BIOPAC Systems, Inc.
updated 11.04.2005

42 Aero Camino
Goleta, CA 93117
Ph (805) 685-0066
Fax (805) 685-0067
www.biopac.com
info@biopac.com

#AH141 Tri-axial Accelerometer Calibration

Tri-axial accelerometers are high-level output transducers requiring no additional amplification since the amplifier is built into the transducer. They connect directly to the HLT100 High Level Transducer module or TEL100 module to provide three outputs, each simultaneously measuring acceleration in the X, Y, and Z direction. The 5 g accelerometer is well suited for measuring slow movements, whereas the 50 g accelerometer is made to measure quick movements. With the proper equipment and proper scaling parameters listed below, precise acceleration measurements can be obtained.

Equipment

TSD109C Tri-axial Accelerometer- Output +/- 5 g (400 mV/g)
TSD109F Tri-axial Accelerometer- Output +/- 50 g (40 mV/g)
MP100/150 Starter System HLT100 High Level Transducer Module

or

SS26 Tri-Axial Accelerometer- Output +/- 5 g (400 mV/g)
SS27 Tri-Axial Accelerometer- Output +/- 50 g (40 mV/g)
MP100/150 Starter System TEL100 Remote Monitoring Module Set

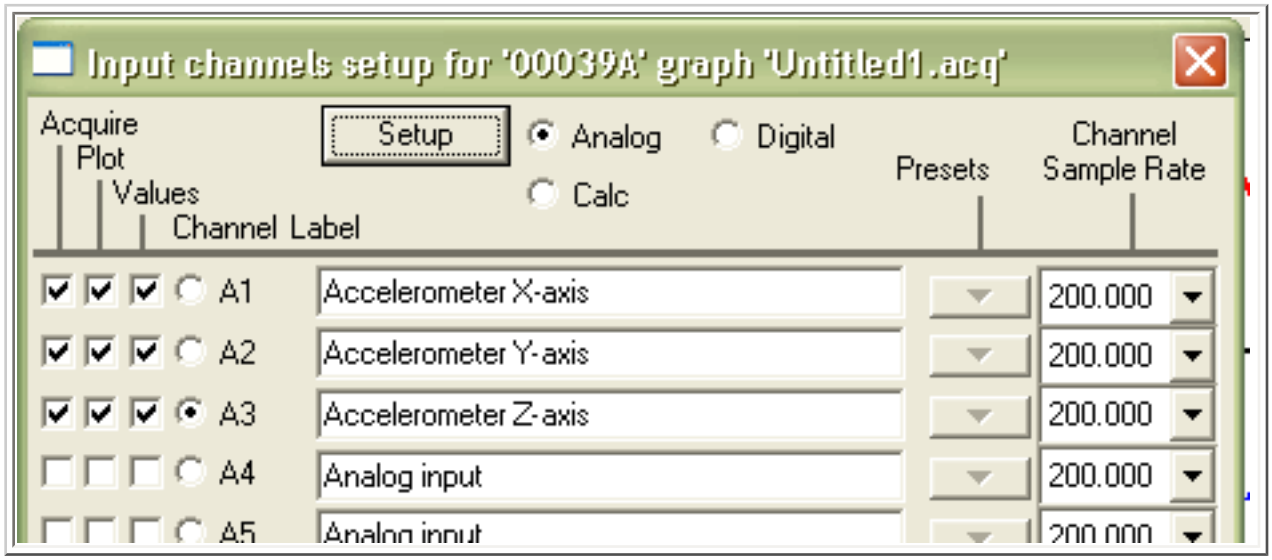
Hardware Setup

1. Connect the Module to the MP System.
    - If using HLT100: Connect the HLT100 to the **left** side of the UIM100 Universal Interface Module.
    - If using TEL100: Connect the TEL100 receiver module to the **right** side of the UIM100.
2. Connect the Accelerometer outputs directly to three channels on the Module.
    - The accelerometers (TSD109, SS26, SS27, SS26L, and SS27L) require 3 output connectors, 1 each for the X-, Y-, and Z-axis. Each output connector must be connected to one channel on the HLT100 or TEL100 transmitter. For example, the X-

axis to channel 1, the Y-axis to channel 2, and the Z-axis to channel 3.

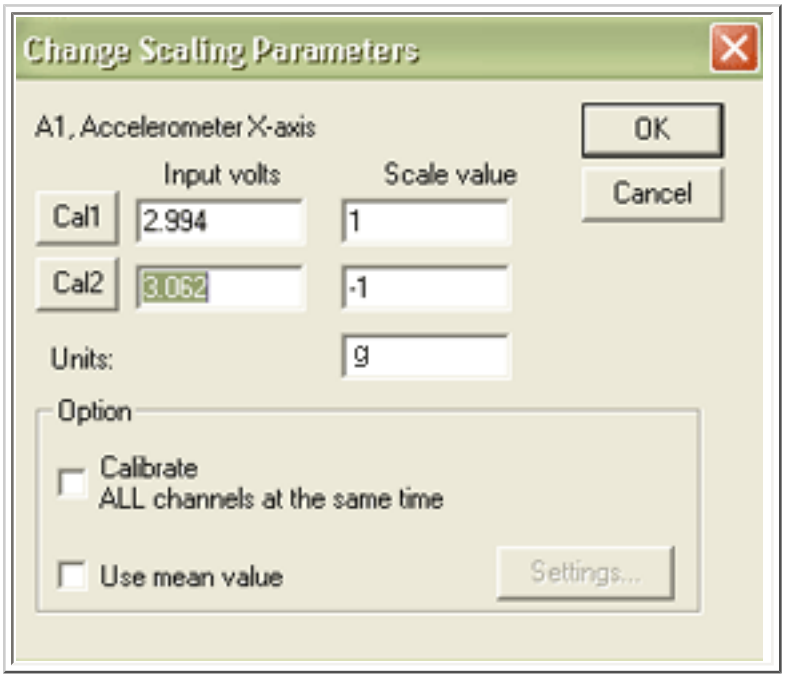
Software Setup for Acq*Knowledge*

1. Click MP menu > Set up Channels.
2. Enable 3 analog channels, one for each axis (as shown below).

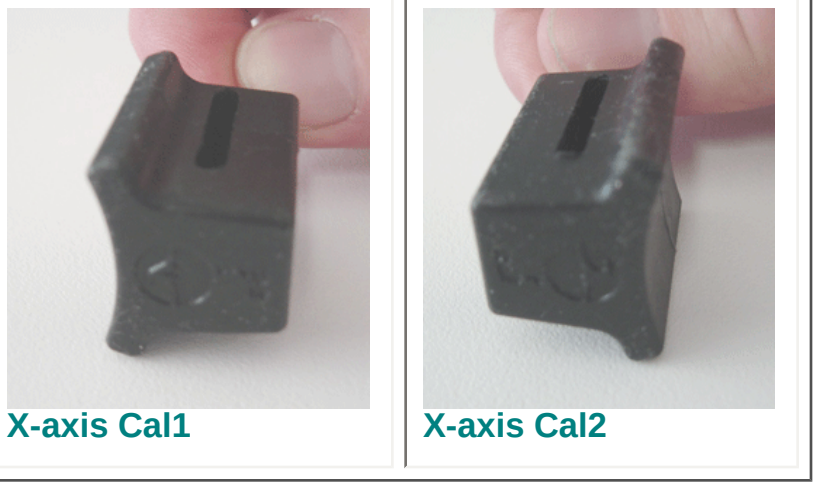


You will calibrate the accelerometer (TSD109, SS26, or SS27) by rotating each channel through 180 degrees and taking a calibration reading at each axis point (see pictures):

3. **X-axis Scaling:**
   a. Click **A1** and then click "Setup" to generate the Change Scaling Parameters dialog.
   b. Enter the "Scale values" Cal1 = 1 and Cal2 = -1, and enter the Units label "g" (as shown below).



   c. Rest the accelerometer on a flat surface in the sideways position and then click Cal1.


X-axis Cal1

X-axis Cal2

d. Rotate the accelerometer 180 degrees, rest it on a flat surface in the flipped position, and then click Cal2.

4. **Y-axis Scaling:**
   a. Click **A2** and then click "Setup" to generate the Change Scaling Parameters dialog.
   b. Enter the "Scale values" Cal1 = 1 and Cal2 = -1, and enter the Units label "G".
   c. Rest the accelerometer on a flat surface in the wide upright position and then click Cal1.


Y-axis Cal1


Y-axis Cal2

   d. Rotate the accelerometer 180 degrees, rest it on a flat surface in the flipped position, and then click Cal2.

5. **Z-axis Scaling:**
   a. Click **A3** and then click "Setup" to generate the Change Scaling Parameters dialog.
   b. Enter the "Scale values" Cal1 = 1 and Cal2 = -1, and enter the Units label "G".
   c. Rest the accelerometer on a flat surface in the tall upright (cord up) position and then click Cal1.

Z-axis Cal1

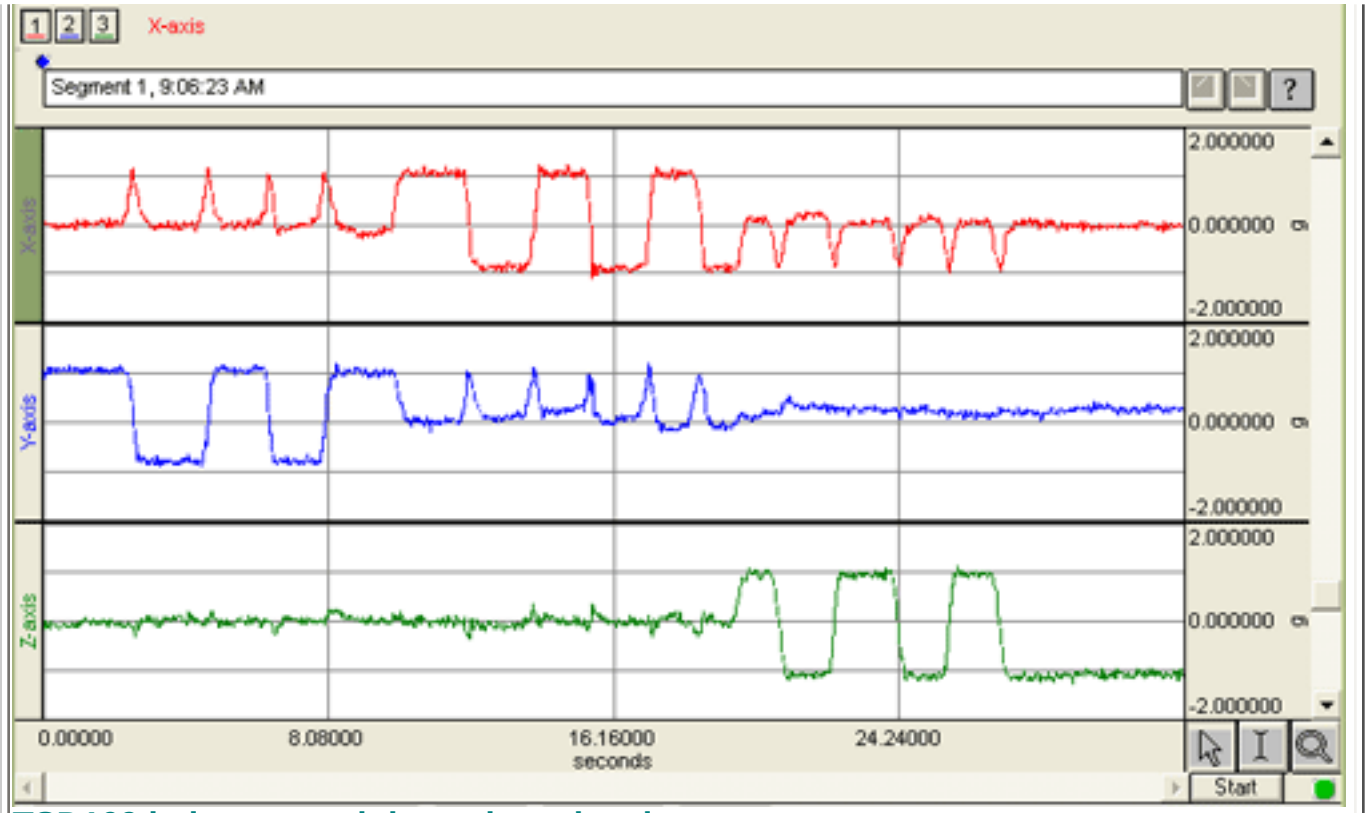
Z-axis Cal2

d. Rotate the accelerometer 180 degrees, rest it on a flat surface in the flipped (cord down) position, and then click Cal2.

Calibration Validation

To visually confirm that calibration is correct, repeat the calibration procedure of rotating the accelerometer 180 degrees through each axis.

1. Set up acquisition parameters.
    - A sample rate of 50 samples/second was used in this example.
2. Click "Start" to begin acquiring data.
3. Rotate the accelerometer 180 degrees through each axis.
4. Click "Stop" to end data acquisition.
5. Set the vertical scale to 1 and the midpoint to 0 for all channels.
6. Check the data to confirm the scaling:
    - Each channel should show the signal moving from 1 g to -1 g as the accelerometer axis is rotated.



TSD109 being rotated through each axis:

- Channel 1 (top) is the X-axis
- Channel 2 (middle) is the Y-axis
- Channel 3 (bottom) is the Z-axis

When calibration is confirmed, the tri-axial accelerometer is ready to measure movement.

Return To Application Note Menu