

CALIBRATING THE SCXI™-1104/C WITH CALIBRATION EXECUTIVE

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Introduction

This document contains information and step-by-step instructions for loading and running a calibration procedure for SCXI-1104/C modules 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 (NI) Calibration Executive automates the verification and adjustment of NI measurement devices and 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 the module to its specified accuracy and ensures that it still meets NI standards.

How Often Should You Calibrate?

The measurement accuracy requirements of your application determine how often you should calibrate the SCXI-1104/C module. NI 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

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

Test Equipment

Calibration requires a high-precision voltage standard with an accuracy of at least 50 ppm, a multiranging 6 1/2 digit digital multimeter (DMM) with an accuracy of 15 ppm, and an 8-bit E Series data acquisition (DAQ) device.

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

- Calibrator—Fluke 5700A
- DMM—HP34401A
- 8-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.

Connectors

Although you can perform the calibration procedure without any special connectors, connecting and disconnecting the 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-1300
- 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 the SCXI-1104/C. In addition to this calibration document, you may need to refer to the following:

- *Calibration Executive Software User Manual*
- *DAQ Quick Start Guide*
- *SCXI Quick Start Guide*
- *Getting Started with SCXI*
- *SCXI-1104/C User Manual*
- *CB-50 Connector Block Installation Guide*

You can download these documents from ni.com/manuals.

Software

Complete the following steps to install Calibration Executive:

1. Make sure that the computer and monitor are powered on and that you have installed Windows 2000/NT/XP/Me/9x.
2. Close all open applications.
3. Insert the Calibration Executive installation CD into the CD drive.

4. Select **Run** from the **Start** menu on the desktop task bar.
5. In the command line box, enter `x:setup.exe` (where `x` is the letter of the CD drive you are using), then 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-1104\Limits	Directory that contains calibration limits database.
Calibration Executive\Procedures\SCXI-1104\	Directory structure that contains the calibration procedures.
Calibration Executive\Procedures\SCXI-1104\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

This section explains how to set up 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.



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 the *Calibration Executive Software User Manual*.

Setting Up the SCXI-1104/C Module for Calibration

To make sure the module is ready for calibration, refer to Figure 1 as you complete the following steps:

1. Install the SCXI-1104/C in slot 1 of the SCXI chassis.
2. Install the E Series DAQ device in the host computer.
3. Connect a 68-to-68-pin cable between the SCXI module and the E Series DAQ device installed in the host computer using the SCXI cable adapter.
4. Connect the CB-50 connector block to the 50-pin breakout on the SCXI-1349 cable adapter using the 50-pin ribbon cable.
5. 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.

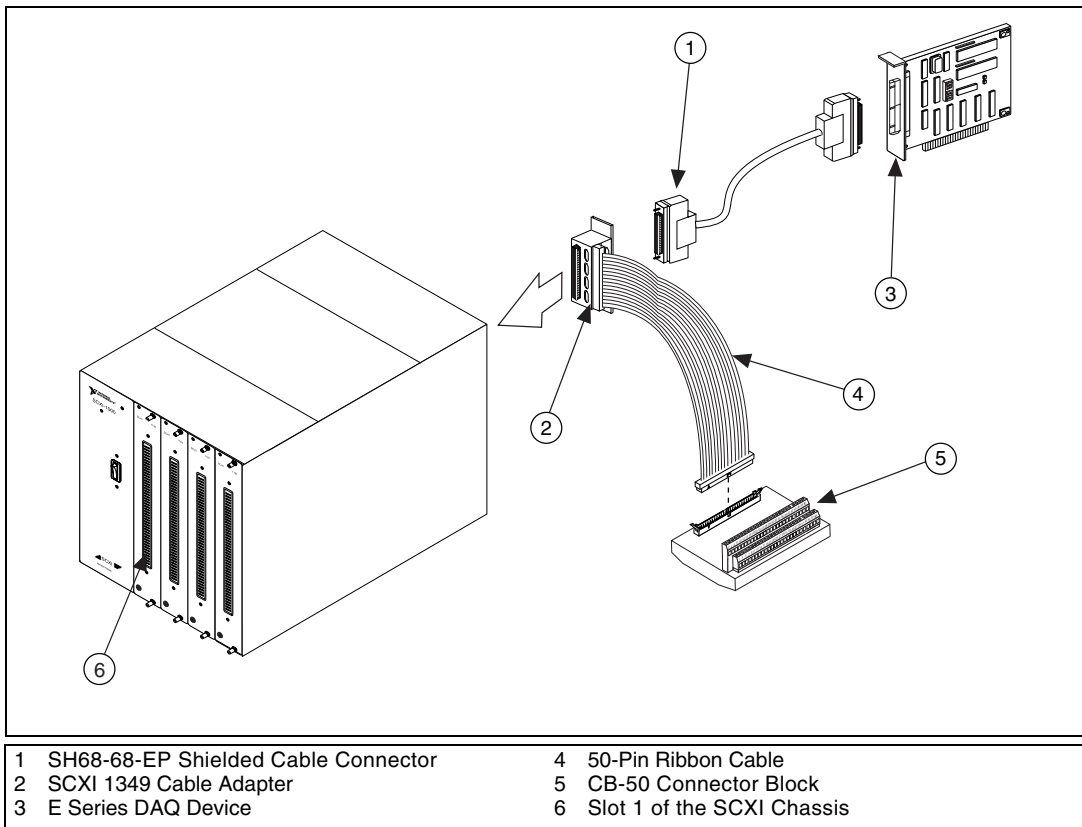


Figure 1. Connecting an SCXI Module to an E Series DAQ Device



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

Connecting the Calibrator, DMM, and SCXI Module

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

1. Connect all negative inputs of channels 0 through 31 on the SCXI-1104/C together on the SCXI-1300 terminal block. If a terminal block is not available, you can connect to the pins on the front panel using a 96-pin Euro-style connector. Refer to Figure 2 for pin assignments.
2. Connect all positive inputs of each channel together on the SCXI-1300 terminal block.
3. Connect the calibrator positive output to CH0+ of the SCXI-1300 terminal block.

4. Connect the calibrator negative output to CH0- of the SCXI-1300 terminal block.
5. Connect the calibrator guard and ground cables together, then connect these to the CHO- of the SCXI-1300 terminal block.
6. Connect the SCXI-1300 terminal block to the front of the SCXI-1104/C.
7. Connect the DMM HI voltage input to pin 3 of the CB-50 connector block.
8. Connect the DMM LO voltage input to pin 4 of the CB-50 connector block.

	A		B		C
CGND	32	CH0-	32	CH0+	32
NC	31	CH1-	31	CH1+	31
NC	30	CH2-	30	CH2+	30
NC	29	CH3-	29	CH3+	29
NC	28	CH4-	28	CH4+	28
NC	27	CH5-	27	CH5+	27
NC	26	CH6-	26	CH6+	26
NC	25	CH7-	25	CH7+	25
CGND	24	CH8-	24	CH8+	24
NC	23	CH9-	23	CH9+	23
NC	22	CH10-	22	CH10+	22
NC	21	CH11-	21	CH11+	21
NC	20	CH12-	20	CH12+	20
NC	19	CH13-	19	CH13+	19
NC	18	CH14-	18	CH14+	18
NC	17	CH15-	17	CH15+	17
CGND	16	CH16-	16	CH16+	16
NC	15	CH17-	15	CH17+	15
NC	14	CH18-	14	CH18+	14
NC	13	CH19-	13	CH19+	13
NC	12	CH20-	12	CH20+	12
NC	11	CH21-	11	CH21+	11
NC	10	CH22-	10	CH22+	10
NC	9	CH23-	9	CH23+	9
NC	8	CH24-	8	CH24+	8
NC	7	CH25-	7	CH25+	7
NC	6	CH26-	6	CH26+	6
CGND	5	CH27-	5	CH27+	5
RSVD	4	CH28-	4	CH28+	4
RSVD	3	CH29-	3	CH29+	3
CGND	2	CH30-	2	CH30+	2
+5 V	1	CH31-	1	CH31+	1

Figure 2. SCXI 1104/C Front Connector Pin Assignments

Running the Calibration Executive 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-1104/C 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 the E Series DAQ device
 - **MIO Channel**—the analog input channel that the E Series DAQ device uses to communicate with the SCXI module; this value can be left at 0
 - **SCXI Chassis ID**—the ID number that MAX assigns for the SCXI chassis
 - **SCXI Module Slot**—the SCXI slot where the SCXI-1104/C is installed
 - **MIO Resolution**—the resolution of the E Series DAQ device; the user manual tells you the resolution of the device
 - **Channels to Verify and Adjust**—the SCXI-1104/C 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 when prompted by Calibration Executive.

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

1. Click on **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 the SCXI-1104/C with Calibration Executive.



Note If the SCXI-1104/C module fails after calibration, return it to NI for repair or replacement.

Troubleshooting Guidelines

This section describes common problems you might encounter when calibrating an SCXI-1104/C module and explains how to correct the problems.

If the SCXI-1104/C module is not recognized in MAX, make sure that you followed the configuration guidelines. Additional configuration information is available at ni.com/support/daq. If MAX fails to recognize the SCXI-1104/C module after you reconfigure and refresh (<F5>), refer to the [Technical Support Resources](#) section to contact NI technical support.

If the SCXI-1104/C module fails after calibration, try the following:

1. Check the connections and run the Calibration Executive procedure again.
2. If the calibration still fails after trying step 1, try inputting or outputting the failed test points using the Test Panel of the E Series DAQ device in MAX. For example, if the analog input (AI) failed at 0.98 V, input that value from the calibrator.
 - a. Launch the test panel in MAX.
 - b. Click the **Analog Input** tab.
 - c. Set the **High Limit** to 1.00 V and set the **Low Limit** to -1.00 V for bipolar readings.
 - d. Enter SC!MDx!y in the channel string field, where x is the slot in the SCXI chassis where the SCXI 1104/C is installed, and y is the channel you are testing on the SCXI-1104/C.
 - e. Check the Average Reading indicator.

If the Average Reading still fails after you complete steps 1 and 2, contact NI for repair or replacement. If the Average Reading passes, you can change the calibration report to indicate the passing value.



Note If you have Microsoft Access 2000 or later, you can also modify the database containing the test results. By default, this database is located in `\Calibration Executive\Databases\Calibration Reports.mdb`.

NI-DAQ Errors and Other Errors

This sections describes some of the common errors that can occur when calibrating an SCXI-1104/C module.

The error `Could not find ividmm.dll` is caused by a problem with the original installation of Calibration Executive. If you see this error when you launch the calibration procedure, complete the following steps:

1. Navigate to `\Program Files\National Instruments\Calibration Executive\TestStand\Cfg`.
2. Using a text editor, look at the `testexec.ini` file. The entry under the `config.searchdirectories` should be as listed in Table 2.

Table 2. Location of the `testexec.ini` File

Operating System	Path
Windows Me/98/95	[Config.SearchDirectories [11]] Path= "c:\\VXIpn\\Win95\\Bin"
Windows 2000/NT/XP	[Config.SearchDirectories [11]] Path= "c:\\VXIpn\\WinNT\\Bin"

If the search path contains more than two backslashes between folders, the extra backslashes can cause the error. Remove the extra backslashes so that the search path matches the correct path from Table 2, then save `testexec.ini` and relaunch Calibration Executive.

Error code `-10005` indicates that the device number you selected is not configured or recognized in MAX. Configure the device in MAX and restart Calibration Executive.

Error code `-10842` during the internal calibration step indicates that the E Series device hardware is not responding correctly and needs repair. When you contact NI for repair, explicitly indicate that the E Series DAQ device internal calibration function returns error `-10842` during calibration.



Note Error code `-10842` involves the E Series DAQ device hardware only, not the SCXI-1104/C module.

Error code –15 at the beginning of the calibration procedure indicates that the computer may be configured to use commas as decimal places. Calibration Executive only supports using periods (.) for decimal places. To change this configuration on the computer, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. If you are using Windows Me/98/95, click **Regional Settings**. If you are using Windows 2000/NT/XP, click **Regional Options**.
3. Click the **Numbers** tab and change the Decimal Symbol from a comma (,) to a period (.). Change the Digit Grouping Symbol from (.) to (,).



Note If you change the Regional Settings or Regional Options on the computer, remember to change them back to the default after running the Calibration Executive procedure.

You can find more information on other error codes in the *Status Codes* section of the *NI-DAQ Function Reference Help* file. To find this file, select **Start»Programs»National Instruments»NI-Daq»NI-DAQ Help**.

Technical Support Resources

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.

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. 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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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