

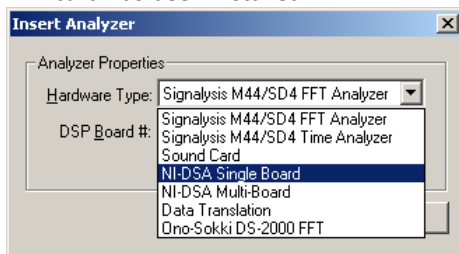
### Overview

This document describes the procedure for calibration of an accelerometer using SigAnalyzer and a hand-held Accelerometer Calibrator. For this example, it is assumed the calibrator provides a  $1g_{rms}$  sinusoidal source centered at 159.2 Hz.

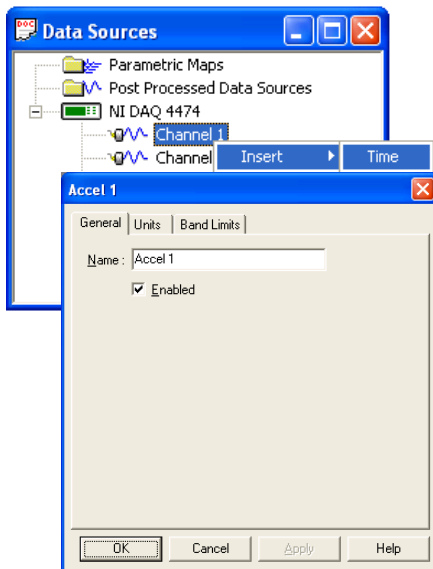
### Setup

#### Open SigAnalyzer and create a new SigAnalyzer project

1. From the SigAnalyzer main menu, select "File-New..."
2. Select the appropriate acquisition hardware. In this example, a National Instruments 4474 DSA acquisition card has been installed.



#### Create a time signal for each of the accelerometer channels



1. Expand the NI-4474 Icon.
2. Right mouse click on the appropriate data channel, then select "Insert-Time".
3. Name the data source by accelerometer and/or location, then click the OK button.
4. Repeat for each additional accelerometer.

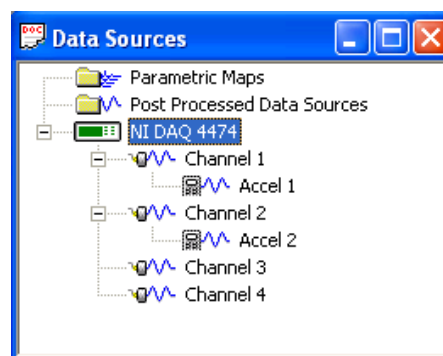


Figure 1 – Example of Data Sources window after inserting two Time signals (Accel 1 and Accel 2) beneath Channel 1 and Channel 2 respectively.

### Define acquisition properties

1. Double click on the NI DAQ 4474 icon.
2. Click on the “Channel Setup” tab.
3. Within the *Physical Channels* list, select the accelerometer channels to be calibrated.
4. Place a check in the *Enable* checkbox.
5. Set the *Units Label* field to “V”.
6. Set the *Units Description* field to “Volts”.
7. Set the *Sensitivity* field to 1000 mV/EU.
8. Click on the “Acquisition” tab.
9. Within the *Maximum* (Hz) control, enter the value 10000.
10. Within the *Blocksize* control, select 4096.

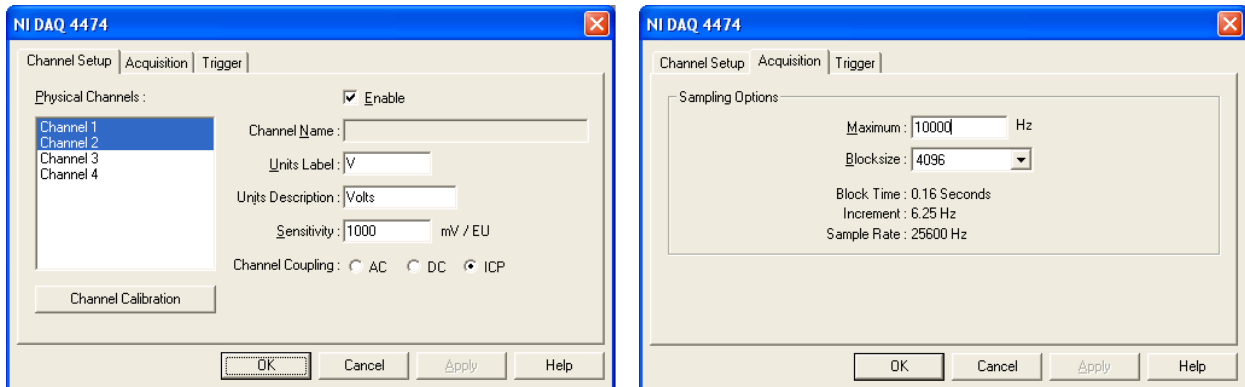


Figure 2 – Image of settings within the Channel Setup and Acquisition tabs of the setup. This example assumes the first two channels are accelerometer channels to be calibrated.

### Create auto spectrum post-process data sources for each accelerometer channel

1. Right click on the "Post-Process Data Sources" folder icon.
2. Select "Insert-Auto Spectrum".
3. Define the Auto Spectrum post-process as shown in the graphic below.

The figure consists of four overlapping screenshots of the 'Auto Spectrum-Accel 1' dialog box, each illustrating a different configuration step:

- Step A:** The 'General' tab is selected. The 'Name' field is set to 'Auto Spectrum-Accel 1' and the 'Enabled' checkbox is checked.
- Step B:** The 'Dependencies' tab is selected. The 'Data Source' dropdown is set to 'Accel 1' and the 'Analyzer' field is set to 'NI DAQ 4474'.
- Step C:** The 'Spectral Averaging' tab is selected. The 'Averaging Mode' dropdown is set to 'Linear', the 'Number of Averages' is set to 100, and the 'Exponential Weight' is set to 0.5.
- Step D:** The 'Response Window' tab is selected. The 'Window Type' dropdown is set to 'Hanning'. Below this, a graph shows the Hanning window function. The y-axis is labeled 'Window (Gain)' and ranges from -0.1 to 1.1. The x-axis is labeled 'Block size (%)' and ranges from 0 to 100. The graph shows a smooth, bell-shaped curve peaking at 1.0 when the block size is 50%.

### Create a slice post-process data source for each auto spectrum data source

A post-process slice from the auto spectrum will be used to calculate the  $V_{rms}$  produced over a small frequency range centered about the calibrator output frequency. This will prevent external vibration at frequencies other than the calibrator frequency from being included in the calibration.

1. Right click on the "Auto Spectrum-Accel  $n$ " post-process data source created in the previous section.
2. Select "Insert-Slice".
3. Define the Slice post-process as shown in the graphic below.

**A.** From the "General" tab, name the slice as "Sensitivity-Accel  $n$ " where " $n$ " represents the accelerometer channel being calibrated.

**B.** From the "Units" tab, uncheck the "Use the default..." checkbox, then enter the settings shown.




*Note: If your calibrator produces a level other than 1.0 g, divide 1000 by the provided g level and enter that number.*  $\left[ \frac{1000 \text{ mV}}{X \text{ g}} \right]$

**C.** From the "Averaging" tab, select "None" since the parent auto spectrum data source performs the averaging.

**D.** From the "Slice" tab, select "Frequency Range", and specify as "Center/Bandwidth". In the "Center" field, enter the frequency of the calibrator. In the example shown, the slice will span from 109.2Hz to 209.2Hz.

## Implementation

### Calibrate the accelerometers


1. Connect the hand-held accelerometer calibrator to the first accelerometer
-  2. Display the "Sensitivity" graph for that accelerometer by double clicking on the "Sensitivity-Accel *n*" icon.
3. Turn on the hand-held accelerometer calibrator.
-  4. Press the *start* acquisition button in SigAnalyzer.
5. Allow the "Sensitivity" value to complete 100 averages (about about 10 seconds)
-  6. Press the *stop* acquisition button.
7. Within the "Sensitivity-Accel *n*" graph, right-click and select "Insert-Cursor".
8. Left-click on the cursor and record the value. The value represents the transducer sensitivity in units of mV/g.
9. Repeat this procedure for each accelerometer.

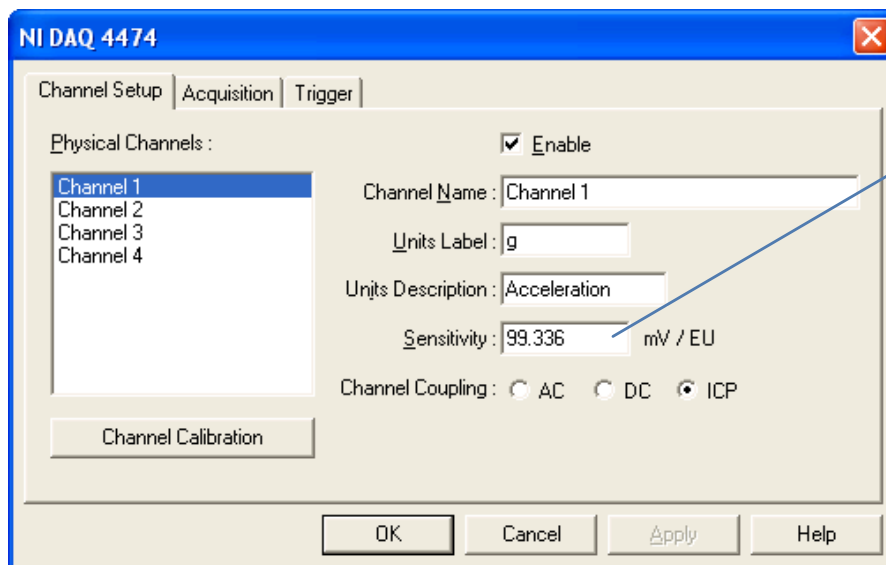
### Save and close the SigAnalyzer calibration project

1. Once all accelerometer sensitivities have been recorded, save the project created in the sections above as "Calibration.san" in the same location as your other SigAnalyzer projects.
2. Close the "Calibration" project by selecting "File-Close" from the SigAnalyzer application menu.

### Adjust the sensitivity in other SigAnalyzer projects

All SigAnalyzer projects that reference the calibrated accelerometers must be updated to reflect the new sensitivity values. For each affected SigAnalyzer project, follow the procedure below. Note, do not make adjustments to the "Calibration.san" file. You may use that project to calibrate again at a later date.

1. Open a SigAnalyzer project to be updated.
-  2. Double click the analyzer icon within the "Data Sources" window, then select the "Channel Setup" tab.
3. From the "Physical Channels" list, select the channel that is connected to first calibrated accelerometer.
4. Enter the recorded sensitivity value within the "Sensitivity" field.
5. Repeat steps 3 and 4 for each calibrated accelerometer.
6. Save and close the project.



Enter the recorded sensitivity for each accelerometer.

Repeat the above procedures for each SigAnalyzer project that references the newly calibrated accelerometers.