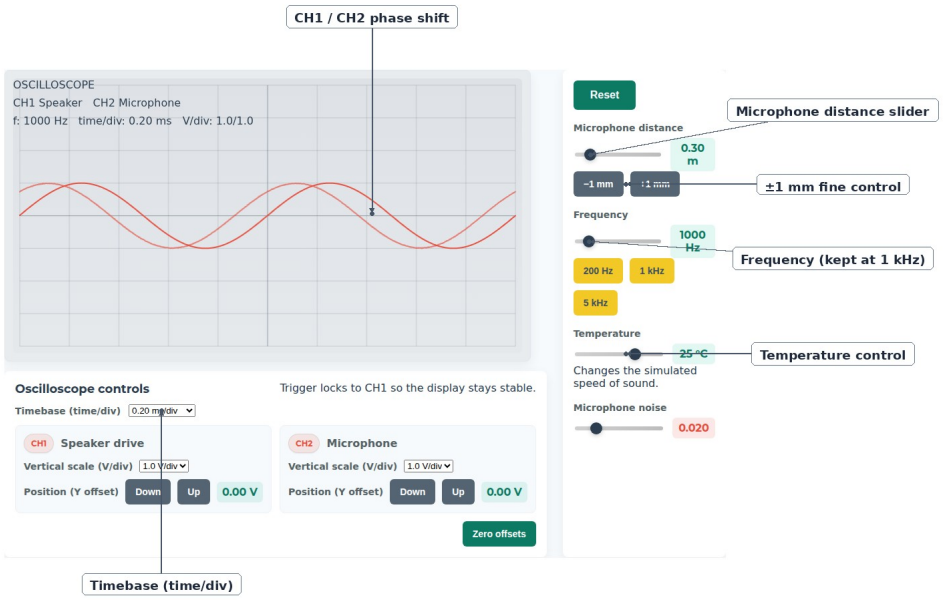
Measuring the Speed of Sound in Air

Phase Difference Between Two Microphones

Aim:

To investigate the speed of sound in air using a two-beam oscilloscope and the phase difference between two microphones.



Method:

1. Set the frequency to 1000 Hz using the 1 kHz button. Start with a small microphone distance and watch the CH1 (speaker) and CH2 (microphone) traces on the oscilloscope — they should be in phase.
2. Increase the microphone distance slowly, using the −1 mm / +1 mm buttons for fine control, until CH2 comes back into phase with CH1 for the first time. Record this distance as x_1.
3. Keep increasing the distance in the same direction until the traces come back into phase again. Record this distance as x_2. The wavelength is $\boldsymbol{\lambda = x_2 - x_1}$.
4. Calculate the speed of sound using $\boldsymbol{v = f\lambda}$.
5. Set the Temperature control to a new value and repeat steps 1–4, keeping the frequency at 1000 Hz throughout.
6. Repeat step 5 for at least eight different temperatures, spread across the full 0–35 °C range of the Temperature control.

Prediction:

You are about to repeat this measurement at different temperatures. Do you predict the speed of sound you calculate will increase, decrease, or stay the same as temperature increases? Explain your reasoning.

.....

.....

Test your prediction using the Temperature control in the sim.

Results:

Frequency for every reading: 1000 Hz.

temperature (°C)	**x_1 (m)**	**x_2 (m)**	**$\lambda = x_2 - x_1$ (m)**	**$v = f\lambda$ (m/s)**

Analysis:

Look at your reading taken closest to room temperature (around 20 °C). How does your calculated speed of sound compare with the accepted value of about 340 m/s?

Plot temperature (°C) on the horizontal axis and calculated speed of sound (m/s) on the vertical axis. Describe the pattern shown by your graph.

Does the wavelength you measure, and the speed you calculate, change in the way you predicted?

Why is it more accurate to measure the distance between traces coming back into phase over several wavelengths, rather than relying on a single wavelength shift?

What effect does the microphone noise control have on how precisely you can judge that two traces are "in phase"?