

## USER GUIDE

# Calibrating FieldPoint™ Analog Input Modules with Calibration Executive

This document contains step-by-step instructions for loading and running National Instruments Calibration Executive to calibrate FieldPoint analog input (AI) modules, including the FP-AI-100, FP-AI-110, FP-AI-111, FP-RTD-122, and FP-TC-120.

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# Equipment and Other Test Requirements

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This section describes the equipment, documentation, software, and test conditions you need to calibrate a FieldPoint module using Calibration Executive.

## Test Equipment

Calibration requires using a high-precision calibrator with the voltage accuracy in parts per million (ppm) listed in Table 1.

NI recommends that you use the following instruments for calibration:

**Table 1.** Test Equipment Specifications and Recommended Models

FieldPoint Module	Required Accuracy	Recommended Instrument
FP-AI-100	500 ppm	Fluke 5500A
FP-AI-110	100 ppm	Fluke 5500A
FP-AI-111	100 ppm	Fluke 5500A
FP-RTD-122	6.5 digits	NI-4070
FP-TC-120	30 ppm	Fluke 5520A

- FieldPoint FP-1000 serial network module
- FP-TB-CAL FieldPoint Calibration Terminal Base (part number 777519-90), a modified FieldPoint base that enables you to write new calibration constants to the module EEPROM
- 11–24 V power supply—NI PS-2 power supply
- RS-232 serial cable

If the recommended instrument is not available, use the accuracy specifications to choose a substitute calibration standard.

## Documentation

This section describes the documentation you need to calibrate a FieldPoint AI module. In addition to this calibration procedure, you may need to refer to the following documentation:

- *Calibration Executive Software User Manual*
- *FP-1000/1001 User Manual*
- *FP-1000/1001 Quick Start Guide*
- Operating instructions for the AI module

You can download these documents from the NI Web site at [ni.com/manuals](http://ni.com/manuals).

## Software

The Calibration Executive setup program installs Calibration Executive, the FieldPoint software, and the associated files listed in Table 2. Refer to the *Calibration Executive Software User Manual* for more information about installing and uninstalling Calibration Executive software and procedures.

**Table 2.** Calibration Executive Directories and Supporting Files

Directory Name	Contents
Calibration Executive\Procedures\FP-XX-XXX\Limits	Microsoft Access database that stores the calibration limits for FieldPoint AI modules (excluding FP-TC-120)
Calibration Executive\Procedures\FP-XX-XXX	Directory structure that contains the calibration procedures
Calibration Executive\Procedures\FP-XX-XXX\Support Files	Required support files

## Test Conditions

Follow these guidelines to optimize connections and test conditions during calibration:

- Keep connections to the module short. Long cables and wires act as antennae, picking up extra noise that can affect measurements.
- Use shielded copper wire for all cable connections to the device. Use twisted-pair wire to eliminate noise and thermal offsets.
- Maintain a temperature between 18 and 28 °C. If you intend to operate the module at a specific temperature outside this range, calibrate the module at that temperature.

- Keep relative humidity below 80%.
- Allow a warm-up time of at least 15 minutes to ensure that the measurement circuitry is at a stable operating temperature.

## Calibration Procedures

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This section explains how to configure and set up the module for calibration, and how to run the Calibration Executive procedure. Refer to Table 3 for the approximate times to complete the procedure in both automated and manual modes.

**Table 3.** Approximate Time to Complete Calibration Executive Procedure

Module	Automated Mode	Manual Mode
FP-TC-120	20 minutes	45 minutes
FP-AI-100	120 minutes	180 minutes
FP-AI-110	45 minutes	90 minutes
FP-AI-111	60 minutes	90 minutes
FP-RTD-122	10 minutes	10 minutes

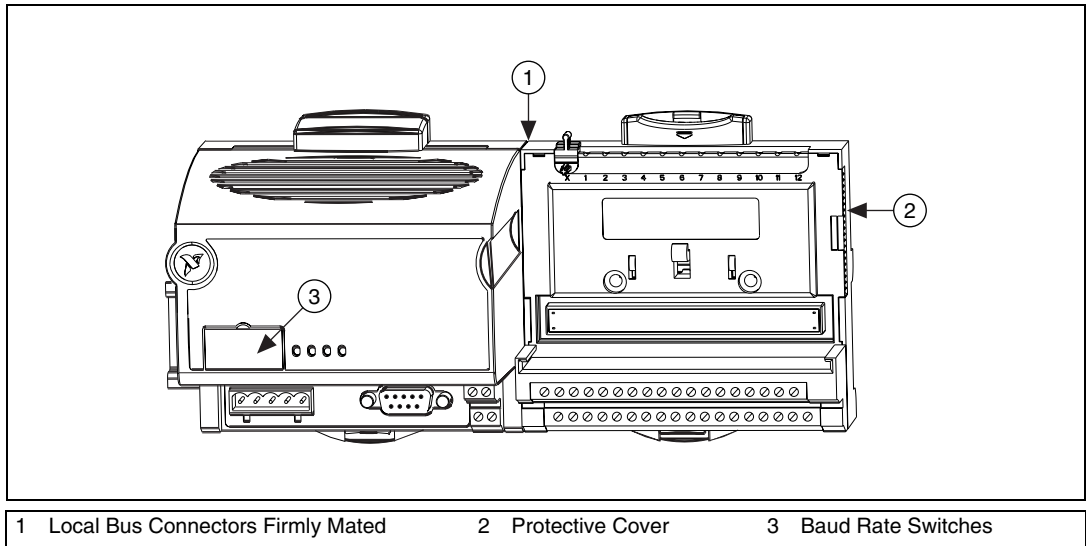


**Note** For an explanation of automated versus manual calibration, refer to the *Automated Versus Manual Calibration* section of the *Calibration Executive Software User Manual*.

# Configuring the FieldPoint AI Module for Calibration

Complete the following steps to build the FieldPoint bank:








1. Attach the network module to the FP-TB-CAL as shown in Figure 1.



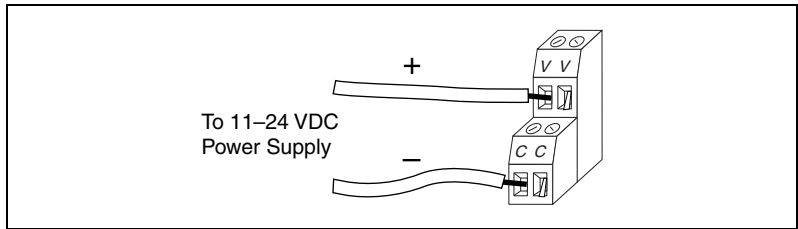
**Figure 1.** Connecting FieldPoint Terminal Bases

2. Install the FieldPoint AI module on the calibration terminal base as described in the module operating instructions.
3. Connect the bank to the host computer using an RS-232 cable.
4. Use the DIP switches on the network interface module to select a baud rate that your computer supports. Table 4 shows the available baud rates. The default baud rate for the FP-1000 is 115,200, which provides the fastest performance. You do not need to change this setting unless you experience communication problems.

**Table 4.** Baud Rate Switch Settings for the FP-1000/1001

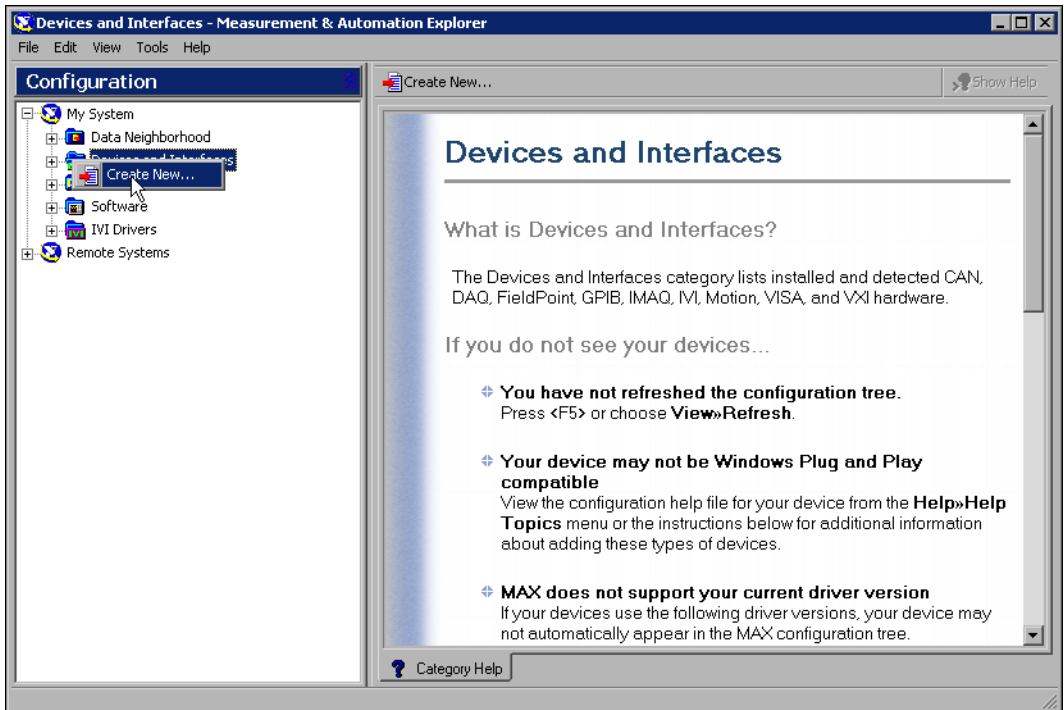
Switch Positions 6–8	Network Module Baud Rate
	300
	1,200
	2,400
	9,600
	19,200
	38,400
	57,600
	115,200

5. Connect the positive wire of the power supply to the first V terminal of the network module. Connect the negative wire of the power supply to the first C terminal of the FP-1000 network module as shown in Figure 2.

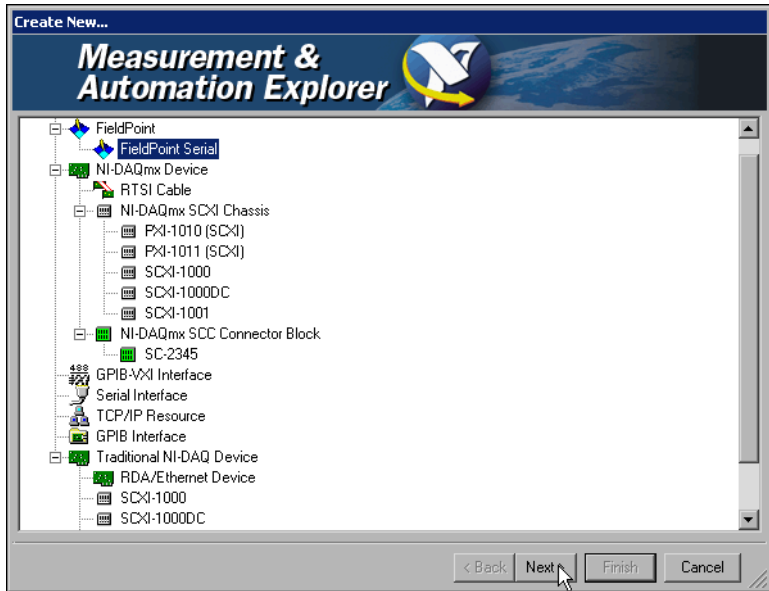


**Figure 2.** FP-1000/1001 Power Connector Pinout

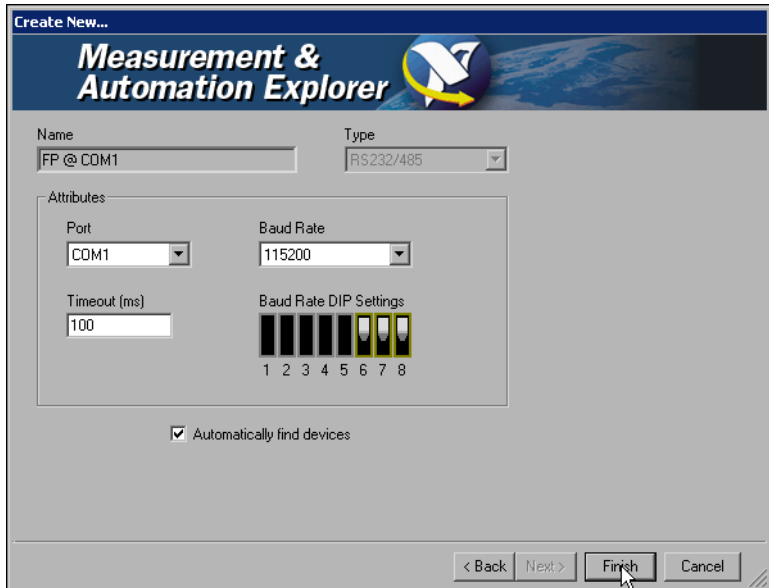
6. Launch Measurement & Automation Explorer (MAX).
7. In the MAX configuration tree, right-click **Devices and Interfaces** and select **Create New**.



8. Select **FieldPoint Serial**, then click **Next**.

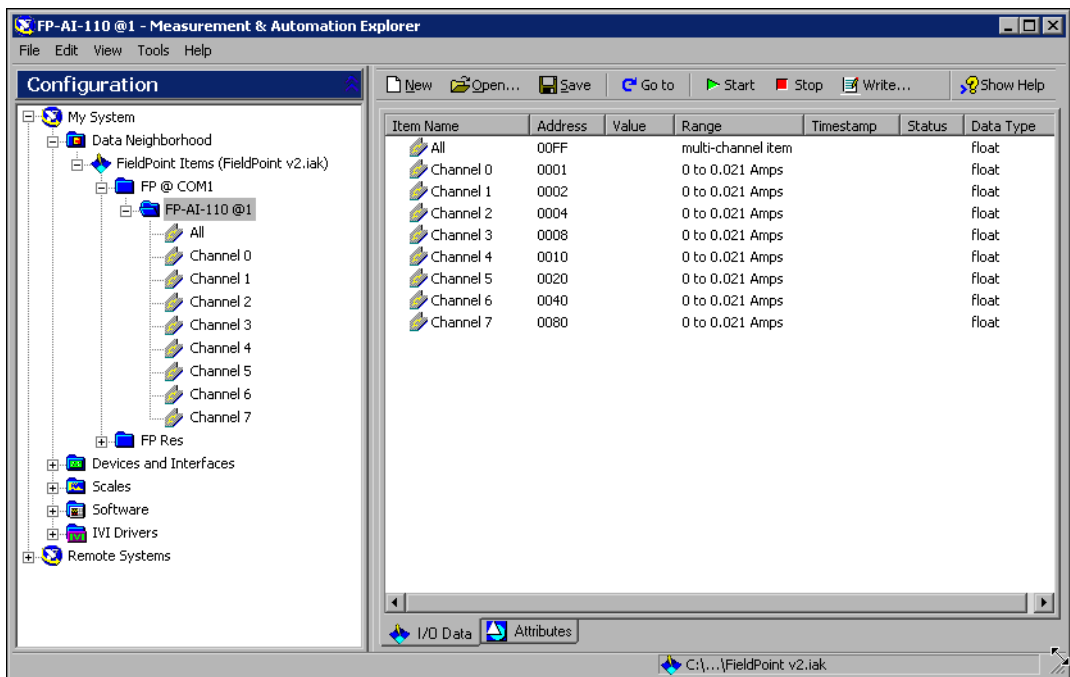


9. Change the serial configuration if you need to, then click **Finish**.





- Under **My System»Data Neighborhood**, expand the configuration tree until the I/O module you want to calibrate appears. If you do not see the module, the network module is not communicating properly with either the host or the I/O module. Check the connections and try again.



- Close MAX before you go on to the next section. You do not need to save the .iak file.

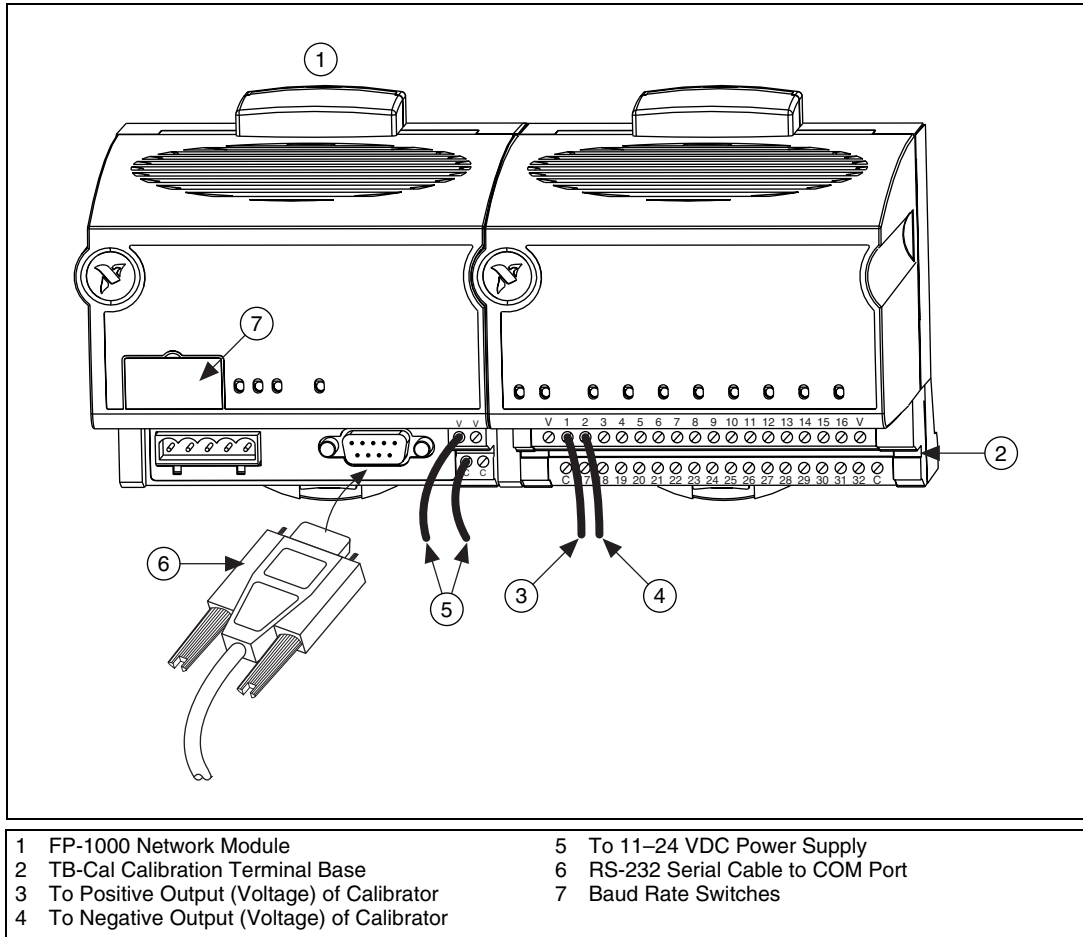


**Caution** You *must* close MAX and keep it closed during the remainder of this procedure to prevent a system crash.

## Connecting the Calibrator to an FP-TC-120 Module

If you are calibrating the FP-TC-120, make the following connections as shown in Figure 3:

1. Connect the positive output (voltage) of the calibrator to terminal 1 of the calibration terminal base.
2. Connect the negative output (voltage) of the calibrator to terminal 2 of the calibration terminal base.



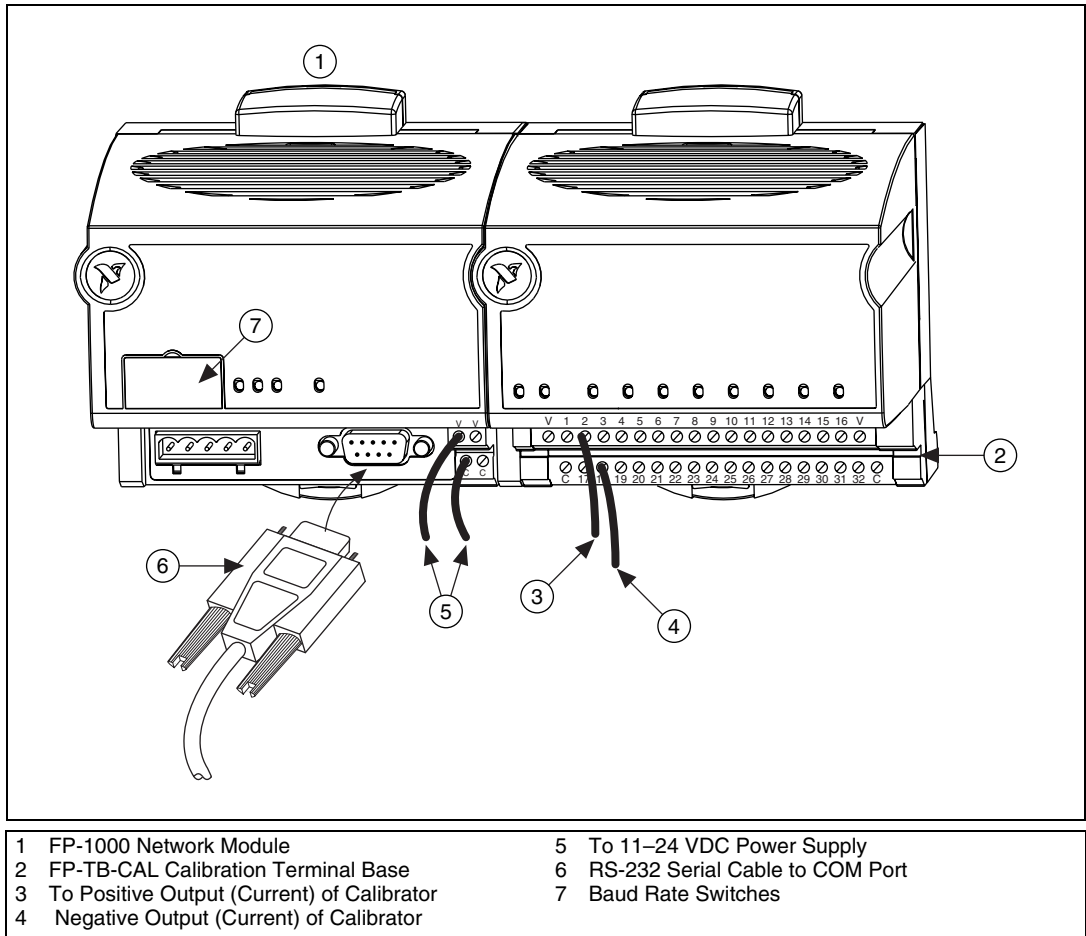
**Figure 3.** FP-TC-120 Connections to Calibrator

## Connecting the Calibrator to an FP-AI-1xx Module

If you are calibrating an FP-AI-100, FP-AI-110, or FP-AI-111 module, make the connections shown in Figure 4.

1. Connect the positive output (current) of the calibrator to terminal 2 of the calibration terminal base.
2. Connect the negative output (current) of the calibrator to terminal 18 of the calibration terminal base.

While the Calibration Executive procedure runs, you are prompted to make additional connections between the calibrator and the module you are calibrating. Follow the onscreen instructions at each prompt.

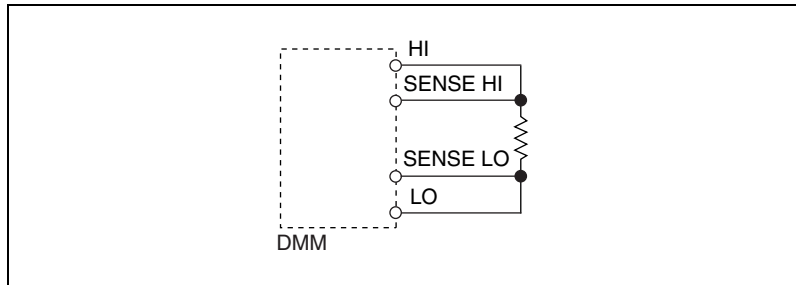


**Figure 4.** FP-AI-1xx Connections to Calibrator for Current Offset Testing

## Using Precision Resistors to Calibrate an FP-RTD-122 Module

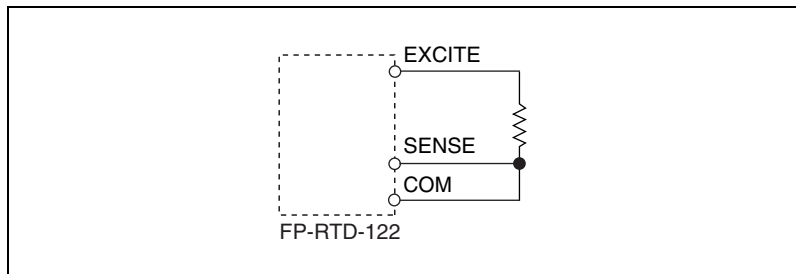
Calibrating the FP-RTD-122 requires four precision resistors with less than 25 ppm/°C temperature drift. The resistors must be of the following values: 100  $\Omega$ , 350  $\Omega$ , 1 k $\Omega$ , and 3.5 k $\Omega$ .

Use the DMM to determine the real value of each reference resistor. Take four-wire measurements, connecting the DMM to each resistor as shown in Figure 5.



**Figure 5.** Connecting the DMM to a Resistor

When you run the calibration procedure, Calibration Executive prompts you to connect each resistor to channel 0 of the FP-RTD-122 and enter the actual resistance value of each resistor. Connect each resistor as shown in Figure 6.



**Figure 6.** Connecting the FP-RTD-122 to a Resistor

## Running the Calibration Executive Procedure

To run the Calibration Executive procedure, complete the following steps:

1. Launch Calibration Executive and follow the instructions in the Calibration Configuration Wizard to load the appropriate FieldPoint calibration procedure for the module. Refer to the *Calibration Executive Software User Manual* if you need more information on configuring and loading a calibration procedure.
2. Enter the following information about the installed hardware when prompted by Calibration Executive:
  - **Selected Calibrator Information**—The calibrator you are using for this calibration procedure (for example, the Fluke 5700A).
  - **Available Address**—Select *None* if you are using the manual mode; otherwise, select the GPIB address of the calibrator.
3. When the procedure is loaded, click **Run Procedure** to begin.
4. Enter the following information in the first dialog box, which is titled *FieldPoint Bank Configuration*:
  - **Baud Rate**—The correct rate from Table 4 to communicate with the network module.
  - **COM Port Number**—The serial port used to connect to the FP-1000 network module, for example, COM1, COM2, and so on.
  - **Device Number**—The address of the I/O module you want to verify or calibrate. The first module to the right of a network module has an address of 1.

If you enter a value incorrectly, Calibration Executive prompts you to re-enter the information.

5. Follow any instructions you receive from Calibration Executive.

After the procedure finishes, complete the following steps to see the calibration report:

1. Click **View»Reports**.
2. Select **View** to launch your browser and view the report. The calibration report appears as a printable HTML file.

You have completed calibrating your FieldPoint AI module with Calibration Executive.



**Note** If the FieldPoint AI module fails after calibration, return it to NI for repair or replacement.

# Troubleshooting and Common Questions

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**When I change the baud rate of the FP-1000 and run the Calibration Executive procedure, a dialog box prompts me to re-enter the correct baud rate. How do I do that?**

Power down the FP-1000, then power it up again to enable the new settings that you entered.

**Some test points fail even after I run the Calibration Executive procedure. What can I do to correct this problem?**

Before running the Calibration Executive procedure, allow the FieldPoint bank to warm up at least 15 minutes to ensure accurate readings. Also, make sure you are using shielded copper wire for all cable connections to the module.

**In the FP-AI-100 current offset test, my test points are significantly out of specification. What causes this problem?**

The voltage terminals (1, 3, 5, 7, 9, 11, 13, and 15) on the calibration base may still be connected together from the voltage offset test. Disconnect all the wires that connect these terminals before attempting the current offset test.

**Communication with the FieldPoint AI module times out. What causes this to happen?**

The watchdog timer on the FP-1000 may be enabled. Refer to the *FP-1000/1001 User Manual* to find out how to disable the watchdog timer.

## Technical Support Resources

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### NI Web Support

National Instruments Web support is your first stop for help in solving installation, configuration, and application problems and questions. Online problem-solving and diagnostic resources include frequently asked questions, knowledge bases, product-specific troubleshooting wizards, manuals, drivers, software updates, and more. Web support is available through the Technical Support section of [ni.com](http://ni.com).

# Worldwide Support

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Germany 49 0 89 741 31 30, India 91 80 51190000,  
Israel 972 0 3 6393737, Italy 39 02 413091, Japan 81 3 5472 2970,  
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New Zealand 0800 553 322, Norway 47 0 66 90 76 60,  
Poland 48 22 3390150, Portugal 351 210 311 210,  
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