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***cDAQ-9138***

# cDAQ Chassis and Controllers

This document contains information for calibrating NI CompactDAQ (cDAQ-913x/917x/918x/919x) chassis and controllers. For more information about calibration, visit [ni.com/calibration](http://ni.com/calibration).

## Software Requirements

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Calibrating cDAQ chassis and controllers requires the installation of NI-DAQmx on the calibration system. NI recommends using the latest NI-DAQmx driver. Refer to the *NI-DAQmx Readme* to ensure support for the chassis or controller you want to calibrate, as well as for the C Series digital module you are using. You can download NI-DAQmx from [ni.com/downloads](http://ni.com/downloads). NI-DAQmx supports many programming languages, including 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

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Consult the following documents for information about cDAQ chassis and controllers, C Series modules, and the NI-DAQmx driver. All documents are available on [ni.com/manuals](http://ni.com/manuals); help files install with the software.



Quick start for your cDAQ chassis or controller

The quick start provides instructions for installing and configuring your cDAQ chassis or controller and C Series module.<sup>1</sup>



User manual for your cDAQ chassis or controller

The user manual provides information about your cDAQ chassis or controller.<sup>2</sup>

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<sup>1</sup> The *NI cDAQ-9172 User Guide and Specifications* provides instructions for installing and configuring your cDAQ-9172 and C Series module.

<sup>2</sup> The *NI cDAQ-9172 User Guide and Specifications* provides information about the cDAQ-9172 chassis.



### Specifications for your cDAQ chassis or controller

The specifications provides detailed specifications for your cDAQ chassis or controller.<sup>3</sup>



### Getting started guide for your C Series module

The getting started guide for your C Series module provides information about wiring to your C Series digital module.



### NI-DAQmx Readme

Provides operating system and application software support in NI-DAQmx.



### NI-DAQmx Help

Provides information about creating applications that use the NI-DAQmx driver.



### NI-DAQmx C Reference Help

Provides reference information for NI-DAQmx C functions and NI-DAQmx C properties.

## Calibration Interval

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NI recommends a calibration interval of one year for cDAQ chassis and controllers. Adjust the recommended calibration interval based on the measurement accuracy demands of your application.

## Test Equipment

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The following table lists the equipment required for calibrating your chassis or controller. If you do not have the recommended instruments, use the minimum requirements to select substitute equipment.

**Table 1. Recommended Test Equipment**

Equipment	Recommended Models	Minimum Requirements
Counter	Keysight 53131A/53220A	Counter accuracy to $\pm 5$ ppm
C Series Digital Module	NI 9401 or NI 9402	—

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<sup>3</sup> The *NI cDAQ-9172 User Guide and Specifications* provides detailed specifications for the cDAQ-9172 chassis.

**Table 1. Recommended Test Equipment (Continued)**

Equipment	Recommended Models	Minimum Requirements
(NI 9401) Front-Mounted Terminal Block	NI 9924 or NI 9934	Terminal block for 25-pin DSUB modules
(NI 9401) BNC-to-Leads Cable	—	BNC male-to-leads cable with a length suitable for the application
(NI 9402) BNC Cable	NI part number 781887-01	BNC male-to-BNC male cable with a length suitable for the application

## Test Conditions

The following setup and environmental conditions are required to ensure the cDAQ chassis or controller meets published specifications:

- Keep connections to the C Series digital module as short as possible. Long cables and wires act as antennas, picking up extra noise that can affect measurements.
- Maintain an ambient temperature of  $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ . The cDAQ chassis/controller temperature will be greater than the ambient temperature.
- Keep relative humidity below 90%.
- Allow a warm up time of at least 10 minutes to ensure that the cDAQ chassis/controller is at a stable operating temperature.
- Consult the user documentation for the counter for the recommended warm up time (at least 45 minutes) to ensure that the counter circuitry is at a stable operating temperature.

## Calibration Procedure

The calibration process includes the following steps:

1. **Initial Setup**—Set up the chassis or controller, install the module, and configure them in Measurement & Automation Explorer (NI MAX).
2. **Counter Verification**—Verify the existing operation of the chassis or controller. This step confirms whether the cDAQ chassis or controller is operating within the published specifications.

## Initial Setup

Refer to the quick start for your cDAQ chassis or controller for instructions on installing the application and NI-DAQmx driver software, setting up your chassis or controller, installing your C Series digital module, and confirming the system is operating properly.<sup>4</sup> If you are

<sup>4</sup> For the cDAQ-9172, refer to the *NI cDAQ-9172 User Guide and Specifications* for installation information.

using the NI 9401 for verification, refer to the *NI 9924 User Guide and Specifications* for installation information.



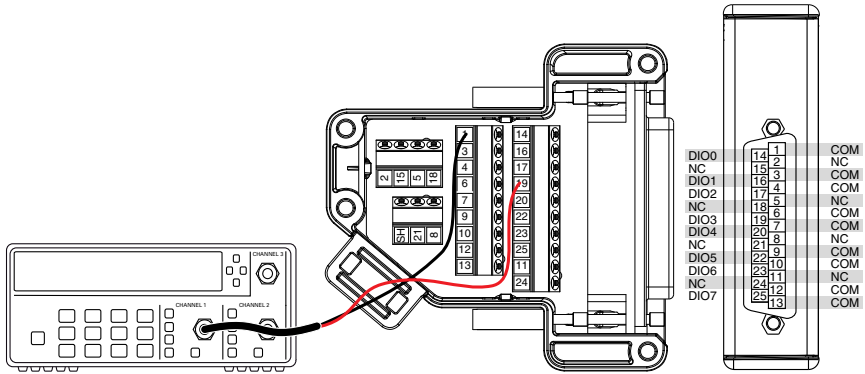
**Note (cDAQ-9172)** You must install the C Series digital module in slot 5 or 6 of the chassis.

# Counter Verification

CompactDAQ chassis and controllers have only one timebase to verify, so only Counter 0 needs to be checked. It is not possible to adjust this timebase, so only verification can be performed. Complete the following steps to verify the counter on the cDAQ chassis or controller.

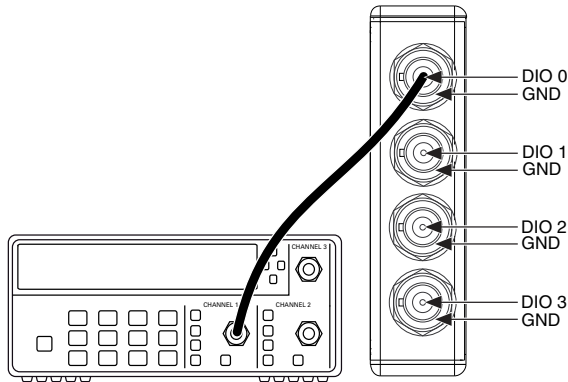
1. Connect the external counter to the C Series digital module.
  - **(NI 9401)** Connect the positive input of CHANNEL 1 to DIO 3 (pin 19) and the negative input to COM (pin 1) using a BNC-to-leads cable, as shown in the following figure.

**Figure 1.** NI 9401 and NI 9924 Signal Connections to the External Counter



- **(NI 9402)** Connect CHANNEL 1 to the DIO 0 BNC with a standard BNC cable, as shown in the following figure.

**Figure 2. NI 9402 Signal Connections to the External Counter**



2. Call `DAQmxCreateTask` to configure Counter 0 with the following parameters:
  - **Frequency** = 5000000
  - **Scaled Units** = Seconds
  - **Idle State** = Low
  - **Initial Delay** = 0
  - **DAQmx Timing Instance** = Implicit
  - **Generation Mode** = Continuous Pulses
  - **Samples to Write** = 1000
3. Call `DAQmxStartTask` to start the generation of a square wave
4. Configure the external counter to measure frequency and use a 1 M $\Omega$  impedance.
5. Take a measurement of the square wave using the external counter.
6. Compare the counter reading to the limits in the following table.

**Table 2. cDAQ Counter Limits**

Set Point (MHz)	Lower Limit (MHz)	Upper Limit (MHz)
5	4.99975	5.00025

7. Call `DAQmxStopTask` to stop the generation.
8. Call `DAQmxClearTask` to clear the generation.
9. Disconnect the external counter from the C Series module.

The counter on the cDAQ chassis/controller is now verified.

If the cDAQ chassis or controller does not fall within the desired specifications, return it to NI for repair. Refer to [Where to Go for Support](#) for assistance in returning the chassis or controller to NI.

# Where to Go for Support

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The National Instruments website is your complete resource for technical support. At [ni.com/support](https://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.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at [ni.com/support](https://ni.com/support) and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, visit the Worldwide Offices section of [ni.com/global](https://ni.com/global) to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

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