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CALIBRATION PROCEDURE

NI 9246/9247

This document contains the verification and adjustment procedures for the NI 9246 and NI 9247. For more information about calibration solutions, visit ni.com/calibration.

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Software

Calibrating the NI 9247 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™, 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.

NATIONAL INSTRUMENTS

Documentation

Consult the following documents for information about the NI 9246/9247, 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 9246 Getting Started Guide

NI 9246 specific information.

NI 9246 Datasheet

NI 9246 specifications and calibration interval.

NI 9247 Getting Started Guide

NI 9247 specific information.

NI 9247 Datasheet

NI 9247 specifications and calibration interval.

NI DAQmx Readme

Operating system and application software support.

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	Parameter Measured	Requirements
Source	Fluke 5522A	Accuracy, Adjustment	Use a high-precision current source with an accuracy ≤650 ppm
cDAQ Chassis	NI cDAQ-9178	All	—

Test Conditions

The following setup and environmental conditions are required to ensure the NI 9246/9247 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 °C ± 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 9246/9247 measurement circuitry is at a stable operating temperature.

Initial Setup

Complete the following steps to set up the NI 9246/9247.

1. Install NI-DAQmx.
2. Make sure 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 chassis 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.

Verification

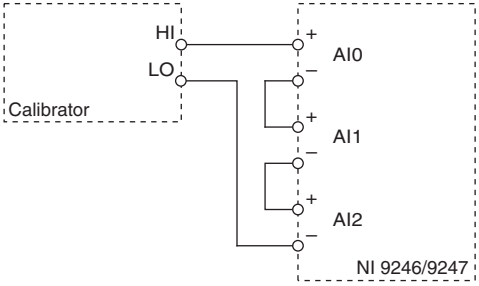
The following performance verification procedures describe the sequence of operation and test points required to verify the NI 9246/9247 and assumes that adequate traceable uncertainties are available for the calibration references.

Accuracy Verification

Complete the following procedure to determine the As-Found status of the NI 9246/9247.

1. Set the calibrator to Standby mode (STBY).
2. Connect the NI 9246/9247 to the calibrator as shown in Figure 1.

Figure 1. Accuracy Verification Connections



3. Set the calibrator current to a Test Point Value indicated in Table 4.
4. Set the calibrator to Operate mode (OPR).
5. Wait at least 45 seconds for the signal to settle.
6. Acquire samples from each channel.
   a. Create and configure an AI current task on the NI 9246/9247 according to Table 2.

Table 2. NI 9246/9247Configuration for Accuracy Verification

	Min	Max	Scaled Units	Physical Channels
NI 9246	-31.25	31.25	Current	AI0:2
NI 9247	-147	147	Current	AI0:2

b. Configure the AI current task according to Table 3.

Table 3. NI 9246/9247 Timing Configuration

Sample Mode	Samples Per Channel	Sample Rate (kS/s)
Finite Samples	50,000	50

c. Start the task.

d. For the maximum Test Point calculate and record the AC magnitude for each channel on the NI 9246/9247. NI recommends using the Extract Single Tone Information VI to calculate the magnitude. For the minimum test point average the value and record the result.

Note The output magnitude of the Extract Single Tone Information is in Apk. To convert to RMS, use the following equation:

$$Arms = (Apk) \div (\sqrt{2})$$

e. Stop and clear the task.

7. Compare the average for each channel to the limits in Table 4.

Table 4. NI 9246/9247 Verification Test Limits for Accuracy

	Test Point			1-Year Limits	
	Location	Value	Frequency (Hz)	Lower Limit	Upper Limit
NI 9246	Max	2 Arms	55	1.9913 Arms	2.0087 Arms
	Min	0.00 Adc	0.00	-0.023 Adc	0.023 Adc
NI 9247	Max	2 Arms	55	1.9925 Arms	2.0075 Arms
	Min	0.00 Adc	0.00	-0.133 Adc	0.133 Adc

Note The test limits listed in Table 4 should be used for calibration verification only. These values only apply under the specific calibration conditions described in this document, and are not to be construed as general operational specification of the NI 9246/9247. For operation specification, refer to the most recent *NI 9246 Datasheet* and *NI 9247 Datasheet* at ni.com/manual.

8. Set the calibrator to Standby mode (STBY).
9. Repeat steps 3 through 7 for each test point listed in Table 4.
10. Disconnect the calibrator from the device.

Adjustments

The following performance adjustment procedure describes the sequence of operation required to adjust the NI 9246/9247.

Accuracy Adjustment

Complete the following procedure to adjust the accuracy performance of the NI 9246/9247.

1. Set the calibrator to Standby mode (STBY).
2. Connect the NI 9246/9247 to the calibrator as shown in Figure 1.
3. Adjust the NI 9246/9247.
    a. Initialize a calibration session on the NI 9246/9247. The default password is `NI`.
    b. Input the external temperature in degrees Celsius.
    c. Call the NI 9246/9247 DAQmx Get C Series Calibration Adjustment Points function to obtain an array of recommended calibration current for the NI 9246/9247.
    d. Set the calibrator to a reference value determined by the array of recommended calibration currents.
    e. Set the calibrator's output frequency to 55 Hz.
    f. Set the calibrator to Operate mode (OPR).
    g. Wait at least 45 seconds for the signal to settle.
    h. Call and configure the NI 9246/9247 adjustment function according to Table 5.

Table 5. Adjustment Configuration

Physical Channel	Reference Value
cDAQMod8/ai*x*	The reference value from the array of adjustment points

Note To adjust all channels in parallel, use 'ai0:2' as the channel name.

    i. Set the calibrator to Standby mode (STBY).
    j. Close and commit the calibration session.
4. Disconnect the NI 9246/9247 from the calibrator.

EEPROM Update

When an adjustment procedure is completed, the NI 9246/9247 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.

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.

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

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