

CALIBRATION PROCEDURE

NI 9361

8-Channel Counter Input Module

This document contains the verification procedure for the NI 9361. For more information about calibration solutions, visit ni.com/calibration.

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Software

Calibrating the NI 9361 requires the installation of NI-DAQmx 14.5 or later on the calibration system. You can download NI-DAQmx from ni.com/downloads. NI-DAQmx supports LabVIEW, LabWindows™/CVI™, ANSI C, and Microsoft 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 9361, NI-DAQmx, and your application software. All documents are available on ni.com and help files install with the software.



NI cDAQ-9174/9178 Quick Start
NI-DAQmx installation and hardware setup



NI 9361 Getting Started Guide
NI 9361 specific information



NI 9361 Datasheet

NI 9361 specifications and calibration interval



NI-DAQmx Readme

Operating system and application software support in NI-DAQmx



NI DAQmx Help

Information about creating applications that use the NI-DAQmx driver



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

The following table lists the equipment recommended for the performance verification procedure. If the recommended equipment is not available, select a substitute using the requirements listed.

Table 1. Recommended Equipment

Equipment	Recommended Model	Requirements
Frequency Standard	NI PXIe-6674T, NI PXIe-6614, or Keysight 33250A	A highly stable clock source that is able to generate 1 MHz, 5 V TTL output with $\leq \pm 5$ ppm total accuracy
Chassis	NI cDAQ-9178	—
Connection Accessory	NI 9923	—

Test Conditions

The following setup and environmental conditions are required to ensure the NI 9361 meets published specifications.

- Keep connections to the NI 9361 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 9361 are secure.
- Maintain an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. The NI 9361 temperature will be greater than the ambient temperature.
- Keep relative humidity below 80%.

Initial Setup

Refer to the *NI cDAQ-9174/9178 Quick Start* for information about how to install the software and hardware and how to configure the device in Measurement & Automation Explorer (MAX).



Note When a device is configured in MAX, it is assigned a device name. Each function call uses this device name to determine which device to calibrate. This document uses **Dev_name** to refer to the device name. In the following procedures, use the device name as it appears in MAX.

Complete the following steps to set up the NI 9361.

1. Install NI-DAQmx.
2. Make sure the NI cDAQ-9178 power source is not connected.
3. Connect the NI cDAQ-9178 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 MAX.
8. Right-click the device name and select **Self-Test** to ensure that the module is working properly.

Verification

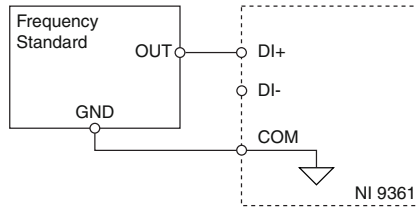
The following performance verification procedure describes the sequence of operation and provides test points required to verify the NI 9361. The verification procedure assumes that adequate traceable uncertainties are available for the calibration references.

Base Clock Accuracy Verification

Complete the following procedure to determine the As-Found status of the NI 9361.

1. Connect the Frequency Standard to the NI 9361 as shown in the following figure. Use the NI 9923 to make the connections.

Figure 1. Base Clock Accuracy Verification Connections



2. Acquire a Base Clock Accuracy sample.
 - a) Configure the NI 9361 in single-ended mode with the settings in [Table 2](#).
 - b) Configure the Frequency Standard with the settings in [Table 3](#).
 - c) Start task.
 - d) Wait at least 20 ms after starting the acquisition before reading the data in order to provide time for the measurement to become valid.
 - e) Read the measurement value for the Base Clock Accuracy.
 - f) Compare the Base Clock Accuracy measurement to the test limits in [Table 4](#).

Table 2. NI 9361 Configuration

Test Points	NI 9361 Settings					
	Counter Channel	Measurement Type	Measurement Method	Measurement Time	Divisor	Maximum Measurable Period
1 MHz	ctr0	Frequency	Dynamic Averaging	0	10,000	0



Note To configure Measurement Time, Divisor, and Maximum Measurable Period, you must explicitly set these properties with the DAQmx Channel Property Node after calling DAQmx Create Channel.

Table 3. Frequency Standard Settings

Frequency	Format	Duty Cycle
1 MHz	TTL	50%

Table 4. NI 9361 Base Clock Accuracy Verification Test Limits

Test Point	Lower Limit	Upper Limit
1,000,000 Hz	999,950 Hz	1,000,050 Hz

If the Base Clock Accuracy verification procedure determines that the NI 9361 is outside of the limits, 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 $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$
- NI 9361 installed in slot 8 of an NI cDAQ-9178 chassis
- Slots 1 through 7 of the NI cDAQ-9178 chassis are empty

Table 5. NI 9361 Base Clock Accuracy

Test Point	Specification Limit
1 MHz	50 ppm



Note For operational specifications, refer to the most recent NI 9361 Datasheet 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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