



NATIONAL INSTRUMENTS SCXI-1104 Channel Medium Voltage Input Module Instruction Manual

[Home](#) » [NATIONAL INSTRUMENTS](#) » NATIONAL INSTRUMENTS SCXI-1104 Channel Medium Voltage Input Module Instruction Manual 

Contents

- 1 NATIONAL INSTRUMENTS SCXI-1104 Channel Medium Voltage Input Module
- 2 Product Information
- 3 Why Calibration is Important
- 4 Recommended Calibration Frequency
- 5 Equipment Requirements
- 6 Software and Documentation
- 7 Product Usage Instructions
- 8 Introduction
- 9 Equipment and Other Test Requirements
- 10 Software and Documentation
- 11 Software
- 12 Documentation
- 13 Test Conditions
- 14 Verifying the Operation of Your Module
- 15 Adjusting Calibration Constants
- 16 Verifying Adjusted Values
- 17 Front and Rear Panel Diagrams
- 18 Specifications
- 19 Documents / Resources
 - 19.1 References



NATIONAL INSTRUMENTS SCXI-1104 Channel Medium Voltage Input Module



Product Information

The SCXI-1104 is a signal-conditioning module manufactured by National Instruments. It is designed to provide accurate and reliable measurement of analog signals. The module undergoes factory calibration, where calibration constants are stored in non-volatile memory to ensure specified accuracy. However, over time and due to temperature variations, offset and gain errors may occur, necessitating periodic calibration.

Why Calibration is Important

Calibration is crucial to maintain the accuracy of the SCXI-1104 module. It involves reading offset and gain errors and updating the analog calibration circuitry to correct these errors. By calibrating the module, you can restore it to its specified accuracy and ensure reliable measurements.

Recommended Calibration Frequency

The recommended calibration interval for the SCXI-1104 module depends on the measurement accuracy requirements of your application. National Instruments suggests performing a complete calibration at least once every year. However, if your application demands higher accuracy or if you anticipate significant drift in offset and gain errors, you may consider shortening the interval to six months or 90 days.

Equipment Requirements

For calibrating the SCXI-1104 module, you will need the following equipment:

- A high-precision voltage source with at least 50 ppm accuracy
- A multi ranging 5 1/2 digit digital multimeter (DMM) with 15 ppm accuracy
- A National Instruments E Series DAQ device

If these specific instruments are not available, you can select substitute calibration standards based on the accuracy requirements mentioned above.

Note: If you do not have custom connection hardware, you will also need additional components such as the National Instruments SCXI-1300 connector block, a shielded 68-pin connector cable, a 50-pin ribbon cable, a 50-pin breakout box, and an SCXI adapter. These components allow easy access to the individual pins on the SCXI-1104 front and rear connectors.

Software and Documentation

To perform the SCXI-1104 calibration procedure, you will need the latest version of the National Instruments NI-DAQ driver installed on your calibration system. The driver supports various programming languages such as LabVIEW, LabWindows/CVI, Microsoft Visual C++, Microsoft Visual Basic, and Borland C++. It is recommended to install support for the programming language you intend to use.

Product Usage Instructions

The SCXI-1104 calibration process consists of the following steps:

1. Setting up the module for testing
2. Verifying the existing operation of the module to determine if it is operating within its specifications
3. Adjusting your module with respect to a known voltage source
4. Verifying that the module is operating within its specifications after calibration

Ensure that you have the necessary equipment, software, and documentation as described above before proceeding with the calibration procedure.

Introduction

This document contains information and step-by-step instructions for verifying and calibrating the National Instruments SCXI-1104 signal conditioning module.

What Is Calibration?

Calibration is a procedure of reading offset and gain errors from a device and updating special analog calibration circuitry that corrects these errors. National Instruments calibrates every SCXI-1104 module at the factory. During the factory calibration process, the calibration constants are stored in the non-volatile memory of the device. These values are loaded from memory and used as needed by the device.

Why Should You Calibrate?

Offset and gain errors drift with time and temperature, which could invalidate the factory-set calibration of a device. Calibration restores the device to its specified accuracy.

How Often Should You Calibrate?

The measurement accuracy requirements of your application determine how often you should calibrate your SCXI-1104 module. National Instruments recommends you perform a complete calibration at least once every year. You can shorten this interval to six months or 90 days, based on the demands of your application.

Equipment and Other Test Requirements

This section describes the equipment, software, documentation, and test conditions required for calibrating the SCXI-1104.

Test Equipment

Calibration requires a high-precision voltage source with at least 50 ppm accuracy, a multiranging 5 1/2 digit digital multimeter (DMM) with 15 ppm accuracy, and a National Instruments E Series DAQ device. National Instruments recommends the following instruments for calibration of an SCXI-1104:

- Calibrator—Fluke 5700A
- DMM—NI 4060 or HP 34401A
- National Instruments E Series DAQ device

If these instruments are not available, use the accuracy requirements listed above to select a substitute calibration standard.

Note If you do not have custom connection hardware, you will need a connector block such as the National Instruments SCXI-1300, a shielded 68-pin connector cable, a 50-pin ribbon cable, a 50-pin breakout box, and an SCXI adapter. These components give easy access to the individual pins on the SCXI-1104 front and rear connectors.

Software and Documentation

You will need the following software and documentation to calibrate the SCXI-1104. You can find these on the National Instruments Web site at ni.com/calibration:

- The latest version of the National Instruments NI-DAQ driver
- NI-DAQ Function Reference Online Help file
- NI-DAQ User Manual for PC Compatibles

Software

The SCXI-1104 calibration procedure requires the latest version of the National Instruments NI-DAQ driver on the calibration system. The driver supports a number of programming languages, including LabVIEW, LabWindows/CVI, Microsoft Visual C++, Microsoft Visual Basic, and Borland C++. When you install the driver, you only need to install support for the programming language you will use.

Documentation

The NI-DAQ Function Reference Online Help file and the NI-DAQ User Manual for PC Compatibles contain detailed information on using the NI-DAQ driver. The online help file includes detailed information on the driver functions. You can access the online help file by clicking Start»Programs»National Instruments DAQ»NI-DAQ Help. The user manual provides instructions on installing and configuring National Instruments DAQ devices. This manual also includes detailed information on creating applications that use the NI-DAQ driver. These are your primary references for writing your calibration utility. For further information on the products you are calibrating, refer to your device user manuals.

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 can act as antennae, which pick 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 the temperature between 18 and 28 °C.
- Keep relative humidity below 80%.
- Allow a warm-up time of at least 15 minutes for the SCXI module and 30 minutes for the E Series device to ensure the measurement circuitry is at a stable operating temperature

The calibration process consists of the following steps:

1. Setting up the module for testing.
2. Verifying the existing operation of the module to determine whether your module is operating within its specifications.
3. Adjusting your module with respect to a known voltage source.
4. Verifying that the module is operating within its specifications after adjustments.

Setting Up Your Module

Complete the following steps to set up your module for verification:

1. Install your SCXI-1104 in slot 1 of your SCXI chassis.
2. Connect a 68-to-68-pin cable between your SCXI module and E Series DAQ device.
3. Configure the hardware with Measurement & Automation Explorer. If you need more information on configuring the system, refer to the E Series device and SCXI module documentation.

Verifying the Operation of Your Module

The verification procedure determines how well the SCXI-1104 module is meeting its specifications. You can use this information to select the appropriate calibration interval for your application.

Complete the following steps to verify the operation of your SCXI-1104:

1. Read the Test Conditions section earlier in this document.
2. Refer to Table 1 at the end of this document to see the test specifications. National Instruments recommends you verify all ranges and gains. However, you can save time by checking only those ranges that you use in your application.
3. Connect the E Series device to the SCXI-1104.
4. Call `Calibrate_E_Series` to minimize the uncertainty associated with the E Series device. Set the following parameters:
 - device number—The value obtained from Measurement & Automation Explorer
 - clip—`ND_SELF_CALIBRATE`
 - setOfCalConstants—`ND_USER_EEPROM_AREA`
 - calRefVolts—0.0
5. Call `AI_Configure` to put the E Series device in bipolar mode.
 - **Set the following parameters:**
 - device number—The value obtained from Measurement & Automation Explorer
 - chan—0
 - input mode—0 • inputRange—0
 - polarity—0
 - driveway—0
6. Call `MIO_Config` to enable dithering on your E Series device. Set the following parameters:
 - device number—The value obtained from Measurement & Automation Explorer
 - dither—1
 - useAMUX—0
7. Connect the calibrator to the appropriate analog input, starting with channel 0. Refer to Figure 1 to determine

the pins on the 96-pin front connector that correspond to the positive and negative inputs of the specified channel. For example, the positive input for channel 0 (CH0+) is pin C32. The negative input for channel 0 (CH0–) is pin B32. If you are using an SCXI-1300 breakout module connected to the SCXI-1104, connect your calibrator to the CH0+ and CH0– inputs.

8. Call `SCXI_Single_Channels_Setup` to configure the module for single-channel measurements. Set the following parameters:
 - `SCXIChassisID`—The value obtained from Measurement & Automation Explorer
 - `module slot`—1
 - `module can`—The channel you are verifying
 - `DAQdeviceNumber`—The device number assigned by Measurement & Automation Explorer for the E Series DAQ device
9. Set your calibrator to output the test point voltage from Table 1.
10. Call `DAQ_Op`. Set the following parameters:
 - `device number`—The device number of the DAQ device
 - `channel`—0
 - `gain`—1 for 16-bit E Series devices or –1 for 12-bit E Series devices
 - `count`—100
 - `sampleRate`—100
11. Call `SCXI_Scale`. Set the following parameters:
 - `SCXIChassisID`—The value obtained from Measurement & Automation Explorer
 - `module slot`—1
 - `channel`—The channel you are verifying
 - `SCXIgain`—0.1
 - `TBgain`—1
 - `DAQboard`—The device number for the DAQ device
 - `DAQChannel`—0
 - `DAQgain`—0 for 16-bit devices, –1 for 12-bit devices
 - `numPoints`—100
 - `binArray`—The array returned from the `DAQ_Op` function
 - The result is a set of scaled voltages that you read from the SCXI module.
12. Average the results returned from the `SCXI_Scale` function. Compare the averaged result to the upper and lower limits in Table 1. If the result falls within these limits, your module has passed this portion of the test. If it does not, use the steps in the next section, Adjusting Gain and Offset Errors and Calibration Constants, to adjust your module.
13. Repeat steps 7 through 12 for the remaining channels. You have now completed verifying the operation of your SCXI-1104.

Note If all channels fall within the upper and lower limits, your module does not need to be adjusted.

Adjusting Gain and Offset Errors and Calibration Constants

This section contains step-by-step instructions on adjusting gain and offset errors and calibration constants. Adjusting Gain and Offset Errors Complete the following steps to adjust gain and offset errors in your SCXI-1104:

1. Read the Test Conditions section.

2. Connect the E Series device to the SCXI-1104.
3. Call `Calibrate_E_Series` to minimize the uncertainty associated with the E-series device. Set the following parameters:
 - device number—The value obtained from Measurement & Automation Explorer
 - clip—`ND_SELF_CALIBRATE`
 - setOfCalConstants—`ND_USER_EEPROM_AREA`
 - calRefVolts—0.0
4. Call `AI_Configure` to put the E Series device in bipolar mode. Set the following parameters:
 - device number—The value obtained from Measurement & Automation Explorer
 - chan—0
 - input mode—0
 - input range—0
 - polarity—0
 - driveway—0
5. Call `MIO_Config` to enable dithering on your E Series device. Set the following parameters:
 - device number—The value obtained from Measurement & Automation Explorer
 - dither—1
 - useAMUX—0
6. Call `SCXI_Single_Chan_Setup` to configure the module for single-channel measurements. Set the following parameters:
 - SCXIchassisID—The value obtained from Measurement & Automation Explorer
 - module slot—1
 - the module can—The channel you want to calibrate
 - DAQdeviceNumber—The device number assigned by Measurement & Automation Explorer for the E Series DAQ device
7. Connect the calibrator to the channel you want to adjust. Refer to Figure 1 to determine the pins on the 96-pin front connector that corresponds to the positive and negative inputs of the specified channel. For example, the positive input for channel 0 is pin C32 which is labeled CH0+. The negative input for channel 0 is pin B32 which is labeled CH0-. If you are using an SCXI-1300 breakout module connected to the SCXI-1104, connect your calibrator to the CH0+ and CH0- inputs.
8. Connect your DMM to the positive output on pin 3 (MCHO+) and negative output on pin 4 (MCHO-) on the rear panel connector. Figure 2 shows the 50-pin rear panel connector pin assignments.
 - Tip For easy access to individual pins, use a screw terminal adapter connected to a 50-pin terminal block.
9. Set the calibrator voltage to the positive test point value in Table 1.
10. Read the voltage from the DMM. Record the actual DMM reading, which is output1, and the calibrator output voltage, which is volt1, for later use.
11. Set the calibrator to the negative test point value for the same gain. Skip any input limits that are specified as 0 V. You need only upper and lower limits for adjustment.
12. Read the voltage from the DMM. Record the actual DMM reading, output2, and the calibrator output voltage, voltage2. You now have two pairs of data points, (volt1, output1) and (volt2, output2), where volt is the calibrator reading and output is the DMM reading.
13. Convert the DMM voltage readings (output1 and output2) to binary readings (binary1 and binary2) by using

one of the following equations:

$$\text{binary reading for 12-bit E Series products (binary)} = \left(\frac{\text{output}}{20} \right) \times 2^{12}$$

$$\text{binary reading for 16-bit E Series products (binary)} = \left(\frac{\text{output}}{20} \right) \times 2^{16}$$

- For example, using a 12-bit product such as a PCI-MIO-16E-1 and obtaining a DMM reading of –9.9 V, you would have the following results: binary reading = $(-9.9/20) \times 2^{12} = -2027.52$

14. Record binary1 with volt1 and binary2 with volt2 for later use.

15. Repeat steps 4 through 14 for the remaining channels you want to adjust.

Adjusting Calibration Constants

Complete the following steps to adjust the calibration constants on your SCXI-1104:

1. Call SCXI_Cal_Constants to create and store the new calibration constants in the SCXI-1104 memory. Set the following parameters:
 - SCXIchassisID—The ID assigned by Measurement & Automation Explorer
 - ModuleSlot—1, unless you have installed the module in a different slot
 - channel—The channel you want to adjust
 - OpCode—2
 - calibrationArea—0
 - rangeCode—0 (not used for the SCXI-1104)
 - SCXIgain—0.1
 - DAQboard—The device number assigned by the Measurement & Automation Explorer
 - DAQChan—0
 - DAQGain—1 for 16-bit devices, –1 for 12-bit devices
 - Tbgain—1.0
 - volt1 and volt2—The first and second voltage readings for the gain values that you are about to save on the SCXI-1104
 - binary1 and binary2—The first and second binary readings for the gain values that you are about to save on the SCXI-1104
 - calConst1 and calConst2—These are return values.
2. Repeat step 1, changing calibrationArea to 1.
3. Repeat step 1, changing calibrationArea to 3.
4. Repeat steps 1 through 3 for the next channel. You have now adjusted the calibration constants.

Verifying Adjusted Values

After completing the adjustments, it is important to verify the adjusted values by repeating the steps listed in the Verifying the Operation of Your Module section of this document. Verifying the adjusted values ensures your module is now operating within its specifications.

Front and Rear Panel Diagrams

Figure 1 shows the pin assignments for the SCXI-1104 module front panel connector. Figure 2 shows the pin assignments for the SCXI-1104 rear panel connector.

	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 1. SCXI-1104 Front Connector Pin Assignments

AOGND	1	2	AOGND
MCH0+	3	4	MCH0-
NC	5	6	NC
NC	7	8	NC
NC	9	10	NC
NC	11	12	NC
NC	13	14	NC
NC	15	16	NC
NC	17	18	NC
OUTREF	19	20	NC
NC	21	22	NC
NC	23	24	DGND
SERDATIN	25	26	SERDATOUT
DAQD*/A	27	28	NC
SLOT0SEL*	29	30	NC
NC	31	32	NC
DGND	33	34	NC
NC	35	36	SCANCLK
SERCLK	37	38	NC
NC	39	40	NC
NC	41	42	NC
RSVD	43	44	NC
NC	45	46	RSVD
NC	47	48	NC
NC	49	50	NC

Figure 2. SCXI-1104 Rear Panel Connector Pin Assignments

Specifications

The following table contains test specifications for the SCXI-1104 signal conditioning module. If the device has been calibrated within the last year, the Test Point value should fall between the Upper Limit and Lower Limit values.

Table 1. SCXI-1104 Specifications

		Ranges	
Gain	Test Point (V)	Upper Limit (V)	Lower Limit (V)
0.100	41.8000	41.8219	41.7781
	0.0000	0.0010	-0.0010
	-41.8000	-41.7781	-41.8219



[NATIONAL INSTRUMENTS SCXI-1104 Channel Medium Voltage Input Module](#) [pdf] Instruction Manual
SCXITM-1104, SCXI-1104, SCXI-1104 Channel Medium Voltage Input Module, Channel Medium Voltage Input Module, Medium Voltage Input Module, Voltage Input Module, Module

References

- [NI Engineer Ambitiously - NI](#)
- [NI Calibration Services - NI](#)
- [NI SCXI-1104 National Instruments Voltage Input Module | Apex Waves](#)

[Manuals+](#).