CALIBRATION PROCEDURE
NI PXIe-4340

4 Ch, 24-bit, 25.6 kS/s Simultaneous AC LVDT Input Module

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This document contains the verification procedure for the National Instruments PXIe-4340 module.

Contents

Software

Calibrating the NI PXIe-4340 requires the installation of NI-DAQmx on the calibration system. Driver support for calibrating the PXIe-4340 was first available in NI-DAQmx 16.1. For the list of devices supported by a specific release, refer to the *NI-DAQmx Readme*, available on the version-specific download page or installation media.

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 PXIe-4340, NI-DAQmx, and your application software. All documents are available on ni.com, and help files install with the software.

NI PXIe-4340 and TB-4340 User Guide and Terminal Block Specifications

NI-DAQmx driver software installation and hardware setup.

NI PXIe-4340 User Manual

PXIe-4340 usage and reference information.

NI PXIe-4340 Device Specifications

PXIe-4340 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.

PXIe-4340 Verification

This section provides information for verifying the PXIe-4340.

Test Equipment

Table 1 lists the equipment recommended for the performance verification procedures of the PXIe-4340. If the recommended equipment is not available, select a substitute using the requirements listed in Table 1.

Table 1. Recommended Equipment for PXIe-4340 Verification

Equipment	Recommended Model	Requirements
DMM	PXI-4070	Use a DMM that has an accuracy of $\leq\pm 60$ µV when measuring 0 VDC with 10 Vpk AC and $\leq\pm(0.05\% + 10$ mVrms) when measuring 7 Vrms AC signals from 400 Hz to 10 kHz.
PXI Express Chassis	PXIe-1062Q	If this chassis is unavailable, use another PXI Express chassis, such as the PXIe-1082 or PXIe-1078.
Connection Accessory	TB-4340	—

Connecting the TB-4340

The TB-4340 provides connections for the PXIe-4340. Figure 1 shows the pin assignments of the TB-4340.

Figure 1. TB-4340 Circuit Board Parts Locator Diagram
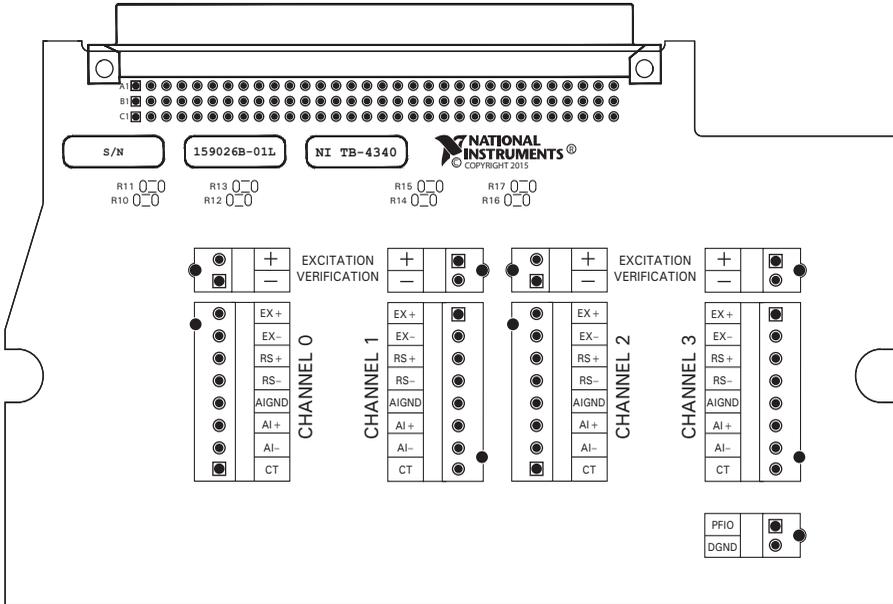
Each channel consists of two terminal connections specific to that channel as shown in Table 2. You can verify the accuracy for any or all channels depending on the desired test coverage.

Refer to Table 2 for the analog signal names of the TB-4340.

Table 2. TB-4340 Analog Signal Names

Signal Name	Signal Description
Excitation Verification +	Positive excitation terminal for gross checks
Excitation Verification -	Negative excitation terminal for gross checks
EX+	Positive excitation terminal
EX-	Negative excitation terminal
RS+	Positive remote sense terminal
RS-	Negative remote sense terminal
AIGND	Analog input ground
AI+	Positive input voltage terminal
AI-	Negative input voltage terminal
CT	LVDT center tap connection

Test Conditions

The following setup and environmental conditions are required to ensure the PXIe-4340 meets published specifications:

- Keep connections to the PXIe-4340 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 TB-4340 are secure.
- Use shielded copper wire for all cable connections to the TB-4340. Use twisted-pair wire to eliminate noise and thermal offsets.
- Maintain an ambient temperature of 23 °C ±5 °C. The PXIe-4340 temperature will be greater than the ambient temperature. Maintain an internal device temperature range of $T_{cal} \pm 5$ °C for the PXI-4070.[1]
- Keep relative humidity below 80%.
- For valid test limits, the device must be within ±5 °C and 24 hours of the last self-calibration.

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[1] T_{cal} is the internal device temperature recorded by the PXI-4070 at the completion of the last self-calibration.

- Allow a warm-up time of at least 15 minutes to ensure that the PXIe-4340 measurement circuitry is at a stable operating temperature.
- Ensure that the PXI/PXI Express chassis fan speed is set to HIGH, that the fan filters are clean, and that the empty slots contain filler panels. For more information, refer to the *Maintain Forced-Air Cooling Note to Users* document available at ni.com/manuals.

Initial Setup

Refer to the *NI PXIe-4340 and TB-4340 Installation Guide and Terminal Block Specifications* for information about how to install the software and hardware and how to configure the device in NI Measurement & Automation Explorer (MAX).

📝 **Note** When a device is configured in MAX, it is assigned a device identifier. Each function call uses this identifier to determine which DAQ device to verify. This document uses Dev1 to refer to the device name. In the following procedures, use the device name as it appears in MAX.

Accuracy Verification

The following performance verification procedures describe the sequence of operations and provides the test points required to verify the PXIe-4340. The verification procedures assume that adequate traceable uncertainties are available for the calibration references.

The PXIe-4340 has four independent analog input channels. You can verify the accuracy of any or all of the channels depending upon your desired test coverage.

Excitation Accuracy

To connect the TB-4340 for excitation verification, install the PXIe-4340 and the TB-4340 in the PXI Express chassis according to the instructions in the *NI PXIe-4340 and TB-4340 User Guide and Terminal Block Specifications*. Do not use the excitation verification terminals as they are only used for gross field checks and will introduce additional errors.

Complete the following steps to verify the excitation accuracy of the PXIe-4340:

1. Connect the PXI-4070 across the EX+ and EX- terminals of the channel to be verified.
2. Refer to Table 3 to configure the PXI-4070 and acquire a voltage measurement for DC Offset.

Table 3. PXI-4070 Voltage Measurement Setup for DC Offset

Configuration	Value
Function	DC Volts
Range	10 V
Digital Resolution	6.5 digits
Aperture Time	100 ms
Autozero	Once
ADC Calibration	On
Input Impedance	10 MΩ
DC Noise Rejection	High Order
Number of Averages	10
Power Line Frequency	Dependent upon the local power line characteristics.

3. Refer to Table 4 to configure the PXI-4070 and acquire a voltage measurement for AC Amplitude.

Table 4. PXI-4070 Voltage Measurement Setup for AC Amplitude

Configuration	Value
Function	AC Volts, DC Coupled
Range	50 V
Digital Resolution	6.5 digits
Aperture Time	200 ms
Autozero	Once
ADC Calibration	On
Input Impedance	1 MΩ
Minimum Frequency	20
Number of Averages	10
Power Line Frequency	Dependent upon the local power line characteristics.

4. Configure a position measurement with the PXIe-4340.

    a. Create a DAQmx task.

    b. Create and configure the AI LVDT channel according to the values shown in Table 5.

Table 5. PXIe-4340 AI LVDT Measurement Setup

Configuration	Value
Channel Name	`Dev1/aix`, where x refers to the channel number
Task	AI Position LVDT
Sample Mode	Finite Number of Samples
Sample Clock Rate	25600
Samples per Channel	25600
Maximum Value	1
Minimum Value	-1
Voltage Excitation Wire Mode	4-wire
Voltage Excitation Source	Internal
Voltage Excitation Value	7
Voltage Excitation Frequency	10000
Sensitivity Units	mV/V/mm
Sensitivity	1
Units	Meters

    c. Commit the task.

    d. Perform DC Offset and AC amplitude measurement(s) with the DMM.

    e. Clear the task.

    f. Compare the DC Offset measurement to the Limits in Table 6. If the measurement is between these values, the devices passes the DC Offset test at this Excitation Voltage.

Table 6. DC Offset

Measurement	Limits
DC Offset (All Amplitudes)	±10 mV

g. Compare the AC Amplitude measurement to the Excitation Accuracy Limits in Table 7. If the measurement is between these values, the device passes the AC Amplitude test at this Excitation Voltage.

Table 7. Excitation Accuracy Limits

Measurement	Nominal	Maximum Limit	Minimum Limit
Excitation Amplitude 7 Vrms Point	7 Vrms	7.35 Vrms	6.65 Vrms
Excitation Amplitude 5 Vrms Point	5 Vrms	5.25 Vrms	4.75 Vrms
Excitation Amplitude 3 Vrms Point	3 Vrms	3.15 Vrms	2.85 Vrms
Excitation Amplitude 1 Vrms Point	1 Vrms	1.05 Vrms	0.95 Vrms

5. Repeat step 4 for the other Voltage Excitation Values in Table 7.
6. Repeat steps 1 to 5 for each additional channel to be verified.
7. Disconnect the PXI-4070 from the TB-4340.

Ratiometric Accuracy

Complete the following steps to connect the TB-4340 for ratiometric accuracy verification:

1. Install the PXIe-4340 and the TB-4340 in the PXI Express chassis according to the instructions in the *NI PXIe-4340 and TB-4340 User Guide and Terminal Block Specifications*.
2. Connect AI+ and AI- according to the measurements in Table 8 for each measurement.

Complete the following steps for each measurement test point to verify the ratiometric accuracy of the PXIe-4340:

1. Connect the channel as shown in Table 8. Leave all other pins disconnected.
2. Configure the channel as shown in Table 5 for 7 Vrms excitation.
3. Perform the configured AI LVDT measurement and average the acquired measurements.
4. Compare the resulting average to the *Minimum Limit* and *Maximum Limit* values shown in Table 8. If the result is between these values, the device passes the test.

Table 8. Verification Connections

Measurement	Short AI+ to	Short AI- to	Nominal Reading	Maximum Limit	Minimum Limit
1 V/V	EX+	EX-	1 V/V	1.0004000 V/V	0.999600 V/V
0 V/V	AI-	AI+	0 V/V	0.000150 V/V	-0.000150 V/V
-1 V/V	EX-	EX+	-1 V/V	-0.999600 V/V	-1.000400 V/V

Note: NI-DAQmx returns units scaled for length, while the PXIe-4340 accuracy is specified as a voltage ratio. With sensitivity set to 1 mV/V/mm and output units set to meters as in Table 5, 1 meter is numerically equivalent to 1 V/V.

Note If any test fails verification, verify that you have met the verification test conditions before returning your device to NI. Refer to *Worldwide Support and Services* section for assistance in returning the device to NI.

EEPROM Update

In order to update the calibration date to track when the last verification was successfully completed, initialize, and close a calibration sessions for `Dev1` using the DAQmx Initialize External Calibration VI and the DAQmx Close External Calibration VI.

Specifications

Refer to the *NI PXIe-4340 Device Specifications* document for detailed PXIe-4340 specification information.

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.

Visit 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. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

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