AudioAnalyzer Calibration

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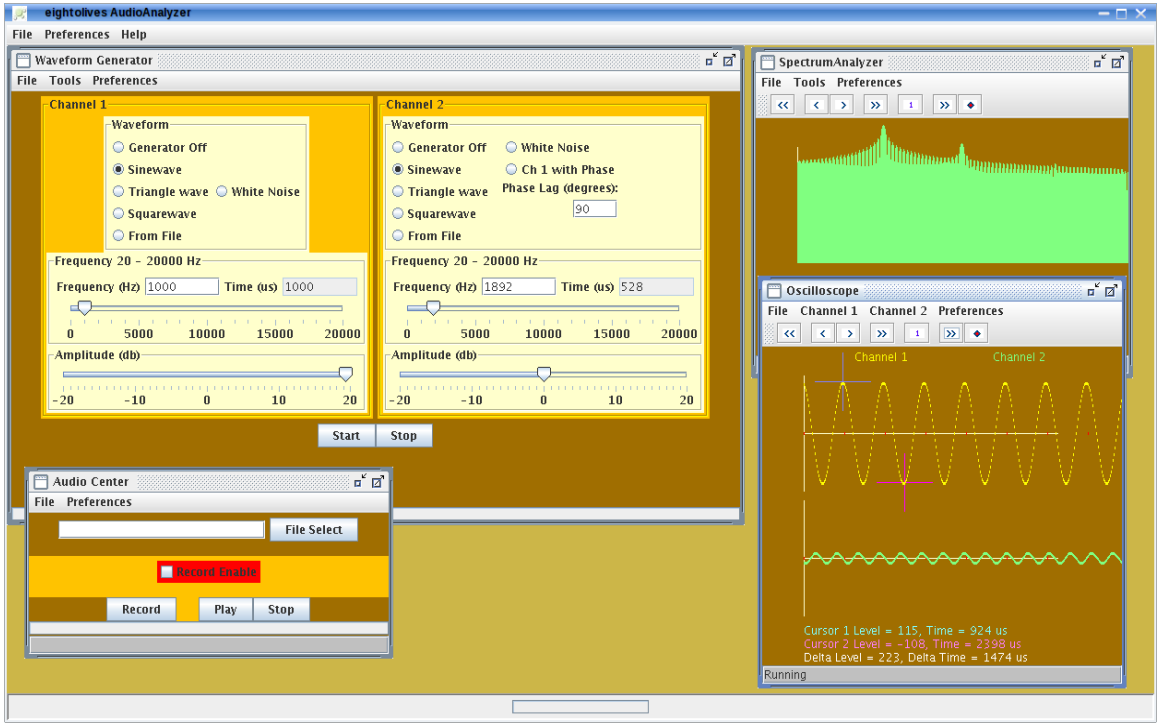
Abstract

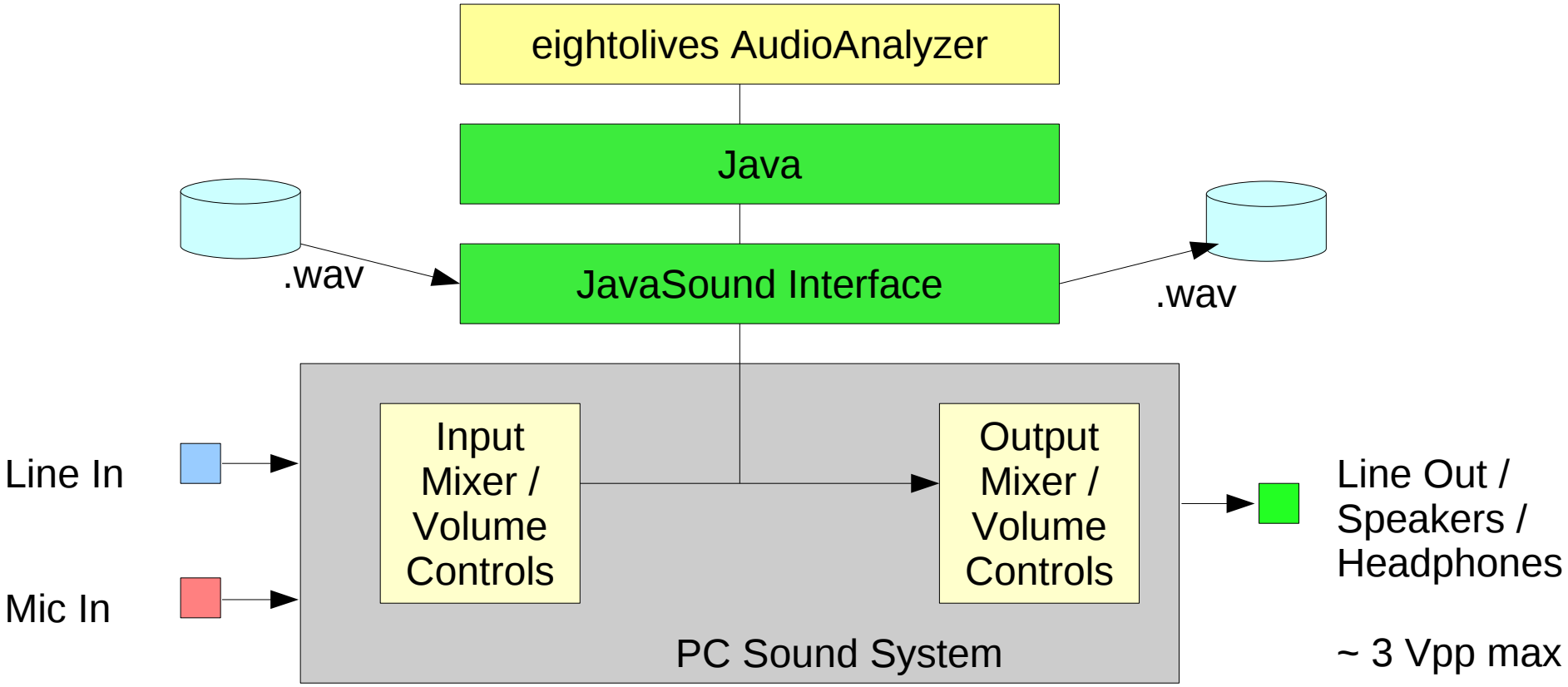
This presentation explains how to calibrate the eightolives AudioAnalyzer on a typical PC.



Background

- The eightolives AudioAnalyzer is a Java-based program that provides a set of audio tools that can interface to a PC's audio system (uses the Javasound interface)
  - 2 – Waveform Generators – sine, triangle, square, white noise, AM, FM, phasing, harmonics
  - Oscilloscope for viewing 2 channels
  - Spectrum Analyzer – FFT view of the audio spectrum
  - Recorder

The Sound System



Calibration is valid only for the selected setting of Input and Output Mixer Volume Controls.

About Signal Levels

- Waveform Generator defines the maximum undistorted sine wave amplitude as +20 db
  - For 16 bit resolution, +20 db peak-to-peak is digitally expressed as +32767 to -32768
  - 0 db (nominal level) peak-to-peak is 10 times less
- Actual analog output levels on Line Out are determined by the PC mixer's volume controls
- Analog input signal levels are also determined by the PC mixer's volume controls

Interface Basics

- Line In – 3.5 mm (1/8”) Tip Ring Sleeve (TRS) connector (light blue)
  - Nominal level = .316 Vrms (.447 V peak, .894 Vpp)
  - Input impedance ~ 10 Kohms
- Line Out – 3.5 mm TRS (lime green)
  - Max output voltage ~ 3 V peak-peak
  - Output impedance ~ 100 ohms
  - Frequency Range = 20 Hz – 20,000 Hz

Source: Wikipedia

Why calibrate?

- Calibration adjusts the voltage scale displayed by the oscilloscope to accurately reflect the actual output on the HEADPHONE / LINE OUT connector and inputs on LINE IN
- Three factors are resolved in calibration
  - The Output Mixer volume control and amplifier gain
  - The Input Mixer volume control and amplifier gain
  - The effect of input impedance

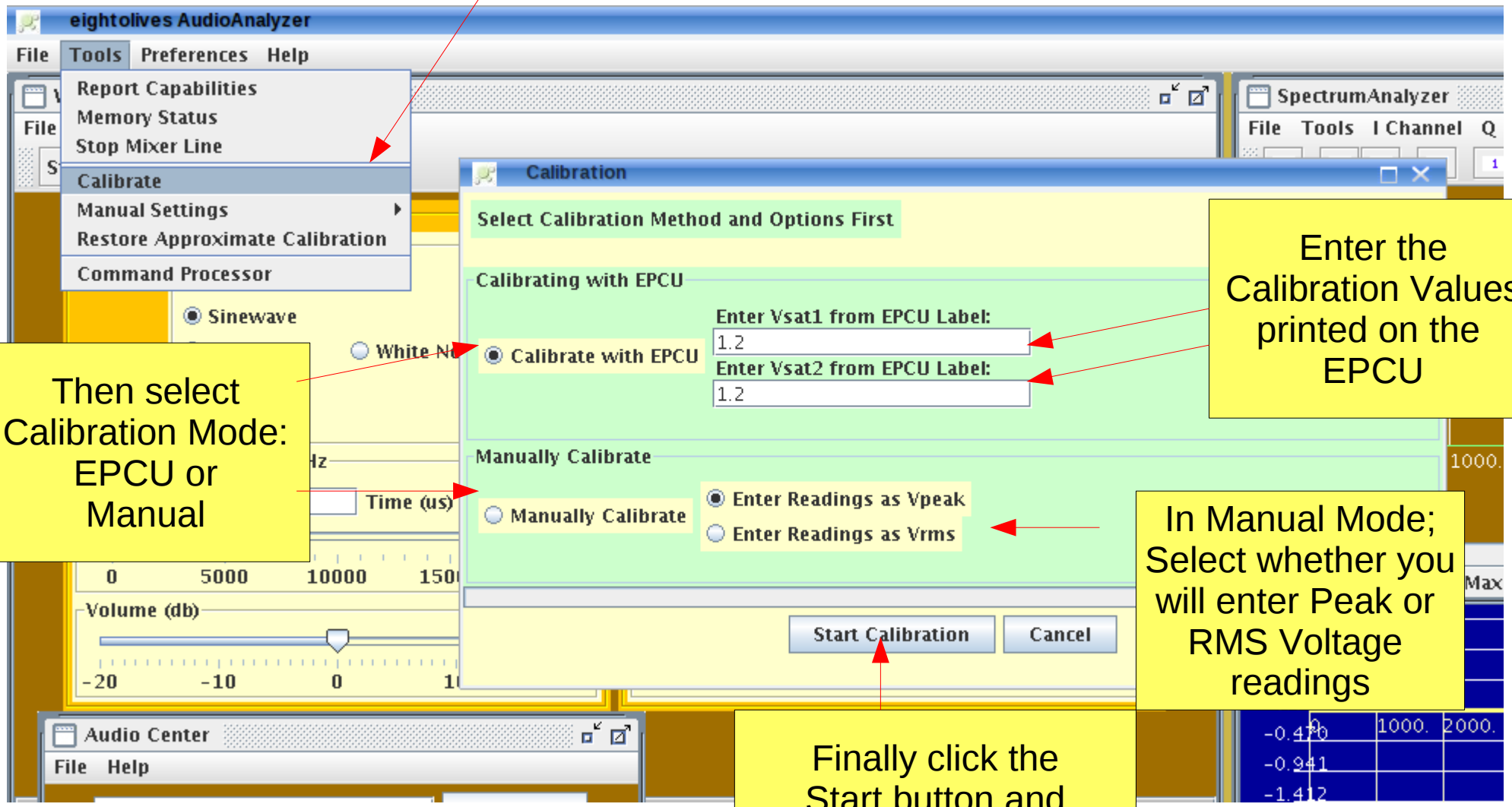
How to calibrate

- You can calibrate using the eightolives' Protection / Calibration Unit (EPCU) which comes in the AudioAnalyzer kit
- Or you can calibrate manually using an external oscilloscope or AC Voltmeter and test cable

Getting Ready

- AudioAnalyzer should be installed and working on your computer
- Verify that a continuous sinewave tone can be output on the HEADPHONE / LINE OUT connector
- Verify that the Audio System mixer selects the LINE IN connector and that inputs to LINE IN can be displayed on the Oscilloscope
- For EPCU calibration, set the Output Mixer Volume Controls to maximum value
- For manual calibration, set the Output Mixer Volume Controls to intended operating level

Select Menu Option: Tools > Calibrate



Then select Calibration Mode: EPCU or Manual

Enter the Calibration Values printed on the EPCU

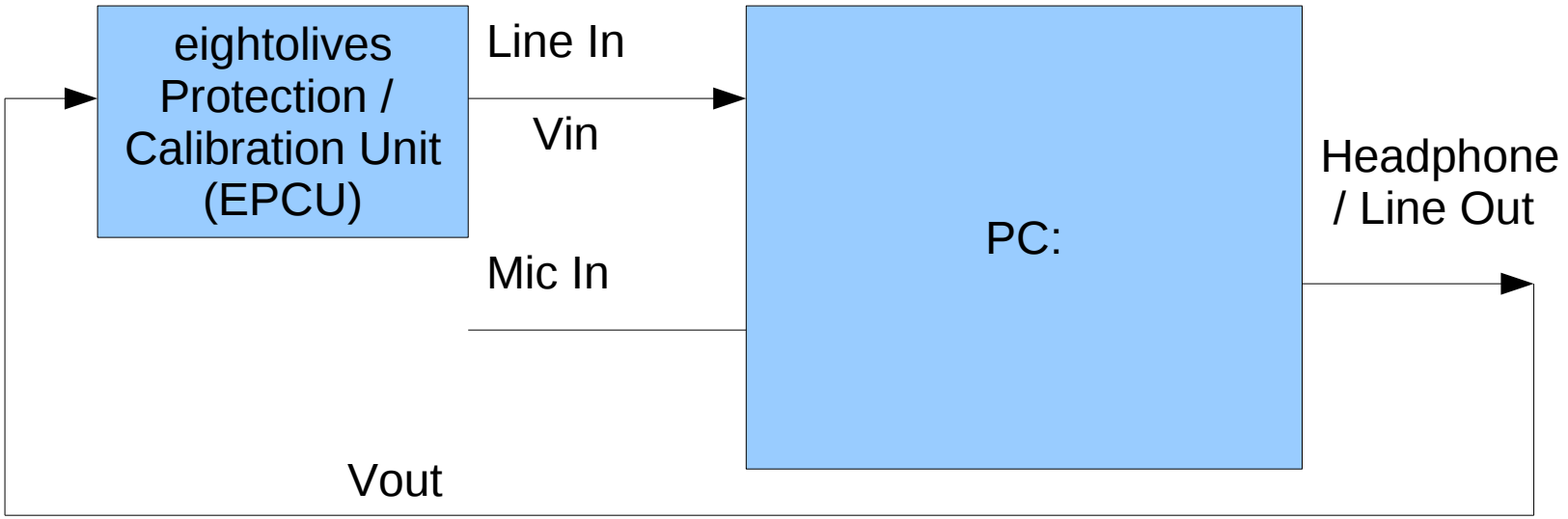
In Manual Mode; Select whether you will enter Peak or RMS Voltage readings

Finally click the Start button and respond to the pop-up dialog instructions

You can Accept or Reject the Results

- When calibration completes, a summary calibration report is displayed in a text window.
- A pop-up will summarize the proposed changes and ask whether you accept or reject the results.

Calibrating using the EPCU

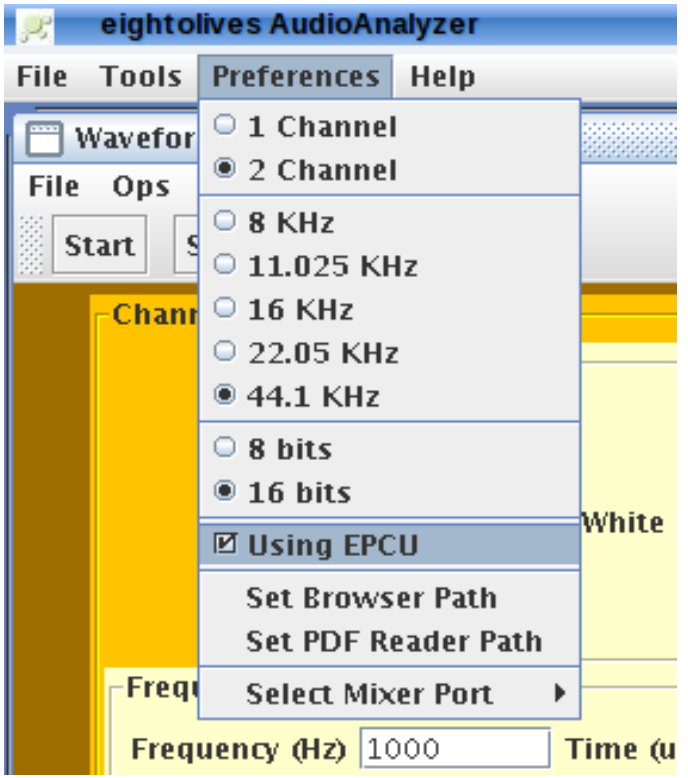


The pop-up dialogs will ask you to connect the EPCU to LINE OUT and LINE IN. The software then measures a ~1 KHz sinewave at the Waveform Generator's 0 db (normal) amplitude setting. The routine then changes the amplitude to the +20 db setting and checks that the input waveform is amplitude limited by the EPCU.

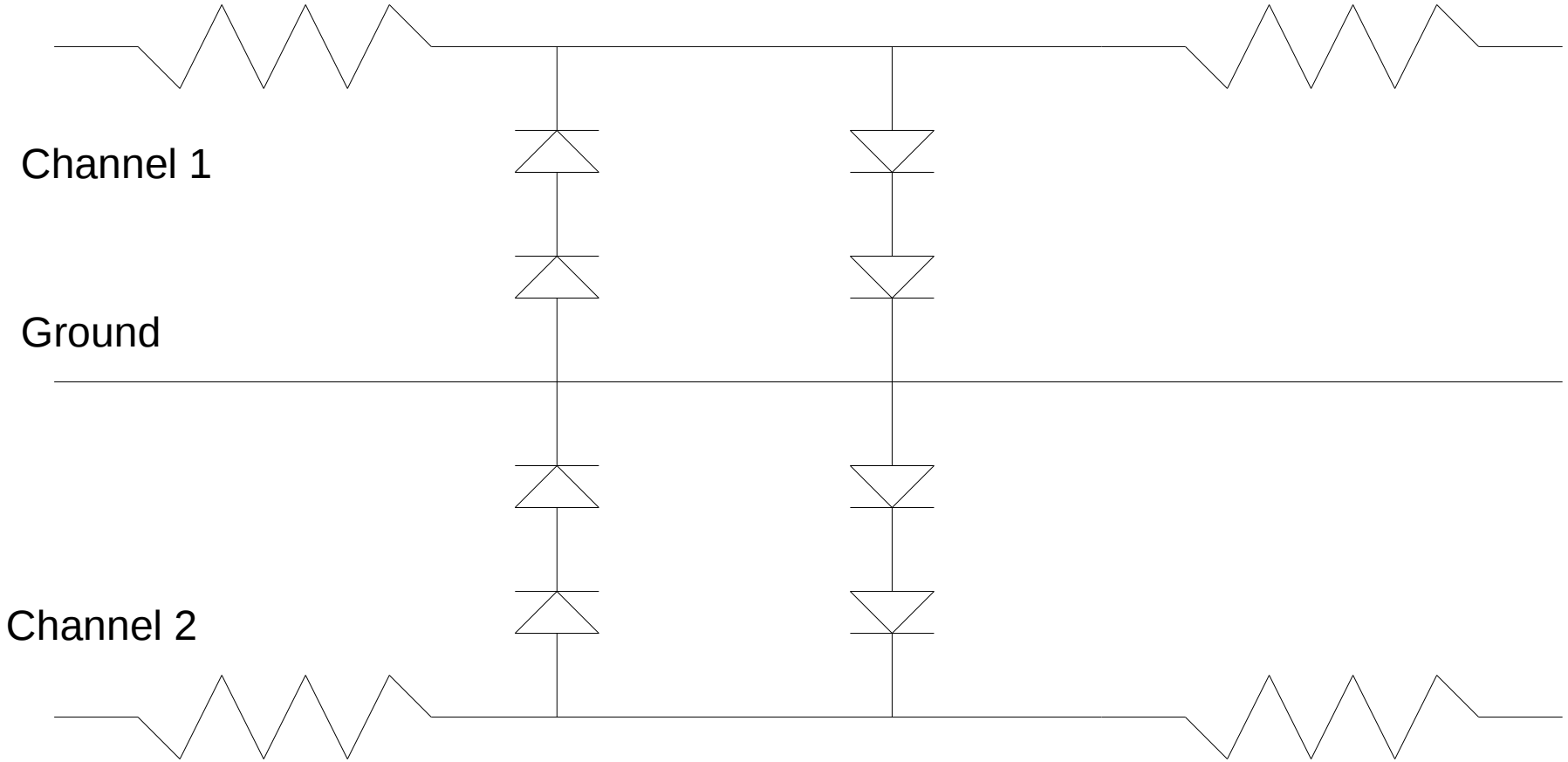
A pop-up dialog will then ask you to directly connect LINE OUT to LINE IN. A 0 db measurement is made with LINE OUT directly connected to LINE IN to account for EPCU impedance.

EPCU as a Protection Device

- If you use the EPCU as an input protection device on LINE IN, select the menu option: Preferences > Using EPCU to use the correct calibration values.
- You can apply up to 150 Volts to the EPCU and the limiter will limit LINE IN to the Vsat values
- If you can have ground differentials, use an external audio transformer to isolate the audio signals



Eightolives Protection / Calibration Unit (EPCU)

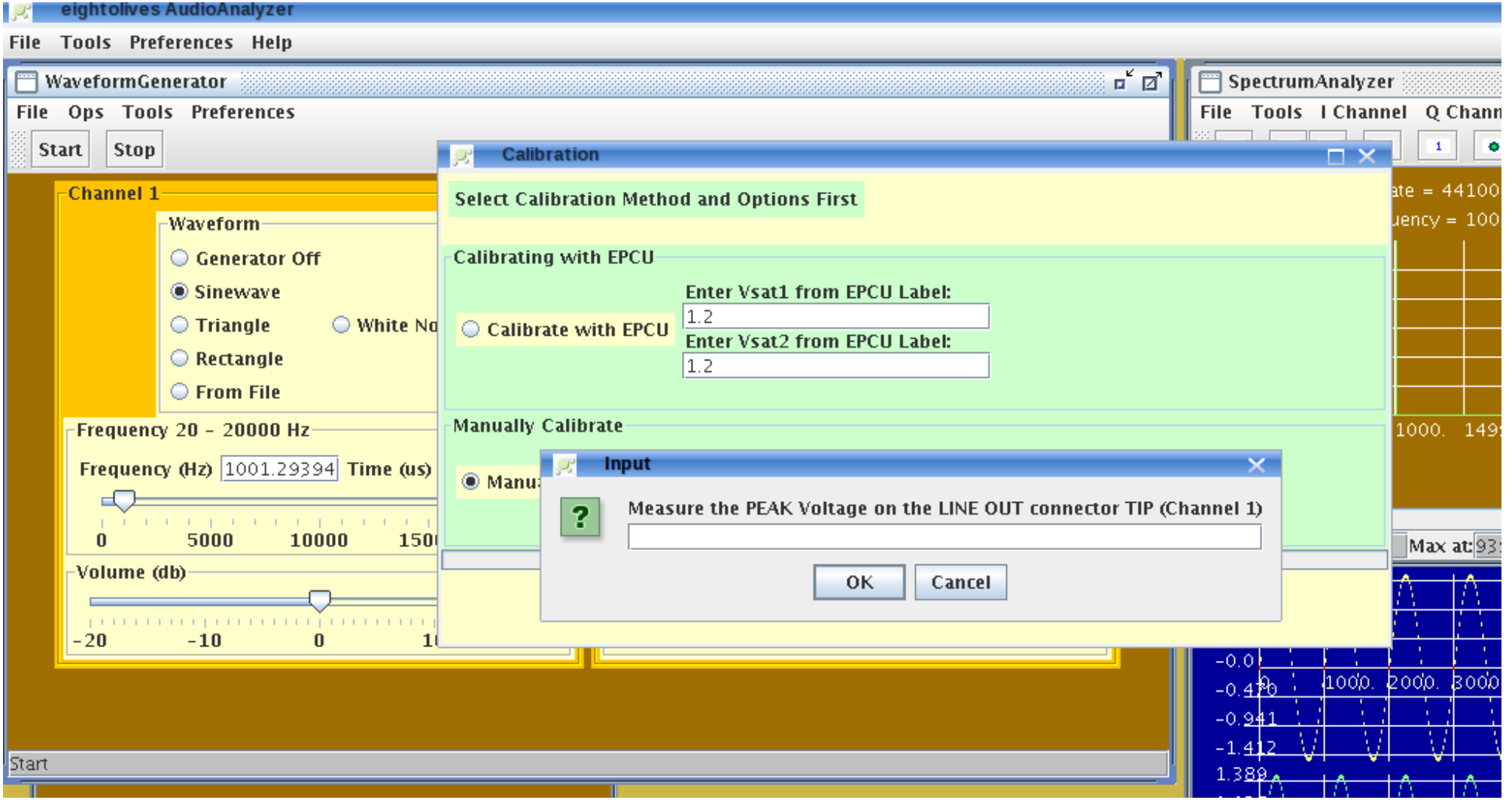


The EPCU limits the audio signal to about +/- 1.2 V.
The measured value is printed on the unit's label.
Note that “Ground” is not isolated.

Manual Calibration

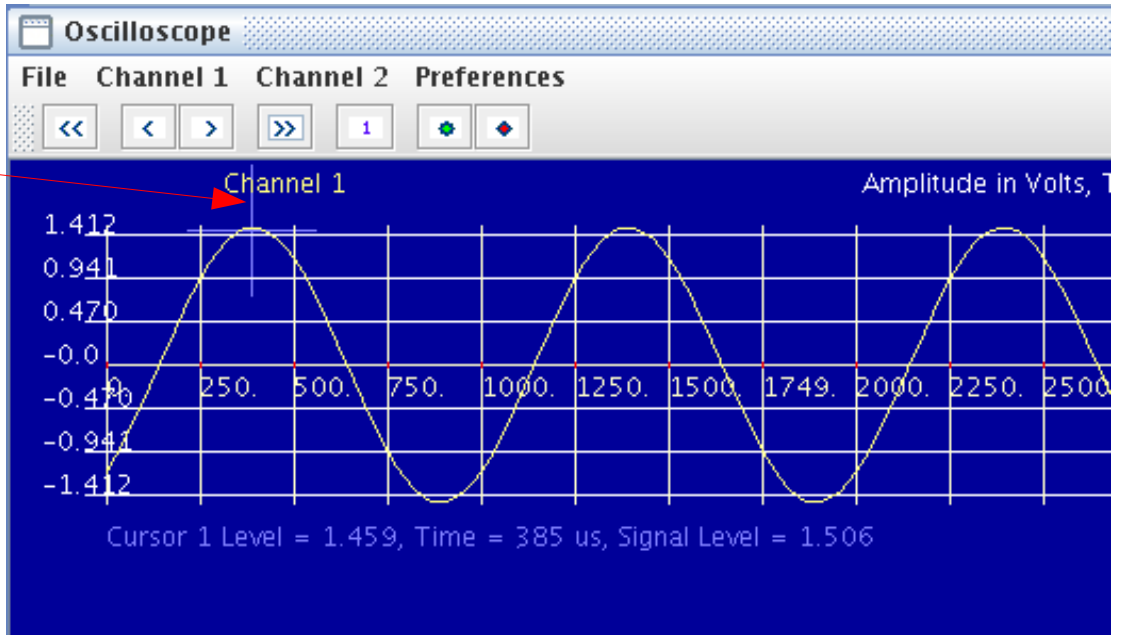
- Manual Calibration requires you to measure the LINE OUT voltage for both Channel 1 (tip) and Channel 2 (ring) using an external Voltmeter or oscilloscope
- Select whether your measurements will be the PEAK voltage (typically read from an oscilloscope) or RMS (typical of a voltmeter)
- Follow the instructions in the pop-up dialogs
- When prompted connect LINE OUT to LINE IN for the automatic input calibration.

Manual Mode Dialogs Request Your Measurements



Definitions

VPEAK is defined as the most positive voltage that the sine wave achieves



VRMS is defined as:

0.707 * Vpeak

for a sine wave and represents the equivalent DC voltage

Troubleshooting

- If the sinewave tone is “choppy”, the selected sample frequency may be too high for your computer environment. Try a lower rate.
- For EPCU calibration to succeed, the +20db setting must output a sinewave amplitude greater than the limiting value, Vsat, printed on the EPCU label.

For more information

- Check the tutorials at: http://www.eightolives.com/tutorials.htm