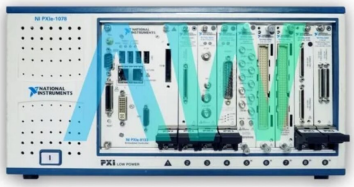

APEX WAVES FD-11613 Temperature Input Device for FieldDAQ User Manual

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Contents

Software Requirements

Calibrating the FD-11613 or FD-11614 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-11613 or FD-11614 is listed in the following table.

Table 1. FD-11613/11614 Driver Support

Driver	Earliest Version Support for Device Calibration
NI-DAQmx	18.1

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-11613/11614 Quick Start —Instructions for installing and configuring your FieldDAQ device.

FD-11613 User Guide or FD-11614 User Guide—Information about your FieldDAQ device.

FD-11613 Specifications or FD-11614 Specifications—Detailed specifications for your FieldDAQ device.

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.

NI-DAQmx C Reference Help—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-11613 or FD-11614. 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 locked in the 3.3 V range	A high-precision voltage source with an uncertainty of ≤70 ppm when sourcing up to 50 µA.
Mini TC (x8)	Omega SMPW-U-M	U type

Test Conditions

The following setup and environmental conditions are required to ensure the FD-11613/11614 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
2. Verification
3. Adjustment
4. EEPROM Update
5. Reverification

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-11613/11614 Quick Start.

   Note You must install NI-DAQmx 18.1 or later for device calibration support.
2. Set up the FieldDAQ device as outlined in the FD-11613/11614 Quick Start.
3. Configure the FieldDAQ device in Measurement & Automation Explorer (NI MAX) as outlined in the FD-11613/11614 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**.

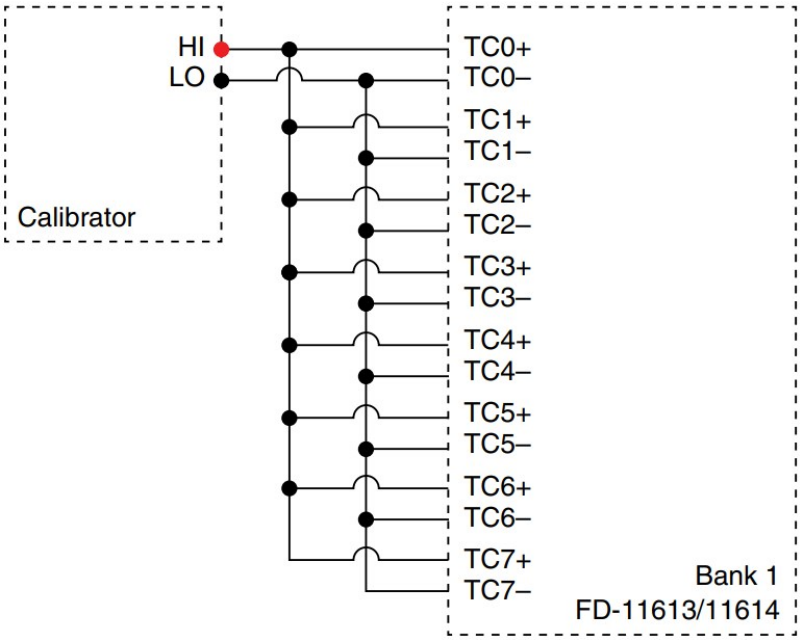
Reserving the Device in MAX
When the FieldDAQ device is connected to a network, multiple users can access the device. To perform any DAQ functionality on the device, including reset and self-test, you must reserve the device in MAX. In MAX, an unreserved device or device reserved by another host appears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

Verification

The following performance verification procedures describe the sequence of operation and test points required to verify the FieldDAQ device. The verification procedures assume that adequate traceable uncertainties are available for the calibration references. Complete the following procedure to determine the As-Found status of the FieldDAQ device.

1. Connect the calibrator to Bank 1 of the FieldDAQ device, as shown in the following figure.

   Figure 1. Bank 1 Voltage Channel Verification Connections



2. On the calibrator, lock the voltage range to 3.3 V to reduce loading error.

   a. Set the output voltage to 2.0 V.

   b. Press the 3.3 V auto button to lock the 3.3 V range.

3. Set the calibrator output to a Test Point value indicated in the following table.

   Table 3. FD-11613/11614 Voltage Verification Test Limits for Positive and Negative Test

ADC Timing Mode	Range (mV)		Test Point		1-Year Limits (mV)	
	Minimum	Maximum	Location	Value (mV)	Lower Limit	Upper Limit
High Resolution	-78.125	78.125	Negative FS	-70	-70.030	-69.970
			Positive FS	70	69.970	70.030
Best 50 Hz Rejection	-78.125	78.125	Negative FS	-70	-70.030	-69.970
			Positive FS	70	69.970	70.030
Best 60 Hz Rejection	-78.125	78.125	Negative FS	-70	-70.030	-69.970
			Positive FS	70	69.970	70.030
High Speed	-78.125	78.125	Negative FS	-70	-70.039	-69.961
			Positive FS	70	69.961	70.039
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-11613/11614 Voltage Channel Configuration

Physical Channel	Input Range (mV)		Units	Terminal Configuration
	Minimum	Maximum		
FD11613-Bank1/ai0:7 or FD11614-Bank1/ai0:7	-78.125	78.125	Volts	Differential

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

Table 5. FD-11613/11614 Voltage Channel Timing Configuration

ADC Timing Mode	Sample Mode	Samples to Read	Rate (S/s)	Timeout (s)
High Resolution	Finite	20	1.8	30
Best 50 Hz Rejection	Finite	80	7.1	30
Best 60 Hz Rejection	Finite	100	8.3	30
High Speed	Finite	1,000	85	30

c. Start the task.

d. Read the samples and average the readings.

e. Clear the task.

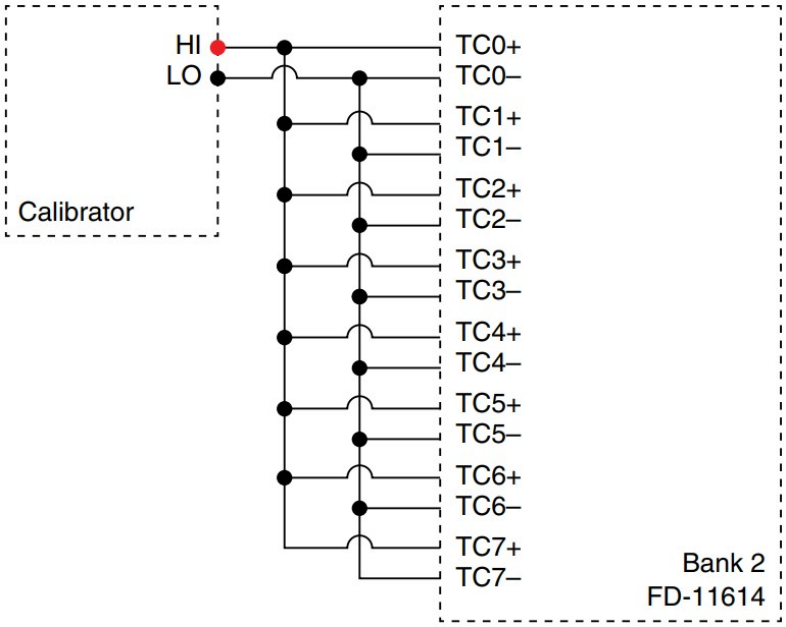
6. Set the calibrator to Standby mode (STBY).
7. Compare the average to the limits in Table 3.
8. Repeat steps 3 through 7 for each test point.
9. Repeat steps 3 through 8 for each ADC timing mode on the FieldDAQ device (High Resolution, Best 50 Hz Rejection, Best 60 Hz Rejection, and High Speed).
10. Disconnect the calibrator from the FieldDAQ device.
11. Short all TC+ and TC- terminals on the FieldDAQ device together.
12. Acquire and average samples.
    a. Create and configure an AI voltage channel on the FieldDAQ device according to Table 3.
    b. Configure the AI voltage channel timing according to Table 4.
    c. Start the task.
    d. Read the samples from each channel and average the readings.
    e. Clear the task.
13. Compare the average to the limits in the following table.

Table 6. FD-11613/11614 Voltage Verification Test Limits for Zero Test Points

ADC Timing Mode	Range (mV)		Test Point		1-Year Limits (mV)	
	Minimum	Maximum	Location	Value (mV)	Lower Limit	Upper Limit
High Resolution	-78.125	78.125	Zero	0	-0.0044	0.0044
Best 50 Hz Rejection	-78.125	78.125	Zero	0	-0.0045	0.0045
Best 60 Hz Rejection	-78.125	78.125	Zero	0	-0.0045	0.0045
High Speed	-78.125	78.125	Zero	0	-0.0049	0.0049
The test limits in this table are derived using the values listed in ***Accuracy Under Calibration Conditions***.						

14. Repeat steps 12 through 13 for each ADC timing mode on the FieldDAQ device.
15. Disconnect the short from the TC channels.
16. (FD-11614) Connect the calibrator to Bank 2 of the FD-11614, as shown in the following figure.

Figure 2. Bank 2 Voltage Channel Verification Connections



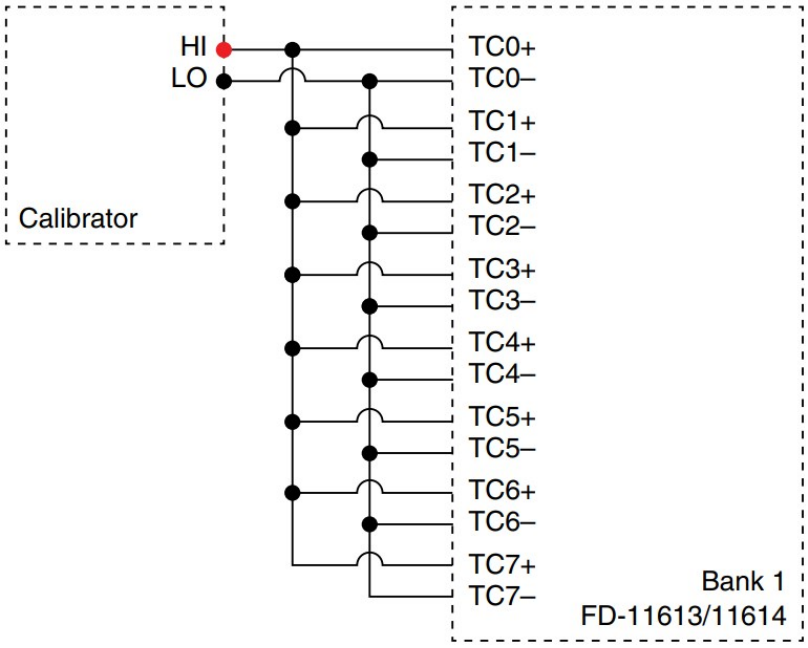
17. (FD-11614) Complete Steps 2 through 15 for Bank 2 using FD11614-Bank2/ai0:7 as the physical channel.

Adjustment

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

1. Connect the calibrator to Bank 1 of the FieldDAQ device, as shown in the following figure.

   Figure 3. Bank 1 Voltage Channel Adjustment Connections



2. Initialize a calibration session on the FieldDAQ device. The default password is NI.
3. Adjust the FieldDAQ device voltage.

   a. Input the ambient temperature in degrees Celsius using the Set Temperature FieldDAQ function.

   b. Call the DAQmx Get 11613 Calibration Adjustment Points or DAQmx Get 11614 Calibration Adjustment Points function.

   c. On the calibrator, lock the voltage range to 3.3 V to reduce loading error.

   d. Set the calibrator to the first reference value determined by the array of adjustment points.

   e. Set the calibrator to Operate mode (OPR).

   f. Call and configure the DAQmx Adjust 11613 Calibration or DAQmx Adjust 11614 Calibration function

according to the following table.

Table 7. Voltage Adjustment Configuration

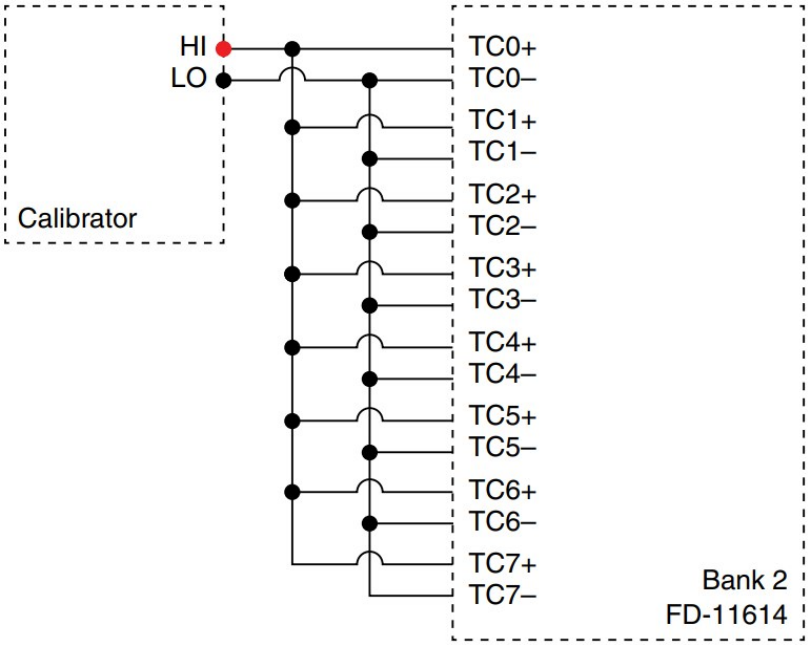
Physical Channel	Reference Value
FD11613-Bank1/ai0:7 or FD11614-Bank1/ai0:7	A reference value from the array of adjustment points

g. Set the calibrator to Standby mode (STBY).

h. Repeat steps d through g for each reference value in the array of adjustment points.

4. Disconnect the calibrator from the FieldDAQ device.
5. (FD-11614) Connect the calibrator to Bank 2 of the FD-11614, as shown in the following figure.

Figure 4. Bank 2 Voltage Channel Adjustment Connections



6. (FD-11614) Without closing the Bank 1 session, complete Steps 2 through 4 for Bank 2 using FD11614-Bank2/ai0:7 as the physical channel.
7. (FD-11613) Close and commit the calibration session. (FD-11614) 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 the all 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 Tables 3 and 6 are derived using the values in the following table.

Table 8. FD-11613/11614 Voltage Accuracy Under Calibration Conditions

Mode	±PPM of Reading	±PPM of Range*
High Resolution	362	55.9
Best 50 Hz Rejection	365	56.9
Best 60 Hz Rejection	365	56.9
High Speed	487	62.3
* Range = 78.125 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-11613 or FD-11614. For operational specifications, refer to the most recent FD-11613 Specifications or FD-11614 Specifications at **ni.com/manuals**.

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.

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Documents / Resources

	APEX WAVES FD-11613 Temperature Input Device for FieldDAQ [pdf] User Manual FD-11613, FD-11614, FD-11613 Temperature Input Device for FieldDAQ, FD-11613, Temperature Input Device for FieldDAQ, Temperature Input Device, Input Device, Device

References

- Engineer Ambitiously - NI
- Engineer Ambitiously - NI
- Calibration Services - NI
- Software and Driver Downloads - NI
- Trade Compliance - NI
- Product Documentation - NI
- National Instruments Patents - NI
- Support - NI
- NI Trademarks and Logo Guidelines - NI
- Calibration Services - NI
- Product Documentation - NI
- Contact Us - NI
- Support - NI
- NI-DAQ™mx Download - NI
- FD-11614 National Instruments Temperature Input Device for FieldDAQ | Apex Waves