

# CALIBRATING THE SCXI™-1120/1120D WITH CALIBRATION EXECUTIVE

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# Introduction

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This document contains information and step-by-step instructions for loading and running a calibration procedure for the SCXI-1120/1120D module using Calibration Executive.

## What Is Calibration?

*Calibration* consists of verifying the measurement accuracy of a module and adjusting for any measurement error. *Verification* is measuring performance of a module and comparing the results to the factory specifications. National Instruments Calibration Executive automates the verification and adjustment of your National Instruments measurement modules.

## Why Should You Calibrate?

The accuracy of electronic components drifts with time and temperature, which can affect measurement accuracy of the module. Calibration restores your module to its specified accuracy and ensures that it still meets National Instruments standards.

## How Often Should You Calibrate?

The measurement accuracy requirements of your application determine how often you should calibrate your SCXI-1120/1120D module. National Instruments recommends that you perform a complete calibration at least once every year. You can shorten this interval to 90 days or six months based on the demands of your application.

# Equipment and Other Test Requirements

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This section describes the equipment, documentation, and test conditions needed for calibration.

## Test Equipment

Calibration requires using a high-precision voltage standard with an accuracy of at least 50 ppm, a multiranging 5 1/2 digit digital multimeter (DMM) with an accuracy of 500 ppm, and an E Series data acquisition (DAQ) device.

The calibration procedure runs in automated mode if you use NI-IVI-supported DMMs and calibrators. National Instruments recommends you use the following equipment:

- Calibrator—Fluke 5700A
- DMM—HP34401A
- 16-bit National Instruments E Series DAQ device

If you do not have these instruments, use the accuracy requirements listed above to select a substitute calibration standard.



**Note** For an explanation of automated versus manual calibration, refer to the *Automated Versus Manual Calibration* section in Chapter 2, *Calibration Executive System Overview*, of your *Calibration Executive Software User Manual*.

## Connectors

Although you can run the Calibration Executive procedure without any special connectors, connecting and disconnecting your calibration hardware is easier with the correct equipment. If you do not have custom connection hardware, you may need the following connectors:

- Terminal block such as the National Instruments SCXI-1320, SCXI-1327, or SCXI-1328
- SCXI-1349 shielded cable assembly, which includes an SH68-68-EP shielded cable and a cable adapter
- 50-pin ribbon cable
- 50-pin connector block such as the CB-50

# Documentation

This section describes the documentation you need to calibrate your SCXI-1120/1120D module. The following documents contain information on installing and using Calibration Executive and your SCXI-1120/1120D module:

- *Calibration Executive Software User Manual*
- *Getting Started with SCXI*
- *DAQ Quick Start Guide*
- *SCXI Quick Start Guide*
- *SCXI-1120/D User Manual*

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

# Software

Complete the following steps to install Calibration Executive:

1. Make sure that your computer and monitor are powered on and that you have installed Windows 2000/NT/Me/9x.
2. Close all open applications.
3. Insert the installation CD into the CD-ROM drive.
4. Choose the **Run** option from the **Start** menu on the desktop task bar.
5. In the command line box, type `x:\setup.exe` (where *x* is the letter of the CD-ROM drive you are using), and click **OK**.
6. Follow the instructions that appear in the dialog boxes.

The setup program installs Calibration Executive as well as the associated files listed in Table 1.

**Table 1.** Calibration Executive Directories and Supporting Files

Directory Name	Contents
Calibration Executive\Procedures\SCXI-1120\Limits	Microsoft Access database that stores the calibration limits.
Calibration Executive\Procedures\SCXI-1120\Support Files	Directory structure that contains the calibration procedures.
Calibration Executive\Procedures\SCXI-1120\Support Files	Required support files.

## Test Conditions

Follow these guidelines to optimize the connections and the environment during calibration:

- Keep connections to the SCXI module as short as possible. Long cables and wires act as antennae, which conduct extra noise that can affect measurements.
- Use shielded copper wire for all cable connections to the module. Use twisted-pair wire to eliminate noise and thermal offsets.
- Maintain a temperature between 18 and 28 °C.
- Keep relative humidity below 80%.
- Allow a warm-up time of at least 30 minutes for the SCXI module and the E Series DAQ device to ensure that the measurement circuitry is at a stable operating temperature.

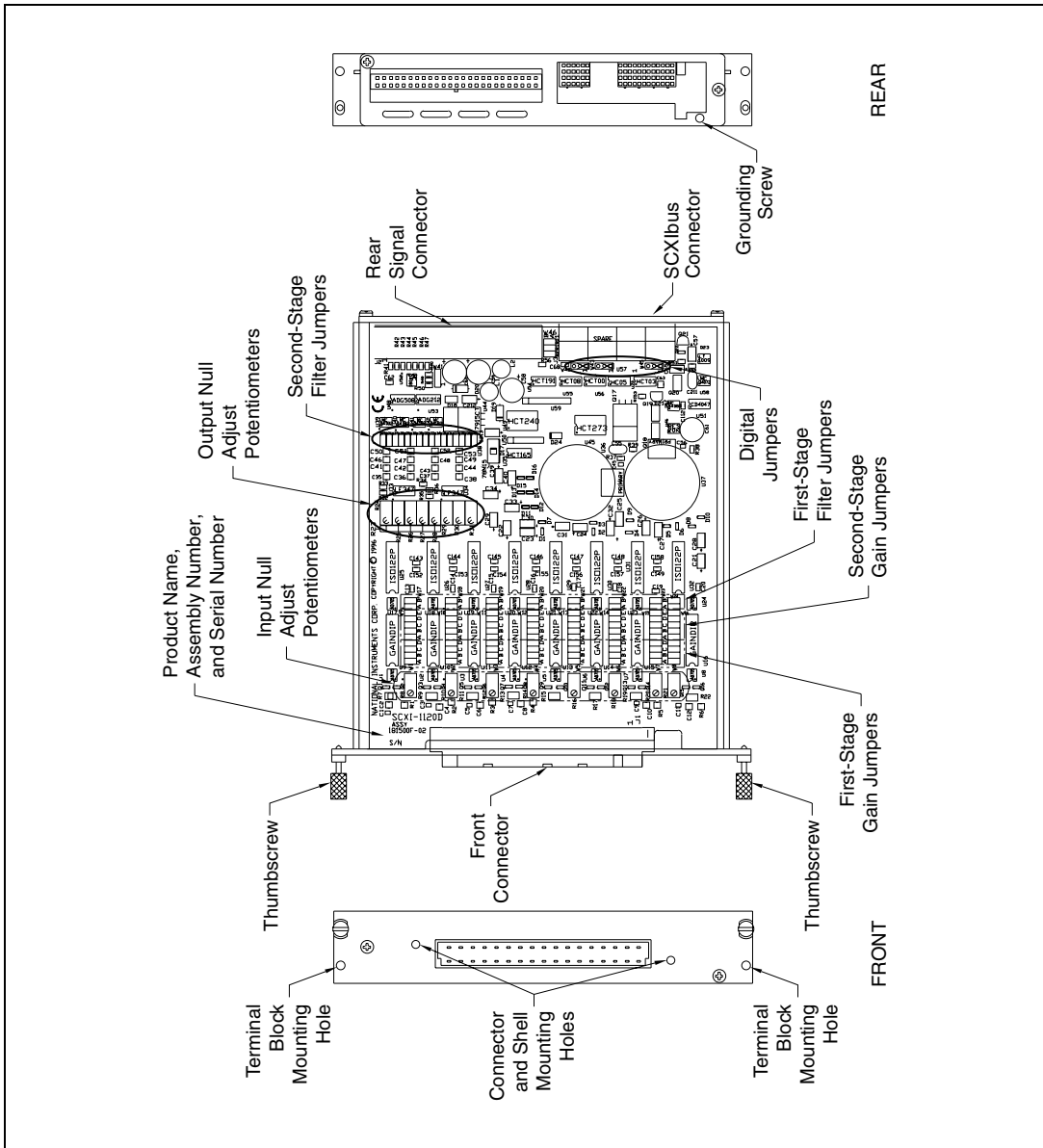
## Calibration Procedures

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This section explains how to configure jumper settings, set up your module for calibration, and run the Calibration Executive procedure. In automated mode, the calibration procedure should take approximately one hour. In manual mode, the calibration procedure can take as long as two hours.

### Configuring Your Module for Calibration

This section describes how to configure the digital jumper settings, gain jumper settings, and filter jumper settings of your SCXI-1120/1120D module for the Calibration Executive procedure. Refer to Figure 1 and 2 to locate the jumpers on the SCXI-1120/1120 D module.



**Figure 1.** SCXI-1120/1120D Parts Locator Diagram

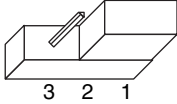
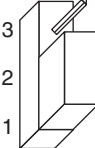
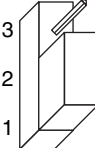
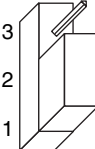
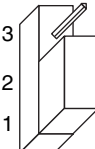
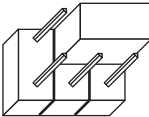


**Note** If you move any jumpers, be sure to restore them to their original positions after calibration.

## Configuring Digital Jumpers

Configure jumpers W41 through W46 as shown in Table 2.

**Table 2.** Digital Jumper Settings

Jumper	Description	Configuration
W41	Position 1—Temperature sensor accessed in MTS mode (factory-default setting).	
W42	Position 1—Connects pullup to SERDATOUT (factory-default setting). Applies only to SCXI-1120 Revisions C or later and all SCXI-1120D modules.	
W43	Position 1—Connects MISO to SERDATOUT (factory-default setting).	
W44	Connects SLOT0SEL* to the SCXIbus INTR* line after buffering (factory-default setting). Applies to Revision A and B of the SCXI-1120 modules only.	
W45	Factory-default setting.	
W46	B-ROR1—Factory-default setting in parking position.	

## Configuring Gain Jumpers

Each input channel has two user-configurable gain stages. The first-stage gain provides gains of 1, 10, 50, and 100. The second-stage gain provides gains of 1, 2, 5, 10, and 20.

Table 3 shows the jumpers for gain selection associated with each channel.

**Table 3.** SCXI-1120/1120D Gain Jumper Allocation

Input Channel Number	First-Stage Gain Jumper	Second-Stage Gain Jumper
0	W1	W9
1	W2	W10
2	W3	W11
3	W4	W12
4	W5	W13
5	W6	W14
6	W7	W15
7	W8	W16

Table 4 shows how to position each jumper to select the desired gain for each channel.

**Table 4.** SCXI-1120/1120D Gain Jumper Positions

Gain	Setting	Jumper Position
First-Stage	1	D
	10	C
	50	B
	100	A
Second-Stage	1	A
	2	B
	5	C
	10	D
	20	E



To change the gain setting of a specified channel on the module, move the appropriate jumper on your module to the position indicated in Table 4.



**Note** The SCXI-1120D has an additional fixed pre-stage gain of 0.5.

The order of the settings for the first- and second-stage does not matter as long as the first stage gain multiplied by the second stage gain—multiplied by 0.5 when using the SCXI-1120D—equals the desired final gain value.

- SCXI-1120—To determine the overall gain of a given channel on the SCXI-1120, multiply the gain selection of the first stage by the gain selection of the second stage.
- SCXI-1120D—To determine the overall gain of a given channel on the SCXI-1120D, multiply the gain selection of the first stage by the gain selection of the second stage and then multiply that product by 0.5.

## Configuring SCXI-1120 Filter Jumpers

This section describes how to configure the filter jumpers on your SCXI-1120. During the Calibration Executive procedure, keep this information available for reference.

The SCXI-1120 module also has two-stage filtering. The first stage is located in the isolated section of the input channel. The second stage is located in the non-isolated section of your input channel. Two-stage filtering eliminates the noise generated by the isolation amplifier, producing a higher signal-to-noise ratio. Two filter bandwidths are available on the SCXI-1120: 10 kHz and 4 Hz. Table 5 contains the filter jumper allocations for the SCXI-1120.

**Table 5.** SCXI-1120 Filter Jumper Allocation

Input Channel Number	First-Stage Filter Jumper		Second-Stage Filter Jumper	
	4 Hz (Factory Default)	10 kHz	4 Hz (Factory Default)	10 kHz
0	W17-A	W17-B	W25	W26
1	W18-A	W18-B	W27	W28
2	W19-A	W19-B	W29	W30
3	W20-A	W20-B	W31	W32
4	W21-A	W21-B	W33	W34
5	W22-A	W22-B	W35	W36
6	W23-A	W23-B	W37	W38
7	W24-A	W24-B	W39	W40

Verify that both filtering stages of your SCXI-1120 are set to the same bandwidth to ensure that the required bandwidth is achieved. One jumper block is available for each filter stage.

## Configuring SCXI-1120D Filter Jumpers

This section describes how to configure the filter jumpers on your SCXI-1120D. During the Calibration Executive procedure, keep this information available for reference.

The SCXI-1120D module also has two-stage filtering. The first stage is located in the isolated section of the input channel. The second stage is located in the non-isolated section of your input channel. Two-stage filtering eliminates the noise generated by the isolation amplifier, producing a higher signal-to-noise ratio. Two filter bandwidths are available on the SCXI-1120D: 22.5 kHz and 4.5 kHz. Table 6 contains the filter jumper allocations for the SCXI-1120D.

**Table 6.** SCXI-1120D Filter Jumper Allocation

Input Channel Number	First-Stage Filter Jumper		Second-Stage Filter Jumper	
	4.5 kHz (Factory Default)	22.5 kHz	22.5 kHz	4.5 kHz (Factory Default)
0	W17-A	W17-B	W25	W26
1	W18-A	W18-B	W27	W28
2	W19-A	W19-B	W29	W30
3	W20-A	W20-B	W31	W32
4	W21-A	W21-B	W33	W34
5	W22-A	W22-B	W35	W36
6	W23-A	W23-B	W37	W38
7	W24-A	W24-B	W39	W40

Verify that both filtering stages of your SCXI-1120D are set to the same bandwidth to ensure that the required bandwidth is achieved. One jumper block is available for each filter stage.

## Configuring Potentiometers

Refer to Figure 1 to locate the potentiometers on the SCXI-1120/1120D module. The Calibration Executive procedure prompts you to adjust these potentiometers as shown in Table 7.

**Table 7.** Calibration Potentiometers Reference Designators

<b>Channel Number</b>	<b>Output Null Potentiometer</b>	<b>Input Null Potentiometer</b>
0	R24	R08
1	R25	R10
2	R26	R12
3	R27	R14
4	R28	R16
5	R29	R18
6	R30	R20
7	R31	R21

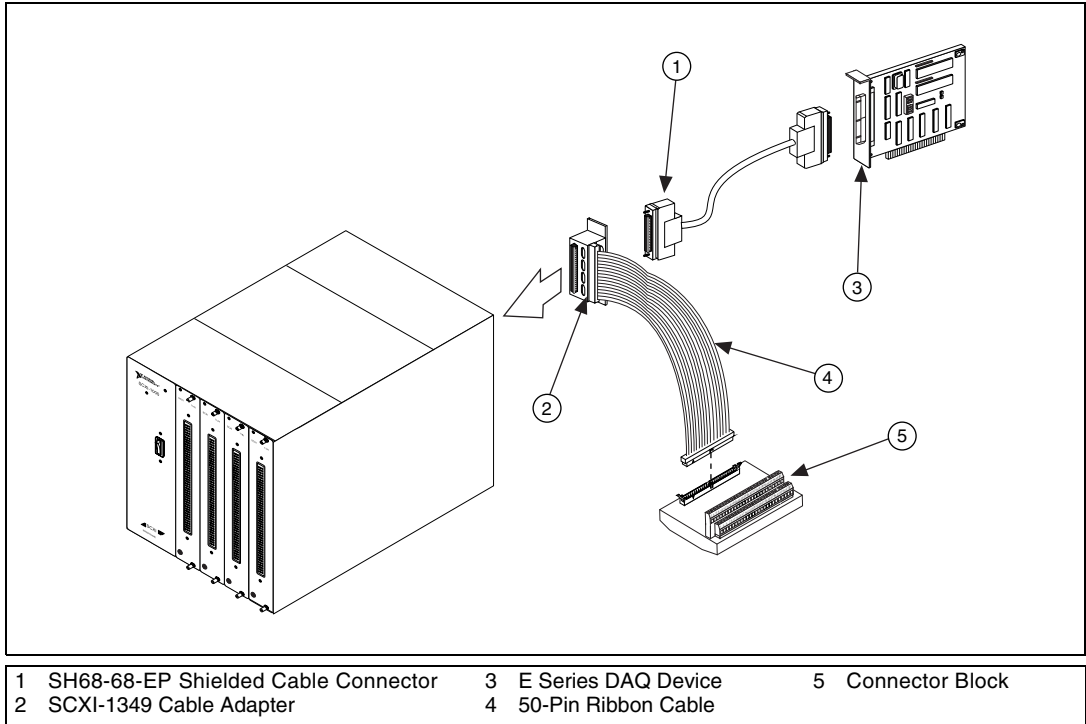
You have finished configuring the jumpers on your SCXI-1120/1120D module for calibration.

## Setting Up Your Module for Calibration

This section explains how to set up your SCXI-1120/1120D module for calibration. To make sure your module is ready for calibration, refer to Figure 2 as you complete the following steps:

1. Remove the side plate of the SCXI chassis and the cover of the SCXI-1120/1120D module to access the potentiometers and jumpers.
2. Install the SCXI-1120/1120D module in slot 1 of the SCXI chassis.
3. Install the E Series DAQ device in your host computer.
4. Connect a 68-to-68-pin cable between the SCXI module and the E Series DAQ device installed in your host computer using the SCXI-1349 cable adapter.
5. Connect the 50-pin connector to the 50-pin breakout on the adapter device.

6. Configure the hardware with Measurement & Automation Explorer (MAX).
  - a. In the MAX Help file, select **Help»Help Topics»NI-DAQ**.
  - b. Double-click **SCXI Devices**.
  - c. Double-click the correct file for the hardware you want to configure and follow the displayed instructions.



**Figure 2.** Connecting an SCXI Module to an E Series DAQ Device and a Terminal Block



**Note** Refer to *Getting Started with SCXI, DAQ Quick Start Guide*, and *SCXI Quick Start Guide* if you need additional configuration information.

## Connecting Your Calibrator, DMM, and SCXI Module

The calibration procedure steps you through the connections between your calibrator, DMM, and the SCXI module. The first connections are as follows:

1. Connect all negative inputs of each SCXI-1120/1120D channel together on the SCXI-1320, SCXI-1327, or SCXI-1328 terminal block.
2. Connect all positive inputs of each channel together on the terminal block.

3. Connect the calibrator positive output to CH0+ of the terminal block.
4. Connect the calibrator negative output, guard, and ground to CH0– of the terminal block.
5. Connect the calibrator guard and ground together, then connect these to the CHO– of the terminal block.
6. Connect the terminal block to the front of the SCXI-1120/1120D module.
7. Connect the DMM HI voltage input to pin 3 of the 50-pin connector block.
8. Connect the DMM LO voltage input to pin 4 of the 50-pin connector block.

## Running the Calibration Procedure

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

1. Launch Calibration Executive and follow the instructions in the Calibration Configuration Wizard to load the SCXI-1120/1120D module calibration procedure. Refer to Chapter 1, *Introduction to Calibration Executive*, in 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:
  - **MIO Device Number**—The device number assigned by MAX for your E Series DAQ device
  - **MIO Channel**—The analog input channel that your E Series DAQ device uses to communicate with your SCXI module; this value can be left at 0
  - **SCXI Chassis ID**—The ID number that MAX assigns for your SCXI chassis
  - **SCXI Module Slot**—The SCXI slot where the SCXI-1120/1120D module has been installed
  - **SCXI Module**—A list of all 1120/1120D modules supported by the calibration procedure; select the module type that you are calibrating
  - **Terminal Block**—The SCXI terminal block you are using
  - **Channels to Verify and Adjust**—The SCXI-1120/1120D channels you want to verify and adjust; refer to the *Calibration Executive Software User Manual* to learn how to perform verification only

3. When the procedure is loaded, click **Run Procedure** to begin. Follow any instructions you receive, such as to reconfigure the filter jumper settings, when prompted by 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 your report. Your calibration report appears as a printable HTML file.

You have completed calibrating your SCXI-1120/1120D module with Calibration Executive.



**Note** If your SCXI-1120/1120D module fails after calibration, return it to National Instruments for repair or replacement.

# 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

National Instruments has offices located around the world to help address your support needs. You can access our branch office Web sites from the Worldwide Offices section of [ni.com](http://ni.com). Branch office Web sites provide up-to-date contact information, support phone numbers, e-mail addresses, and current events.

If you have searched the technical support resources on our Web site and still cannot find the answers you need, contact your local office or National Instruments corporate. For telephone support in the United States, dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

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Brazil 011 284 5011, Canada (Calgary) 403 274 9391,  
Canada (Ottawa) 613 233 5949, Canada (Québec) 514 694 8521,  
Canada (Toronto) 905 785 0085, China (Shanghai) 021 6555 7838,  
China (ShenZhen) 0755 3904939, Denmark 45 76 26 00, Finland 09 725 725 11,  
France 01 48 14 24 24, Germany 089 741 31 30, Greece 30 1 42 96 427,  
Hong Kong 2645 3186, India 91805275406, Israel 03 6120092, Italy 02 413091,  
Japan 03 5472 2970, Korea 02 596 7456, Malaysia 603 9596711,  
Mexico 5 280 7625, Netherlands 0348 433466, New Zealand 09 914 0488,  
Norway 32 27 73 00, Poland 0 22 528 94 06, Portugal 351 1 726 9011,  
Singapore 2265886, Spain 91 640 0085, Sweden 08 587 895 00,  
Switzerland 056 200 51 51, Taiwan 02 2528 7227,  
United Kingdom 01635 523545