

CALIBRATION PROCEDURE

FD-11634

8-Channel Sound and Vibration Input Device for FieldDAQ

This document contains information for calibrating the FD-11634. For more information about calibration, visit ni.com/calibration.

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Software Requirements

Calibrating the FD-11634 requires the installation of NI-DAQmx on the calibration system. NI recommends using the latest NI-DAQmx driver. Earliest driver support version for calibrating the FD-11634 is listed in the following table.

Table 1. FD-11634 Driver Support

Driver	Earliest Version Support for Device Calibration
NI-DAQmx	18.6

You can download NI-DAQmx from 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

Consult the following documents for information about the FieldDAQ device and the NI-DAQmx driver. All documents are available on ni.com/manuals; help files install with the software.



FD-11634 Quick Start— Provides instructions for installing and configuring your FieldDAQ device.



FD-11634 User Guide—Provides information about your FieldDAQ device.



FD-11634 Specifications—Provides detailed specifications for your FieldDAQ device.



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.

Test Equipment

The following table lists the equipment required for calibrating your FD-11634. If you do not have the recommended instruments, use the minimum requirements to select substitute equipment.

Table 2. Recommended Test Equipment

Equipment	Recommended Model	Minimum Requirements
Calibrator	Fluke 5522A	Voltage source with gain uncertainty of <25 ppm and offset uncertainty of <94 μ V in the 10 V range and <12 μ V in the 1 V range.
SHM125M-Pigtail I/O Cable (0.3 m, 1 m, 3 m lengths) (x4)	NI part number 785950-0R3/01/03	—
Banana Plug (optional) (x2)	—	Use banana plugs with an opening large enough to accommodate four 22 AWG signal wires

Test Conditions

The following setup and environmental conditions are required to ensure the FD-11634 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 ± 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 FieldDAQ device measurement circuitry is at a stable operating temperature.

Calibration Procedure

The calibration process includes the following steps:

1. *Initial Setup* on page 4
2. *Verification* on page 4
3. *Adjustment* on page 7
4. *EEPROM Update* on page 8
5. *Reverification* on page 9

Initial Setup

Complete the following steps to set up the FieldDAQ device.

1. Install the software and NI-DAQmx driver as outlined in the *FD-11634 Quick Start*.



Note You must install NI-DAQmx 18.6 or later for device calibration support.

2. Set up the FieldDAQ device as outlined in the *FD-11634 Quick Start*.
3. Configure the FieldDAQ device in Measurement & Automation Explorer (NI MAX) as outlined in the *FD-11634 Quick Start*.
4. If the FieldDAQ device is not reserved automatically, select the device and click the **Reserve Network Device** button. Refer to *Reserving the Device in MAX* for more information.
5. Self-test your device in MAX by expanding **Devices and Interfaces »Network Devices**, right-clicking your FieldDAQ device, and selecting **Self-Test**. Self-test performs a brief test to determine successful device installation. When the self-test finishes, a message indicates successful verification or if an error occurred. If an error occurs, refer to ni.com/support/daqmx.

Reserving the Device in MAX

When the FieldDAQ device is connected to a network, multiple users can access the device. To perform any DAQ functionality on the device, including reset and self-test, you must reserve the device in MAX. In MAX, an unreserved device or device reserved by another host appears with an X and a reserved device appears as dark grey. Only one user at a time can reserve the FieldDAQ device.

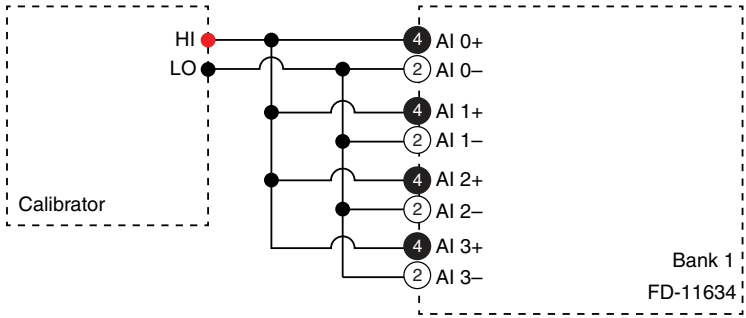
If the device was not reserved automatically after it was added (**Add Device**), you can reserve the device in MAX by expanding **Devices and Interfaces»Network Devices**, selecting the device, and clicking the **Reserve Network Device** button. The Override Reservation dialog box opens when you attempt to explicitly reserve a device. Agreeing to override the reservation forces the FieldDAQ device to be reserved by the current user.

Verification

Complete the following procedure to determine the As-Found status of the FieldDAQ device.

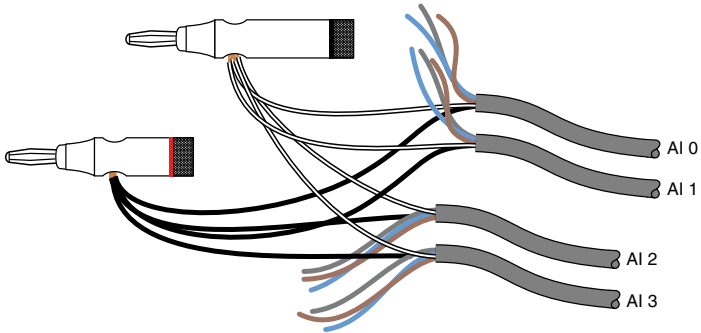
1. Set the calibrator to Standby mode (STBY).
2. Connect the calibrator to Bank 1 of the FieldDAQ device, as shown in the following figure. Refer to *Signal Connector Pinout* for signal connection information.

Figure 1. Bank 1 Verification Connections



- Tie AI 0+, AI 1+, AI 2+, and AI 3+ together.
- Tie AI 0-, AI 1-, AI 2-, and AI 3- together.

Figure 2. Terminating Four Cables to HI and LO



3. Set the calibrator to a reference value determined by the array of recommended calibration voltages indicated in the following table.

Table 3. FD-11634 Test Limits

Range	Test Point		As-Found Limits (V)		As-Left Limits (V)	
	Location	Value (V)	Lower Limit	Upper Limit	Lower Limit	Upper Limit
10 V	Negative Full Scale	-8.9125	-8.9216	-8.9034	-8.9143	-8.9107
	Mid	0.0	-0.0020	0.0020	-0.00094	0.00094
	Positive Full Scale	8.9125	8.9034	8.9216	8.9107	8.9143

Table 3. FD-11634 Test Limits (Continued)

Range	Test Point		As-Found Limits (V)		As-Left Limits (V)	
	Location	Value (V)	Lower Limit	Upper Limit	Lower Limit	Upper Limit
1 V	Negative Full Scale	-0.89125	-0.89244	-0.89006	-0.89149	-0.89101
	Mid	0.0	-0.0003	0.0003	-0.00012	0.00012
	Positive Full Scale	0.89125	0.89006	0.89244	0.89101	0.89149

The test limits in this table are derived using the values listed in *Accuracy Under Calibration Conditions*.

4. Set the calibrator to Operate mode (OPR).
5. Acquire and average samples.
 - a. Create and configure an AI voltage channel on the FieldDAQ device according to the following table.

Table 4. FD-11634 Accuracy Verification Configuration

Physical Channel	Minimum	Maximum	Scaled Units	Channel Configuration
FD11634-Bank1/ai0:3	-10	10	Volts	Pseudodifferential
FD11634-Bank1/ai0:3	-1	1	Volts	Pseudodifferential

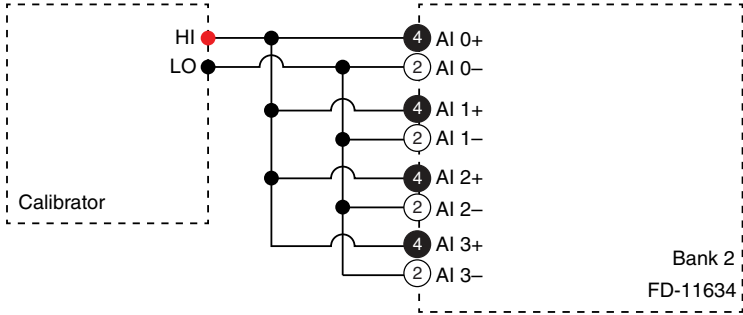
- b. Configure the AI voltage channel timing according to the following table.

Table 5. FD-11634 Voltage Channel Timing Configuration

Sample Mode	Samples per Channel	Rate (kS/s)
Finite Samples	10240	102.4

- c. Start the task.
 - d. Read the samples.
 - e. Average the readings.
 - f. Clear the task.
6. Compare the average to the limits in Table 3.
7. Repeat steps 3 through 6 for each test point and voltage range.
8. Set the calibrator to Standby mode (STBY).
9. Disconnect the calibrator from the FieldDAQ device.
10. Connect the calibrator to Bank 2 of the FD-11634, as shown in the following figure. Refer to *Signal Connector Pinout* for signal connection information.

Figure 3. Bank 2 Verification Connections



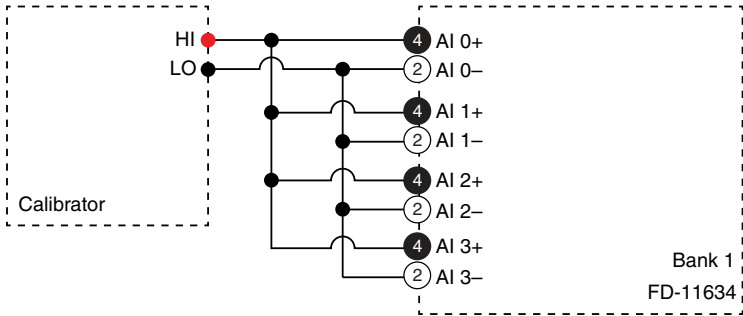
- Tie AI 0+, AI 1+, AI 2+, and AI 3+ together.
 - Tie AI 0-, AI 1-, AI 2-, and AI 3- together.
11. Complete Steps 3 through 9 for Bank 2 using FD11634-Bank2/ai0:3 as the physical channel.

Adjustment

Complete the following procedure to adjust the voltage accuracy of the FieldDAQ device.

1. Set the calibrator to Standby mode (STBY).
2. Connect the calibrator to Bank 1 of the FieldDAQ device, as shown in the following figure. Refer to [Signal Connector Pinout](#) for signal connection information.

Figure 4. Bank 1 Adjustment Connections



- Tie AI 0+, AI 1+, AI 2+, and AI 3+ together.
 - Tie AI 0-, AI 1-, AI 2-, and AI 3- together.
3. Initialize a calibration session on the FieldDAQ device. The default password is NI.
 4. Adjust the FieldDAQ device voltage.
 - a. Input the external temperature in degrees Celsius using the Set Temperature FieldDAQ function.
 - b. Call the Setup FD-11634 Calibration function and set the AI maximum and minimum according to the following table.

Table 6. Setup FD-11634 Calibration Function Configuration

Range	Minimum	Maximum	Scaled Units
10 V	-10	10	Volts
1 V	-1	1	Volts

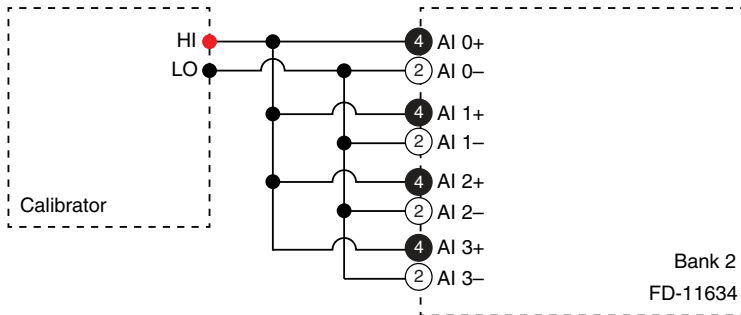
- c. Call the Get FD-11634 Calibration Adjustment Points function.
- d. Set the calibrator to a reference value determined by the array of adjustment points.
- e. Set the calibrator to Operate mode (OPR).
- f. Call and configure the Adjust FD-11634 Calibration function according to the following table.

Table 7. Adjustment Configuration

Physical Channel	Reference Value
FD11634-Bank1/ai0:3	A reference value from the array of adjustment points

- g. Repeat steps d through e for each calibration voltage in the array.
5. Set the calibrator to Standby mode (STBY).
6. Disconnect the calibrator from the FieldDAQ device.
7. Connect the calibrator to Bank 2 of the FD-11634, as shown in the following figure. Refer to [Signal Connector Pinout](#) for signal connection information.

Figure 5. Bank 2 Adjustment Connections



- Tie AI 0+, AI 1+, AI 2+, and AI 3+ together.
 - Tie AI 0-, AI 1-, AI 2-, and AI 3- together.
8. Without closing the Bank 1 session, complete Steps 3 through 5 for Bank 2 using FD11634-Bank2/ai0:3 as the physical channel.
 9. Close and commit both calibration sessions.

EEPROM Update

When an adjustment procedure is completed, the FieldDAQ device 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:

1. Call the DAQmx Initialize External Calibration function to start a calibration session on the FieldDAQ device. The default password is NI.
2. Call the DAQmx Set Temperature FieldDAQ Calibration function to input the external temperature in degrees Celsius.
3. Call the DAQmx Close External Calibration function to end the session. Set the Action input to Commit.

Reverification

Repeat *Verification* to determine the As-Left status of the device.



Note If any test fails reverification after performing an adjustment, verify that you have met all the conditions listed in *Test Conditions* before returning your device to NI. Refer to *NI 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 $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$
- No nodes share power with the FieldDAQ device under calibration

The test limits listed in Table 3 are derived using the values in the following table.

Table 8. FD-11634 Voltage Accuracy Under Calibration Conditions

Range	As-Found Accuracy		As-Left Accuracy	
	Percent of Reading (Gain Error)	Offset Error	Percent of Reading (Gain Error)	Offset Error
10 V	$\pm 0.08\%$	$\pm 2\text{ mV}$	$\pm 0.01\%$	$\pm 0.94\text{ mV}$
1 V	$\pm 0.10\%$	$\pm 0.3\text{ mV}$	$\pm 0.014\%$	$\pm 0.12\text{ mV}$



Note Values in this table are intended 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 specifications of the FD-11634. For operational specifications, refer to the most recent *FD-11634 Specifications* at ni.com/manuals.

Signal Connector Pinout

Figure 6. FD-11634 Pinout

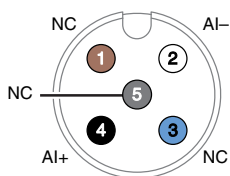


Table 9. Signal Descriptions

Pin Number	Wire Color*	Signal	Description
1	Brown	NC	No connect. Do not connect signals to this terminal.
3	Blue		
5	Gray		
2	White	AI-	Negative analog input signal and TEDS return
4	Black	AI+	Positive analog input signal and TEDS data
* Wire color pertains to SHM125M I/O cables sold through NI. Other manufacturers' cable wire colors may vary.			

Revision History

Table 10. Revision History for the *FD-11634 Calibration Procedure*

Revision	Affected Section	Change(s)
377929A-01 (September 2020)	—	This is the initial release of the <i>FD-11634 Calibration Procedure</i> .

NI Services

Visit ni.com/support to find support resources including documentation, downloads, and troubleshooting and application development self-help such as tutorials and examples.

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377929A-01 September 29, 2020