

## Mechanics

Acoustics

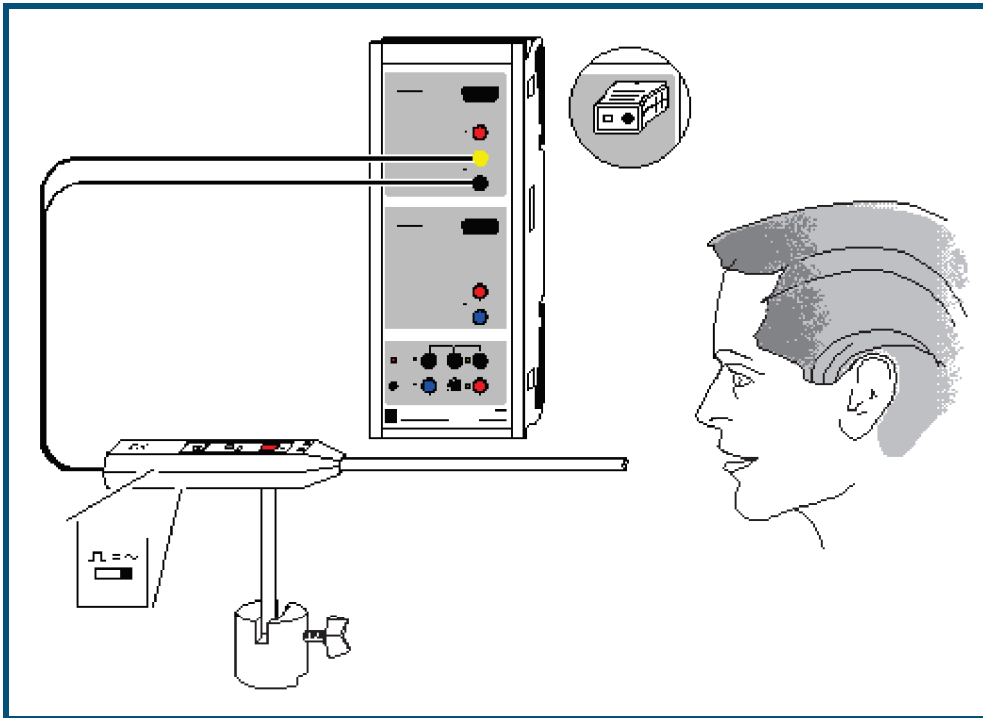
*Fourier analysis*

## Fourier analysis of sounds

### Description from CASSY Lab 2

For loading examples and settings, please use the CASSY Lab 2 help.

## Sound analysis



  can also be carried out with [Pocket-CASSY](#) and [Micro-CASSY](#)

### Experiment description

The object of this experiment is the analysis of sounds having different tones and pitches (e.g. sounds of the human voice or of musical instruments) by means of Fourier analysis. The resulting frequency spectrum shows the fundamental frequency  $f_0$  and the harmonics.

The various vowels of a language differ mainly in the amplitudes of their harmonics. The fundamental frequency  $f_0$  depends on the pitch of the voice. This is approx. 200 Hz for high-pitched voices and approx. 80 Hz for low-pitched voices. The vocal tone is determined by variations in the excitation of the harmonics. The same applies for the tone of musical instruments.

### Equipment list


1	<a href="#">Sensor-CASSY</a>	524 010 or 524 013
1	<a href="#">CASSY Lab 2</a>	524 220
1	Multi-purpose microphone with Base	586 26 300 11
	or	
1	<a href="#">Microphone S</a>	524 059
1	PC with Windows XP/Vista/7	



### Experiment setup (see drawing)

Connect the multipurpose microphone to input A of Sensor-CASSY (don't forget to set the microphone to "Signal" mode and switch it on).

### Carrying out the experiment

#### ■ Load settings

- Start the measurement with .
- Select the **Standard** display and optimize the signal strength using the control on the microphone.
- Record and compare different sounds (**Standard** shows the signal form and **Frequency Spectrum** shows the Fourier analysis).

- To stop the measurement, deactivate **Repeating Measurement** in the [Measuring Parameters](#) window or press  immediately after the end of a recording.
- To compare different frequency spectra, select **Measurement** → **Append New Measurement Series** and restart the measurement with .

### Evaluation

The fundamental frequency and each harmonic can be determined easily in the **Frequency Spectrum** (click with the mouse) using the [coordinate display](#) or by finding the [peak centers](#). The amplitudes of the harmonics determine the tone of the recorded sound.

As the human ear perceives sound intensities in a logarithmic fashion, the logarithmic display of the frequency spectrum is better suited to the sensitivity of the human ear than a linear representation. Select the logarithmic representation by clicking on the y-axis of the frequency spectrum with the right mouse button (increase the lower limit, e.g. to -3).

