APEX WAVES

COMPREHENSIVE SERVICES

We offer competitive repair and calibration services, as well as easily accessible documentation and free downloadable resources.

SELL YOUR SURPLUS

We buy new, used, decommissioned, and surplus parts from every NI series. We work out the best solution to suit your individual needs.

〜 Sell For Cash   〜 Get Credit   〜 Receive a Trade-In Deal

OBSOLETE NI HARDWARE IN STOCK & READY TO SHIP

We stock **New, New Surplus, Refurbished,** and **Reconditioned** NI Hardware.

Bridging the gap between the manufacturer and your legacy test system.

☎ **1-800-915-6216**

🌐 **www.apexwaves.com**

✉ **sales@apexwaves.com**

Request a Quote

✉ **CLICK HERE**

FD-11603

CALIBRATION PROCEDURE

FD-11603

8-Channel, ±10 V Voltage Input Device for FieldDAQ

This document contains information for calibrating the FD-11603. For more information about calibration, visit *ni.com/calibration*.

Contents

Software Requirements

Calibrating the FD-11603 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-11603 is listed in the following table.

Table 1. FD-11603 Driver Support

Driver	Earliest Version Support for Device Calibration
NI-DAQmx	18.5

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.

NATIONAL INSTRUMENTS™

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-11603 Quick Start— Provides instructions for installing and configuring your FieldDAQ device.

FD-11603 User Guide—Provides information about your FieldDAQ device.

FD-11603 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-11603. 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 5502A	High-precision voltage source with gain uncertainty of ≤50 ppm and offset uncertainty of ≤50 µV
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-11603 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 8

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-11603 Quick Start*.

   📝 **Note** You must install NI-DAQmx 18.5 or later for device calibration support.

2. Set up the FieldDAQ device as outlined in the *FD-11603 Quick Start*.
3. Configure the FieldDAQ device in Measurement & Automation Explorer (NI MAX) as outlined in the *FD-11603 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
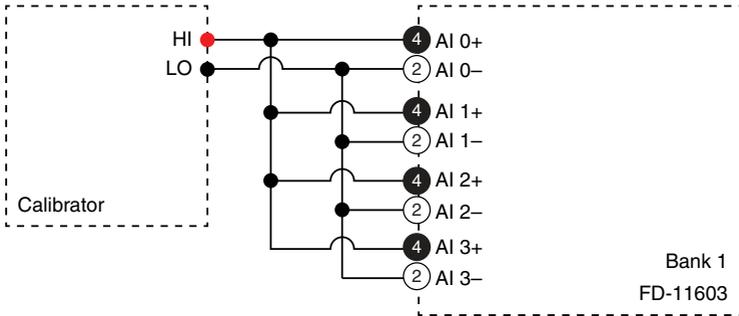
- – Tie AI 0+, AI 1+, AI 2+, and AI 3+ together.
- – Tie AI 0-, AI 1-, AI 2-, and AI 3- together.

Figure 2. Terminating Four Cables to HI and LO
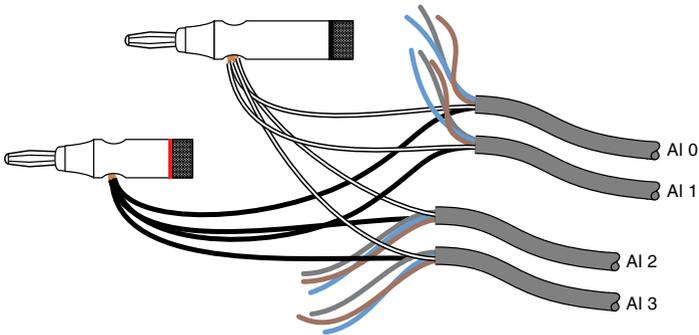
3. Set the calibrator to a reference value determined by the array of recommended calibration voltages indicated in the following table.

Table 3. FD-11603 Test Limits

Test Point		1-Year Limits	
Location	Value (V)	Lower Limit (V)	Upper Limit (V)
Negative Full Scale	-10.0	-10.00475	-9.99525
Mid	0.0	-0.00105	0.00105
Positive Full Scale	10.0	9.99525	10.00475
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-11603 Accuracy Verification Configuration

Physical Channel	Minimum	Maximum	Scaled Units	Channel Configuration
FD11603-Bank1/ai0:3	-10	10	Volts	Differential

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

Table 5. FD-11603 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. Set the calibrator to Standby mode (STBY).
7. Compare the average to the limits in Table 3.
8. Repeat steps 3 through 7 for each test point.
9. Disconnect the calibrator from the FieldDAQ device.
10. Connect the calibrator to Bank 2 of the FD-11603, as shown in the following figure. Refer to *Signal Connector Pinout* for signal connection information.

Figure 3. Bank 2 Verification Connections
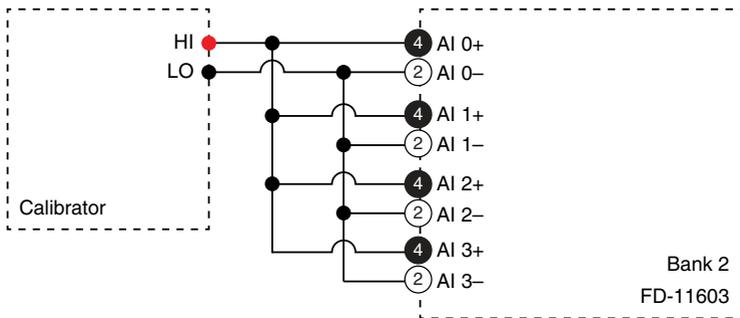
    – Tie AI 0+, AI 1+, AI 2+, and AI 3+ together.
    – Tie AI 0-, AI 1-, AI 2-, and AI 3- together.

11. Complete Steps 3 through 9 for Bank 2 using FD11603-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
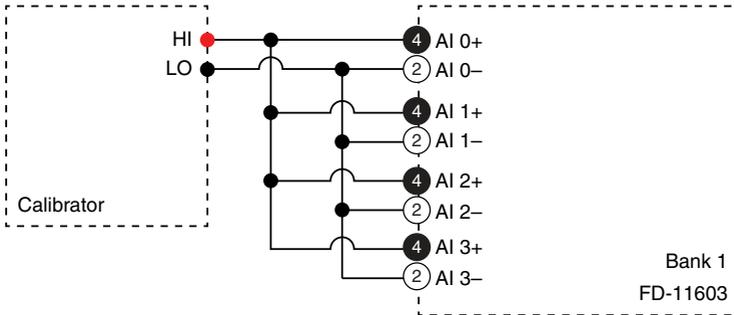
   – Tie AI 0+, AI 1+, AI 2+, and AI 3+ together.
   – Tie AI 0-, AI 1-, AI 2-, and AI 3- together.
3. Initialize a calibration session on the FieldDAQ device. The default password is `NI`.
4. Adjust the FieldDAQ device voltage.
   a. Input the external temperature in degrees Celsius using the Set Temperature FieldDAQ function.
   b. Call the Get FD-11603 Calibration Adjustment Points function.
   c. Set the calibrator to a reference value determined by the array of adjustment points.
   d. Set the calibrator to Operate mode (OPR).
   e. Call and configure the Adjust FD-11603 Calibration function according to the following table.

Table 6. Adjustment Configuration

Physical Channel	Reference Value
FD11603-Bank1/ai0:3	A reference value from the array of adjustment points

   f. Set the calibrator to Standby mode (STBY).
   g. Repeat steps d through f for each calibration voltage in the array.
5. Disconnect the calibrator from the FieldDAQ device.
6. Connect the calibrator to Bank 2 of the FD-11603, as shown in the following figure. Refer to *Signal Connector Pinout* for signal connection information.

Figure 5. Bank 2 Adjustment Connections
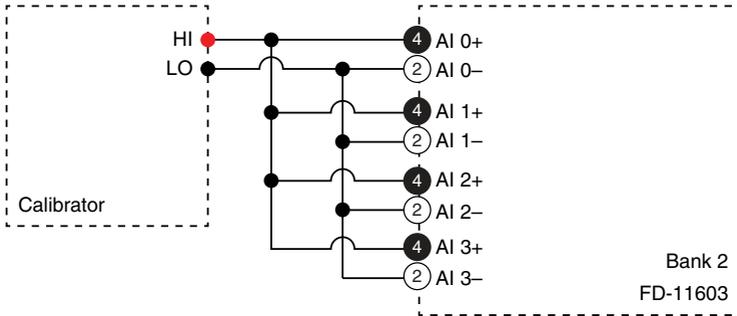
- – Tie AI 0+, AI 1+, AI 2+, and AI 3+ together.
- – Tie AI 0-, AI 1-, AI 2-, and AI 3- together.
7. Without closing the Bank 1 session, complete Steps 3 through 5 for Bank 2 using FD11603-Bank2/ai0:3 as the physical channel.
8. Close and commit both calibration sessions.

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 *Where to Go for Support* 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 °C ± 5 °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 7. FD-11603 Voltage Accuracy Under Calibration Conditions

Percent of Reading (Gain Error)	Percent of Range (Offset)
±0.037%	±1.05 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-11603. For operational specifications, refer to the most recent *FD-11603 Specifications* at *ni.com/manuals*.

Signal Connector Pinout

Figure 6. FD-11603 Pinout
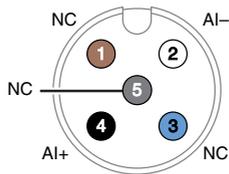
Table 8. Signal Descriptions

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 voltage signal
4	Black	AI+	Positive analog input voltage signal
* Wire color pertains to SHM125M I/O cables sold through NI. Other manufacturers' cable wire colors may vary.			

Where to Go for Support

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.

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* 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/niglobal* to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.