007 then use the Revision D limits.

**Table 4.** NI 9263 Revision D Test Limits

| Range (V) |        | Test Point |           | 1-Year Limits   |                 |
|-----------|--------|------------|-----------|-----------------|-----------------|
| Min       | Max    | Location   | Value (V) | Lower Limit (V) | Upper Limit (V) |
| -10.000   | 10.000 | Max        | 9.500000  | 9.460540        | 9.539460        |
| -10.000   | 10.000 | Mid        | 0.000000  | -0.029960       | 0.029960        |
| -10.000   | 10.000 | Min        | -9.500000 | -9.539460       | -9.460540       |

**Table 5.** NI 9263 Revision E Analog Test Limits

| Range (V) |        | Test Point |           | 1-Year Limits   |                 |
|-----------|--------|------------|-----------|-----------------|-----------------|
| Min       | Max    | Location   | Value (V) | Lower Limit (V) | Upper Limit (V) |
| -10.000   | 10.000 | Max        | 9.500000  | 9.482770        | 9.517230        |
| -10.000   | 10.000 | Mid        | 0.000000  | -0.009630       | 0.009630        |
| -10.000   | 10.000 | Min        | -9.500000 | -9.517230       | -9.482770       |



**Note** Test limits in Table 4 are derived using the values in Table 7.

# Adjustment

---

The following performance adjustment procedure describes the sequence of operation required to adjust the NI 9263.

## Accuracy Adjustment

Complete the following procedure to adjust the accuracy performance of the NI 9263.

1. Connect the DMM to the NI 9263 as shown in Figure 1.
2. Adjust the NI 9263.
  - a. Initialize a calibration session on the NI 9263. The default password is NI.
  - b. Input the external temperature in degrees Celsius.
  - c. Call the NI 9263 get C Series adjustment points function to obtain an array of recommended calibration voltages for the NI 9263.
  - d. Set the DMM to read DC voltage in the minimum range required to cover the NI 9263 output range of  $\pm 10$  V.
  - e. Call and configure the NI 9263 setup calibration function with the DAC value obtained from the array of recommended calibration voltages.
  - f. Wait the appropriate amount of time for the DMM measurement to settle.
  - g. Read the NI 9263 output voltage measurement from the DMM.
  - h. Call and configure the NI 9263 adjustment function according to Table 6.

**Table 6.** Adjustment Configuration

| Physical Channel | Reference Value                                   |
|------------------|---|
| cDAQMod8/aox     | The NI 9263 output voltage measured from the DMM. |

- i. Repeat steps e to h for each calibration voltage in the array.
    - j. Close the calibration session.
3. Disconnect the DMM from the NI 9263.
4. Repeat step 1 for each channel on the NI 9263.

## EEPROM Update

---

When an adjustment procedure is completed, the NI 9263 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 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  $23\text{ °C} \pm 5\text{ °C}$
- NI 9263 installed in slot 8 of an NI cDAQ-9178 chassis
- Slots 1 through 7 of the NI cDAQ-9178 chassis are empty

**Table 7.** NI 9263 Accuracy

| Device                | Percent of Reading<br>(Gain Error) | Percent of Range*<br>(Offset Error) |
|-----------------------|------------------------------------|-------------------------------------|
| NI 9263 Revision D    | 0.10%                              | 0.28%                               |
| NI 9263 Revision E    | 0.08%                              | 0.09%                               |
| * Range equals 10.7 V |                                    |                                     |

# Worldwide Support and Services

---

The NI website is your complete resource for technical support. At [ni.com/support](http://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](http://ni.com/services) for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit [ni.com/register](http://ni.com/register) to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting [ni.com/certification](http://ni.com/certification). If your product supports calibration, you can obtain the calibration certificate for your product at [ni.com/calibration](http://ni.com/calibration).

NI corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. NI also has offices located around the world. For telephone support in the United States, create your service request at [ni.com/support](http://ni.com/support) or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the Worldwide Offices section of [ni.com/niglobal](http://ni.com/niglobal) to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Refer to the *NI Trademarks and Logo Guidelines* at [ni.com/trademarks](http://ni.com/trademarks) for more information on NI trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies. For patents covering NI products/technology, refer to the appropriate location: **Help»Patents** in your software, the `patents.txt` file on your media, or the *National Instruments Patents Notice* at [ni.com/patents](http://ni.com/patents). You can find information about end-user license agreements (EULAs) and third-party legal notices in the `readme` file for your NI product. Refer to the *Export Compliance Information* at [ni.com/legal/export-compliance](http://ni.com/legal/export-compliance) for the NI global trade compliance policy and how to obtain relevant HTS codes, ECCNs, and other import/export data. NI MAKES NO EXPRESS OR IMPLIED WARRANTIES AS TO THE ACCURACY OF THE INFORMATION CONTAINED HEREIN AND SHALL NOT BE LIABLE FOR ANY ERRORS. U.S. Government Customers: The data contained in this manual was developed at private expense and is subject to the applicable limited rights and restricted data rights as set forth in FAR 52.227-14, DFAR 252.227-7014, and DFAR 252.227-7015.

© 2006–2015 National Instruments. All rights reserved.