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CALIBRATION PROCEDURE

NI PXIe-4339

8 Ch, 24-bit, 25.6 kS/s Universal Bridge Input Module

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ni.com/manuals

This document contains the verification and adjustment procedures for the National Instruments PXIe-4339 module. For more information about calibration solutions, visit ni.com/calibration.

Contents

Software

Calibrating the NI PXIe-4339 requires the installation of NI-DAQmx on the calibration system. Driver support for calibrating the NI PXIe-4339 was first available in NI-DAQmx 14.5.1. For the list of devices supported by a specific release, refer to the NI-DAQmx Readme, available on the version-specific download page or installation media.

You can download NI-DAQmx from ni.com/downloads. NI-DAQmx supports 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.

NATIONAL INSTRUMENTS

Documentation

Consult the following documents for information about the NI PXIe-4339, NI-DAQmx, and your application software. All documents are available on ni.com, and help files install with the software.

NI PXIe-4339 and TB-4339/B/C Installation Guide and Terminal Block Specifications

NI-DAQmx driver software installation and hardware setup

NI PXIe-4339 User Manual

NI PXIe-4339 usage and reference information

NI PXIe-4339 Specifications

NI PXIe-4339 specifications and calibration interval

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

LabVIEW Help

LabVIEW programming concepts and reference information about NI-DAQmx VIs and functions

NI-DAQmx C Reference Help

Reference information for NI-DAQmx C functions and NI-DAQmx C properties

NI-DAQmx .NET Help Support for Visual Studio

Reference information for NI-DAQmx .NET methods and NI-DAQmx .NET properties, key concepts, and a C enum to .NET enum mapping table

Test Equipment

Table 1 lists the equipment recommended for the performance verification and adjustment procedures. If the recommended equipment is not available, select a substitute using the requirements listed in Table 1.

Table 1. Recommended Equipment

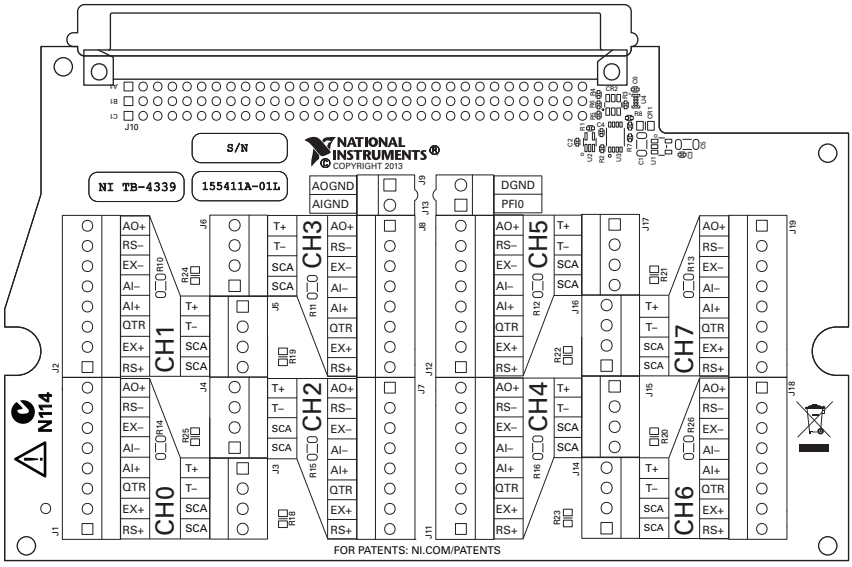
Equipment	Recommended Model	Requirements
Calibrator	Fluke 5700	If this instrument is unavailable, use a calibrator that can provide DC voltage values in the range of 0 to ±10 V with an accuracy of 50 ppm of output or better and a DC offset error of 4 µV or better.
PXI Express Chassis	NI PXIe-1062Q	—
Connection Accessory	TB-4339/B/C	—

Connecting the TB-4339/B/C

The TB-4339/B/C provides connections for the NI PXIe-4339. Figure 1 shows the pin assignments of the TB-4339/B/C.

Caution Always have the NI PXI Express chassis powered off when inserting a module into the chassis.

Figure 1. TB-4339/B/C Pin Assignments



Each channel consists of two terminal connections specific to that channel as shown in Table 2. Parallel connections to the input channels are used for verification and adjustment.

Refer to Table 2 for the analog signal names of the TB-4339/B/C.

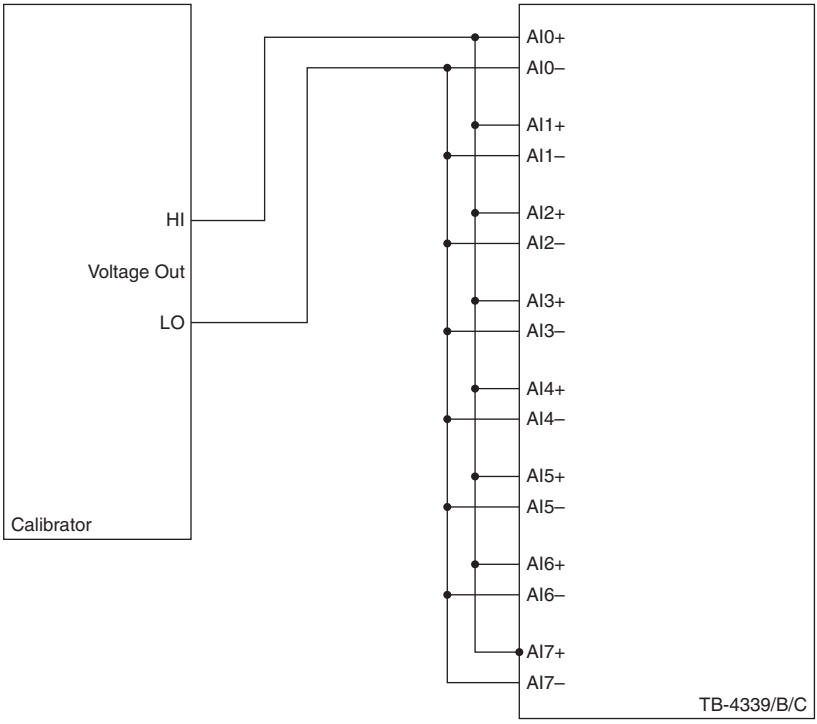
Table 2. TB-4339/B/C Analog Signal Names

Signal Name	Signal Description
AI+	Positive input voltage terminal
AI-	Negative input voltage terminal

Complete the following steps to connect the TB-4339/B/C.

1. Install the NI PXIe-4339 and the TB-4339/B/C modules in the NI PXI Express chassis according to the instructions in the *NI PXIe-4339 and TB-4339/B/C Installation Guide and Terminal Block Specifications*.
2. For voltage verification and adjustment, connect the calibrator to the TB-4339/B/C as shown in Figure 2.
   - If the calibrator has a guard connection, leave it disconnected.
   - If the calibrator output is floating, you must connect the negative output to AIGND.

Figure 2. Calibrator to TB-4339/B/C Voltage and Ratio Mode Connections



Test Conditions

The following setup and environmental conditions are required to ensure the NI PXIe-4339 meets published specifications.

- Keep connections to the NI PXIe-4339 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 TB-4339/B/C are secure.
- Use shielded copper wire for all cable connections to the TB-4339/B/C. Use twisted-pair wire to eliminate noise and thermal offsets.
- Maintain an ambient temperature of 23 °C ± 5 °C. The NI PXIe-4339 temperature will be greater than the ambient temperature.
- Keep relative humidity below 80%.
- Allow a warm-up time of at least 15 minutes to ensure that the NI PXIe-4339 measurement circuitry is at a stable operating temperature.
- Ensure that the PXI/PXI Express chassis fan speed is set to HIGH, that the fan filters are clean, and that the empty slots contain filler panels. For more information, refer to the *Maintain Forced-Air Cooling Note to Users* document available at `ni.com/manuals`.

Initial Setup

Refer to the *NI PXIe-4339 and TB-4339/B/C Installation Guide and Terminal Block Specifications* for information about how to install the software and hardware and how to configure the device in Measurement & Automation Explorer (MAX).

Note When a device is configured in MAX, it is assigned a device identifier. Each function call uses this identifier to determine which DAQ device to verify or to verify and adjust. This document uses `Dev1` to refer to the device name. In the following procedures, use the device name as it appears in MAX.

Verification

The following performance verification procedures describe the sequence of operation and provide test points required to verify the NI PXIe-4339. The verification procedures assume that adequate traceable uncertainties are available for the calibration references.

The NI PXIe-4339 has eight independent analog input channels. Each channel can be configured for voltage mode or ratio mode. Voltage mode is used to measure voltages, and ratio mode is used to provide excitation and measure from bridge-based sensors.

You can verify voltage mode for any or all of the channels depending upon your desired test coverage. Ratio mode verification requires the use of voltage mode channels to internally measure the excitation voltage of the ratio mode channel that is being verified. Voltage mode channels used in ratio mode verification require that you determine gain adjust and offset adjust values (ratio verification adjustment factors) prior to verifying ratio mode accuracy.

Voltage Mode Accuracy Verification

Complete the following steps to verify the voltage mode accuracy of the NI PXIe-4339.

1. Set the calibrator to standby mode (STBY).
2. Connect the calibrator to the TB-4339/B/C as shown in Figure 2.
   - If the calibrator has a guard connection, leave it disconnected.
   - If the calibrator output is floating, you must connect the negative output to AIGND.
3. Set the calibrator voltage output to a *Test Point* value for the appropriate *Range* shown in Table 4, beginning with the values in the first row.

   For the first test point, set the calibrator to operate mode (OPR) to enable output.
4. Acquire a voltage measurement with the NI PXIe-4339.
   a. Create a DAQmx task.
   b. Create and configure the AI channel according to the values shown in Table 3.

Table 3. AI Voltage Mode Setup

Configuration	Value
Channel Name	`Dev1/aix`, where *x* refers to the channel number
Task	AI Voltage
Sample Mode	Finite number of samples
Sample Clock Rate	100
Samples Per Channel	100
Maximum Value	Appropriate maximum range value from Table 4
Minimum Value	Appropriate minimum range value from Table 4
Units	Volts

   c. Start the task.
   d. Average the readings that you acquired.
   e. Clear the task.
   f. Compare the resulting average to the *Lower Limit* and *Upper Limit* values in Table 4. If the result is between these values, the device passes the test.

Table 4. Voltage Mode Accuracy Limits

Range (V)		Test Point (V)	Lower Limit (V)	Upper Limit (V)
Minimum	Maximum			
-0.1	0.1	-0.095	-0.095131	-0.094869
-0.1	0.1	0	-0.000074	0.000074

Table 4. Voltage Mode Accuracy Limits (Continued)

Range (V)				
Minimum	**Maximum**	**Test Point (V)**	**Lower Limit (V)**	**Upper Limit (V)**
-0.1	0.1	0.095	0.094869	0.095131
-0.2	0.2	-0.19	-0.190203	-0.189797
-0.2	0.2	0	-0.000089	0.000089
-0.2	0.2	0.19	0.189797	0.190203
-0.5	0.5	-0.475	-0.475418	-0.474582
-0.5	0.5	0	-0.000133	0.000133
-0.5	0.5	0.475	0.474582	0.475418
-10	10	-9.5	-9.507261	-9.492739
-10	10	0	-0.001561	0.001561
-10	10	9.5	9.492739	9.507261

5. For each value in Table 4, repeat steps 3 through 4 for all channels.
6. Set the calibrator to standby mode (STBY).
7. Disconnect the calibrator from the terminal block.

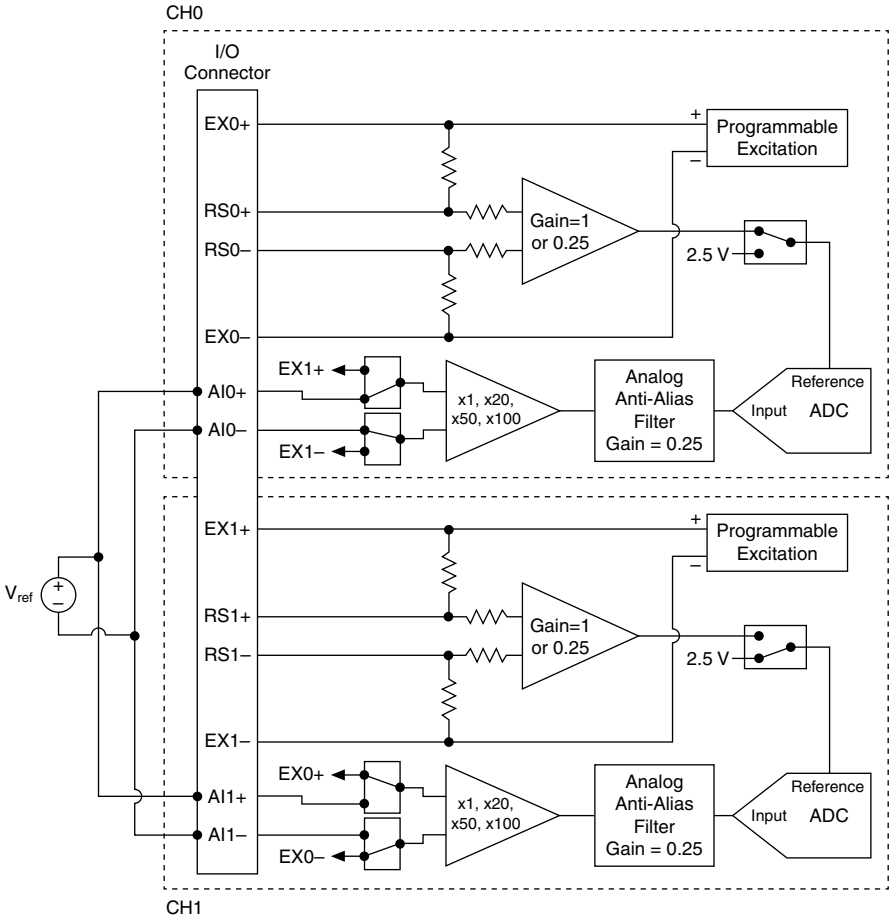
Ratio Mode Accuracy Verification

Ratio mode verification uses paired channels in voltage mode to measure the excitation voltage of the ratio mode channel that is being verified. The paired channels are connected via internal circuitry on the NI PXIe-4339. The channel pairs are CH0 and CH1, CH2 and CH3, CH4 and CH5, and CH6 and CH7.

To verify ratio mode accuracy, you will acquire a voltage measurement (`Vmeas`) for each paired channel at 0 V and 9 V outputs. From these results, you can determine the ratio verification adjustment factors, including the gain adjust (`Gadj`) and offset adjust (`Oadj`) values. The ratio verification adjustment factors are then used to calculate the voltage adjustment (`Vadj`) value for the paired channel.

Figure 3 shows the CH0/CH1 channel pair with CH0 configured for ratio mode verification and CH1 configured to measure CH0 excitation voltage.

Figure 3. Ratio Mode Accuracy Verification



Complete the following steps to verify the ratio mode accuracy of the NI PXIe-4339.

1. Set the calibrator to standby mode (STBY).
2. Connect the calibrator to the TB-4339/B/C as shown in Figure 2.
   - If the calibrator has a guard connection, leave it disconnected.
   - If the calibrator output is floating, you must connect the negative output to AIGND.
3. Set the calibrator voltage output to 0 V.
4. Set the calibrator to operate mode (OPR) to enable output.

5. Acquire a voltage measurement with the NI PXIe-4339.
   a. Create a DAQmx task.
   b. Create and configure the AI channels according to the values shown in Table 5.

Table 5. AI Voltage Mode Setup

Configuration	Value
Channel Name	`Dev1/ai0:7`
Task	AI Voltage
Sample Mode	Finite number of samples
Sample Clock Rate	100
Samples Per Channel	100
Maximum Value	10
Minimum Value	-10
Units	Volts

   c. Start the task.
   d. Average the readings that you acquired, and record the values as `chx_zero`, where *x* is the channel number.
   e. Clear the task.
   f. Set the calibrator to standby mode (STBY).
6. Set the calibrator voltage output to 9 V.
7. Set the calibrator to operate mode (OPR) to enable output.
8. Acquire a voltage measurement with the NI PXIe-4339.
   a. Create a DAQmx task.
   b. Create and configure the AI channels according to the values shown in Table 5.
   c. Start the task.
   d. Average the readings that you acquired, and record the values as `chx_9V`, where *x* is the channel number.
   e. Clear the task.
   f. Set the calibrator to standby mode (STBY).
9. Calculate the gain adjust (*Gadj*) and offset adjust (*Oadj*) of each channel using the `chx_zero` and `chx_9V` values recorded in the previous steps according to the following equation:

$$Gadj\_chx = 9/(chx\_9V - chx\_zero)$$

$$Oadj\_chx = chx\_zero$$

These values will be used to adjust the paired channels measurement of the excitation voltage. Use the following formula to adjust the measurements:

```
Vadj_chx = (Vmeas_chx - Oadj_chx) * Gadj_chx
```

10. Set the calibrator voltage output to a *Test Point* value for the appropriate excitation voltage indicated in Table 8, beginning with the settings in the first row.

    For the first test point, set the calibrator to operate mode (OPR) to enable output.

11. Simultaneously acquire a ratiometric (V/V) measurement of the channel being verified and a voltage measurement of the paired channels excitation with the NI PXIe-4339.
    a. Create a DAQmx task.
    b. Create and configure the AI Bridge (V/V) measurement using the values in Table 6.

Table 6. V/V Measurement Parameters

Configuration	Value
Channel Name	`Dev1/ai0,ai2,ai4,ai6`
Task	AI Bridge (V/V)
Task Out	<task_out>
Sample Mode	Finite number of samples
Sample Clock Rate	100
Samples Per Channel	100
Excitation Voltage	Appropriate excitation voltage value from Tables 8 through 15
Maximum Value	Range Max from Tables 8 through 15
Minimum Value	Range Min from Tables 8 through 15
Units	V/V

    c. Commit the task to turn on and set the excitation voltage using the following parameters:

       Task: DAQmx control task

       task/channels in: <task_out from the previous step>

       action: Commit

    d. Use the paired channels to simultaneously measure the excitation of the ratiometric (V/V) channels that are being verified. This is accomplished by configuring the paired channels for voltage mode and adding them to the task that was configured in step 11b using the values in Table 7.

Table 7. Voltage Mode Parameters

Configuration	Value
Channel Name	`Dev1/ai1,ai3,ai5,ai7` (These are the paired channels of the V/V channels that are being verified.)
Task	AI Voltage
Task Out	<task_out>
Sample Mode	Finite number of samples
Sample Clock Rate	100
Samples Per Channel	100
Maximum Value	10
Minimum Value	-10
Units	Volts

e. Configure the voltage channels to connect to the paired channels excitation voltage using the following parameters:

Property Node: DAQmx channel

reference: <task_out> from the previous step

ActiveChans: Channels used in step 11d

AI.InputSrc: _paired_channel_excitation

f. Start the task.

g. Average the ratiometric readings and excitation channel voltage measurements that you acquired.

h. Scale the averaged excitation channel voltage measurements using the ratio verification adjustment factor and the formula provided in step 9. Record this value in Table 8 as `Vm_ex_ch#` where `#` is the channel number corresponding to the ratiometric channel being verified.

i. Calculate the ratiometric reference input value for each ratiometric channel by dividing the calibrator output voltage setting by the paired channels ratio verification adjusted excitation voltage measurement, `Vm_ex_ch#`, from step h, record this value as the *Test Point* value in Table 8.

j. Use the equations shown in Table 8 to calculate the high limit and low limit using the Test Point value recorded in the previous step.

k. For each channel, compare the averaged ratiometric (V/V) measurement to the high and low limit values from Table 8. If the result is between these values, the device passes the test.

Note The high and low limit values in Table 8 will be slightly different for each channel, due to channel-to-channel differences in the excitation voltage.

12. Repeat steps 10 through 13 for each of the test points for the given excitation.
13. Repeat steps 10 through 11 using `Dev1/ai1,ai3,ai5,ai7` for Table 6 channels and `Dev1/ai0,ai2,ai4,ai6` for Table 7 channels.
14. Repeat steps 10 through 12 for each excitation value in Table 8.
15. Repeat steps 10 through 14 using Table 9 through Table 15.

Table 8. Ratio Mode Accuracy Limits (±0.01 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.01	-0.01	2.75	0.02475	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 26.9 µV/V	(Test Point) * (1 + 0.001) + 26.9 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-26.9 µV/V	26.9 µV/V
			-0.02475	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 26.9 µV/V	(Test Point) * (1 - 0.001) + 26.9 µV/V
0.01	-0.01	3.33	0.02997	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 22.2 µV/V	(Test Point) * (1 + 0.001) + 22.2 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-22.2 µV/V	22.2 µV/V
			-0.02997	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 22.2 µV/V	(Test Point) * (1 - 0.001) + 22.2 µV/V
0.01	-0.01	5	0.045	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 14.8 µV/V	(Test Point) * (1 + 0.001) + 14.8 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-14.8 µV/V	14.8 µV/V
			-0.045	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 14.8 µV/V	(Test Point) * (1 - 0.001) + 14.8 µV/V

Table 8. Ratio Mode Accuracy Limits (±0.01 V/V Range) (Continued)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.01	-0.01	7.5	0.0675	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 9.9 µV/V	(Test Point) * (1 + 0.001) + 9.9 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-9.9 µV/V	9.9 µV/V
			-0.0675	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 9.9 µV/V	(Test Point) * (1 - 0.001) + 9.9 µV/V
0.01	-0.01	10	0.09	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 7.4 µV/V	(Test Point) * (1 + 0.001) + 7.4 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-7.4 µV/V	7.4 µV/V
			-0.09	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 7.4 µV/V	(Test Point) * (1 - 0.001) + 7.4 µV/V

Table 9. Ratio Mode Accuracy Limits (±0.02 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.02	-0.02	2.75	0.0495	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 32.4 µV/V	(Test Point) * (1 + 0.001) + 32.4 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-32.4 µV/V	32.4 µV/V
			-0.0495	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 32.4 µV/V	(Test Point) * (1 - 0.001) + 32.4 µV/V
0.02	-0.02	3.33	0.05994	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 26.7 µV/V	(Test Point) * (1 + 0.001) + 26.7 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-26.7 µV/V	26.7 µV/V
			-0.05994	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 26.7 µV/V	(Test Point) * (1 - 0.001) + 26.7 µV/V

Table 9. Ratio Mode Accuracy Limits (±0.02 V/V Range) (Continued)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.02	-0.02	5	0.09	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 17.8 µV/V	(Test Point) * (1 + 0.001) + 17.8 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-17.8 µV/V	17.8 µV/V
			-0.09	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 17.8 µV/V	(Test Point) * (1 - 0.001) + 17.8 µV/V
0.02	-0.02	7.5	0.135	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 11.9 µV/V	(Test Point) * (1 + 0.001) + 11.9 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-11.9 µV/V	11.9 µV/V
			-0.135	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 11.9 µV/V	(Test Point) * (1 - 0.001) + 11.9 µV/V
0.02	-0.02	10	0.18	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 8.9 µV/V	(Test Point) * (1 + 0.001) + 8.9 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-8.9 µV/V	8.9 µV/V
			-0.18	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 8.9 µV/V	(Test Point) * (1 - 0.001) + 8.9 µV/V

Table 10. Ratio Mode Accuracy Limits (±0.05 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.05	-0.05	2.75	0.12375	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 48.4 µV/V	(Test Point) * (1 + 0.001) + 48.4 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-48.4 µV/V	48.4 µV/V
			-0.12375	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 48.4 µV/V	(Test Point) * (1 - 0.001) + 48.4 µV/V

Table 10. Ratio Mode Accuracy Limits (±0.05 V/V Range) (Continued)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.05	-0.05	3.33	0.14985	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 39.9 µV/V	(Test Point) * (1 + 0.001) + 39.9 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-39.9 µV/V	39.9 µV/V
			-0.14985	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 39.9 µV/V	(Test Point) * (1 - 0.001) + 39.9 µV/V
0.05	-0.05	5	0.225	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 26.6 µV/V	(Test Point) * (1 + 0.001) + 26.6 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-26.6 µV/V	26.6 µV/V
			-0.225	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 26.6 µV/V	(Test Point) * (1 - 0.001) + 26.6 µV/V
0.05	-0.05	7.5	0.3375	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 17.7 µV/V	(Test Point) * (1 + 0.001) + 17.7 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-17.7 µV/V	17.7 µV/V
			-0.3375	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 17.7 µV/V	(Test Point) * (1 - 0.001) + 17.7 µV/V
0.05	-0.05	10	0.45	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 13.3 µV/V	(Test Point) * (1 + 0.001) + 13.3 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-13.3 µV/V	13.3 µV/V
			-0.45	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 13.3 µV/V	(Test Point) * (1 - 0.001) + 13.3 µV/V

Table 11. Ratio Mode Accuracy Limits (±1 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
1	-1	2.75	2.475	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 567.6 µV/V	(Test Point) * (1 + 0.001) + 567.6 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-567.6 µV/V	567.6 µV/V
			-2.475	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 567.6 µV/V	(Test Point) * (1 - 0.001) + 567.6 µV/V
1	-1	3.33	2.997	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 468.8 µV/V	(Test Point) * (1 + 0.001) + 468.8 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-468.8 µV/V	468.8 µV/V
			-2.997	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 468.8 µV/V	(Test Point) * (1 - 0.001) + 468.8 µV/V
1	-1	5	4.5	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 312.2 µV/V	(Test Point) * (1 + 0.001) + 312.2 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-312.2 µV/V	312.2 µV/V
			-4.5	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 312.2 µV/V	(Test Point) * (1 - 0.001) + 312.2 µV/V
1	-1	7.5	6.75	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 208.1 µV/V	(Test Point) * (1 + 0.001) + 208.1 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-208.1 µV/V	208.1 µV/V
			-6.75	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 208.1 µV/V	(Test Point) * (1 - 0.001) + 208.1 µV/V
1	-1	10	9	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 156.1 µV/V	(Test Point) * (1 + 0.001) + 156.1 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-156.1 µV/V	156.1 µV/V
			-9	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 156.1 µV/V	(Test Point) * (1 - 0.001) + 156.1 µV/V

Table 12. Ratio Mode Accuracy Limits (±0.04 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.04	-0.04	0.625	0.0225	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 118.4 µV/V	(Test Point) * (1 + 0.001) + 118.4 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-118.4 µV/V	118.4 µV/V
			-0.0225	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 118.4 µV/V	(Test Point) * (1 - 0.001) + 118.4 µV/V
0.04	-0.04	1	0.036	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 74 µV/V	(Test Point) * (1 + 0.001) + 74 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-74 µV/V	74 µV/V
			-0.036	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 74 µV/V	(Test Point) * (1 - 0.001) + 74 µV/V
0.04	-0.04	1.5	0.054	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 49.3 µV/V	(Test Point) * (1 + 0.001) + 49.3 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-49.3 µV/V	49.3 µV/V
			-0.054	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 49.3 µV/V	(Test Point) * (1 - 0.001) + 49.3 µV/V
0.04	-0.04	2	0.072	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 37.0 µV/V	(Test Point) * (1 + 0.001) + 37.0 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-37.0 µV/V	37.0 µV/V
			-0.072	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 37.0 µV/V	(Test Point) * (1 - 0.001) + 37.0 µV/V
0.04	-0.04	2.5	0.09	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 29.6 µV/V	(Test Point) * (1 + 0.001) + 29.6 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-29.6 µV/V	29.6 µV/V
			-0.09	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 29.6 µV/V	(Test Point) * (1 - 0.001) + 29.6 µV/V

Table 13. Ratio Mode Accuracy Limits (±0.08 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.08	-0.08	0.625	0.045	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 142.4 µV/V	(Test Point) * (1 + 0.001) + 142.4 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-142.4 µV/V	142.4 µV/V
			-0.045	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 142.4 µV/V	(Test Point) * (1 - 0.001) + 142.4 µV/V
0.08	-0.08	1	0.072	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 89.0 µV/V	(Test Point) * (1 + 0.001) + 89.0 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-89.0 µV/V	89.0 µV/V
			-0.072	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 89.0 µV/V	(Test Point) * (1 - 0.001) + 89.0 µV/V
0.08	-0.08	1.5	0.108	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 59.3 µV/V	(Test Point) * (1 + 0.001) + 59.3 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-59.3 µV/V	59.3 µV/V
			-0.108	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 59.3 µV/V	(Test Point) * (1 - 0.001) + 59.3 µV/V
0.08	-0.08	2	0.144	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 44.5 µV/V	(Test Point) * (1 + 0.001) + 44.5 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-44.5 µV/V	44.5 µV/V
			-0.144	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 44.5 µV/V	(Test Point) * (1 - 0.001) + 44.5 µV/V
0.08	-0.08	2.5	0.18	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 35.6 µV/V	(Test Point) * (1 + 0.001) + 35.6 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-35.6 µV/V	35.6 µV/V
			-0.18	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 35.6 µV/V	(Test Point) * (1 - 0.001) + 35.6 µV/V

Table 14. Ratio Mode Accuracy Limits (±0.2 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
0.2	-0.2	0.625	0.1125	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 212.8 µV/V	(Test Point) * (1 + 0.001) + 212.8 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-212.8 µV/V	212.8 µV/V
			-0.1125	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 212.8 µV/V	(Test Point) * (1 - 0.001) + 212.8 µV/V
0.2	-0.2	1	0.18	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 133.0 µV/V	(Test Point) * (1 + 0.001) + 133.0 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-133.0 µV/V	133.0 µV/V
			-0.18	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 133.0 µV/V	(Test Point) * (1 - 0.001) + 133.0 µV/V
0.2	-0.2	1.5	0.27	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 88.7 µV/V	(Test Point) * (1 + 0.001) + 88.7 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-88.7 µV/V	88.7 µV/V
			-0.27	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 88.7 µV/V	(Test Point) * (1 - 0.001) + 88.7 µV/V
0.2	-0.2	2	0.36	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 66.5 µV/V	(Test Point) * (1 + 0.001) + 66.5 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-66.5 µV/V	66.5 µV/V
			-0.36	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 66.5 µV/V	(Test Point) * (1 - 0.001) + 66.5 µV/V
0.2	-0.2	2.5	0.45	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 53.2 µV/V	(Test Point) * (1 + 0.001) + 53.2 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-53.2 µV/V	53.2 µV/V
			-0.45	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 53.2 µV/V	(Test Point) * (1 - 0.001) + 53.2 µV/V

Table 15. Ratio Mode Accuracy Limits (±4 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)	Measured Excitation (V)	Test Point (V/V)	Lower Limit (V/V)	Upper Limit (V/V)
High	Low						
4	-4	0.625	2.25	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 2498 µV/V	(Test Point) * (1 + 0.001) + 2498 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-2498 µV/V	2498 µV/V
			-2.25	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 2498 µV/V	(Test Point) * (1 - 0.001) + 2498 µV/V
4	-4	1	3.6	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 1561 µV/V	(Test Point) * (1 + 0.001) + 1561 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-1561 µV/V	1561 µV/V
			-3.6	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 1561 µV/V	(Test Point) * (1 - 0.001) + 1561 µV/V
4	-4	1.5	5.4	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 1041 µV/V	(Test Point) * (1 + 0.001) + 1041 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-1041 µV/V	1041 µV/V
			-5.4	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 1041 µV/V	(Test Point) * (1 - 0.001) + 1041 µV/V
4	-4	2	7.2	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 781 µV/V	(Test Point) * (1 + 0.001) + 781 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-781 µV/V	781 µV/V
			-7.2	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 781 µV/V	(Test Point) * (1 - 0.001) + 781 µV/V
4	-4	2.5	9	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 - 0.001) - 624 µV/V	(Test Point) * (1 + 0.001) + 624 µV/V
			0	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	-624 µV/V	624 µV/V
			-9	Vm_ex_ch#	(calibrator output)/ Vm_ex_ch#	(Test Point) * (1 + 0.001) - 624 µV/V	(Test Point) * (1 - 0.001) + 624 µV/V

Adjustment

The following performance adjustment procedure describes the sequence of operation required to adjust the NI PXIe-4339.

Adjustment Procedure

Complete the following steps to adjust the accuracy of the NI PXIe-4339.

1. Set the calibrator to standby mode (STBY).
2. Connect the calibrator to the TB-4339/B/C as shown in Figure 2.
   - If the calibrator has a guard connection, leave it disconnected.
   - If the calibrator output is floating, you must connect the negative output to AIGND.
3. Call the DAQmx Initialize External Calibration function with the following parameters:

   Device In: `Dev1`

   Password: `NI`
4. Call the 4339 instance of the DAQmx Setup SC Express Calibration function with the following parameters:

   calhandle in: calhandle output from DAQmx Initialize External Calibration

   rangeMax: Appropriate *Range Max* starting with the value in the first row of Table 16

   rangeMin: Appropriate *Range Min* starting with the value in the first row of Table 16

   physical channels: `dev1/ai0:7`

   cal mode: `Voltage`

Table 16. Voltage Mode

Range (V)		
Max	**Min**	**Calibrator Output (V)**
0.1	-0.1	0.09
		0
		-0.09
0.2	-0.2	0.18
		0
		-0.18
0.5	-0.5	0.45
		0
		-0.45

Table 16. Voltage Mode (Continued)

Range (V)		Calibrator Output (V)
Max	Min	
10	-10	9
		0
		-9

5. Set the calibrator output equal to the first calibrator output for the corresponding range in Table 16 that was configured in step 4.
6. Set the calibrator to operate mode (OPR) to enable output.
7. Call the 4339 instance of the DAQmx Adjust SC Express Calibration function with the following parameters:

   calhandle in: calhandle output from DAQmx Initialize External Calibration

   reference voltage: Calibrator output value from step 5
8. Repeat steps 5 through 7 for the remaining two calibrator output values from Table 16 for the corresponding range that was configured in step 4.
9. Repeat steps 4 through 8 for the remaining ranges from Table 16.
10. Call the 4339 instance of the DAQmx Adjust SC Express Calibration function with the following parameters:

    calhandle in: calhandle output from DAQmx Initialize External Calibration

    rangeMax: Appropriate *Range Max* starting with the value in the first row of Table 17

    rangeMin: Appropriate *Range Min* starting with the value in the first row of Table 17

    physical channels: `dev1/ai0:7`

    cal mode: `Ratiometric`

    excitation voltage: Appropriate *Excitation Setting* from the corresponding row in Table 17

Table 17. Ratio Mode (±0.01 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
0.01	-0.01	2.75	0.02475
			0
			-0.02475
0.01	-0.01	3.33	0.02997
			0
			-0.02997

Table 17. Ratio Mode (±0.01 V/V Range) (Continued)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
0.01	-0.01	5	0.045
			0
			-0.045
0.01	-0.01	7.5	0.0675
			0
			-0.0675
0.01	-0.01	10	0.09
			0
			-0.09

11. Set the calibrator output equal to the first calibrator output for the corresponding excitation value in Table 17.
12. Set the calibrator to operate mode (OPR) to enable the output.
13. Call the 4339 instance of the DAQmx Adjust SC Express Calibration function with the following parameters:

    calhandle in: calhandle output from DAQmx Initialize External Calibration

    reference voltage: Calibrator output value from step 11.
14. Repeat steps 11 through 13 for the remaining calibrator output values from Table 17.
15. Repeat steps 10 through 14 for the remaining excitation voltage values from Table 17.
16. Repeat steps 10 through 15 using values from Table 18 through Table 24.

Table 18. Ratio Mode (±0.02 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
0.02	-0.02	2.75	0.0495
			0
			-0.0495
0.02	-0.02	3.33	0.05994
			0
			-0.05994

Table 18. Ratio Mode (±0.02 V/V Range) (Continued)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
0.02	-0.02	5	0.09
			0
			-0.09
0.02	-0.02	7.5	0.135
			0
			-0.135
0.02	-0.02	10	0.18
			0
			-0.18

Table 19. Ratio Mode (±0.05 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
0.05	-0.05	2.75	0.12375
			0
			-0.12375
0.05	-0.05	3.33	0.14985
			0
			-0.14985
0.05	-0.05	5	0.225
			0
			-0.225
0.05	-0.05	7.5	0.3375
			0
			-0.3375

Table 19. Ratio Mode (±0.05 V/V Range) (Continued)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	**Min**		
0.05	-0.05	10	0.45
			0
			-0.45

Table 20. Ratio Mode (±1 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	**Min**		
1	-1	2.75	2.475
			0
			-2.475
1	-1	3.33	2.997
			0
			-2.997
1	-1	5	4.5
			0
			-4.5
1	-1	7.5	6.75
			0
			-6.75
1	-1	10	9
			0
			-9

Table 21. Ratio Mode (±0.04 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
0.04	-0.04	0.625	0.0225
			0
			-0.0225
0.04	-0.04	1	0.036
			0
			-0.036
0.04	-0.04	1.5	0.054
			0
			-0.054
0.04	-0.04	2	0.072
			0
			-0.072
0.04	-0.04	2.5	0.09
			0
			-0.09

Table 22. Ratio Mode (±0.08 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
0.08	-0.08	0.625	0.045
			0
			-0.045
0.08	-0.08	1	0.072
			0
			-0.072

Table 22. Ratio Mode (±0.08 V/V Range) (Continued)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	**Min**		
0.08	-0.08	1.5	0.108
			0
			-0.108
0.08	-0.08	2	0.144
			0
			-0.144
0.08	-0.08	2.5	0.18
			0
			-0.18

Table 23. Ratio Mode (±0.2 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	**Min**		
0.2	-0.2	0.625	0.1125
			0
			-0.1125
0.2	-0.2	1	0.18
			0
			-0.18
0.2	-0.2	1.5	0.27
			0
			-0.27
0.2	-0.2	2	0.36
			0
			-0.36

Table 23. Ratio Mode (±0.2 V/V Range) (Continued)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
0.2	-0.2	2.5	0.45
			0
			-0.45

Table 24. Ratio Mode (±4 V/V Range)

Range (V/V)		Excitation Setting (V)	Calibrator Output (V)
Max	Min		
4	-4	0.625	2.25
			0
			-2.25
4	-4	1	3.6
			0
			-3.6
4	-4	1.5	5.4
			0
			-5.4
4	-4	2	7.2
			0
			-7.2
4	-4	2.5	9
			0
			-9

17. Call the 4339 instance of the DAQmx Adjust SC Express Calibration function with the following parameters:

    calhandle in: calhandle output from DAQmx Initialize External Calibration

    action: commit

EEPROM Update

When an adjustment procedure is completed, the NI PXIe-4339 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 by initializing an external calibration and closing the external calibration.

Reverification

Repeat the *Verification* section 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 *Test Conditions* before returning your device to NI. Refer to *Where to Go for Support* for assistance in returning the device to NI.

Specifications

Refer to the *NI PXIe-4339 Specifications* for detailed specification information.

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.

Visit `ni.com/services` for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit `ni.com/register` to register your National Instruments product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world. For telephone support in the United States, create your service request at `ni.com/support` or dial 1 866 ASK MYNI (275 6964). 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.