Tuning forks and waves

Apparatus

Sound sensor set to wave.

Tuning forks (known frequency).

Sounding box (optional).

Soft cloth.

Data recording setup.

Intersample to 50 us

Click start to record, Stop to end.

Continuous

Scale to Min - Max

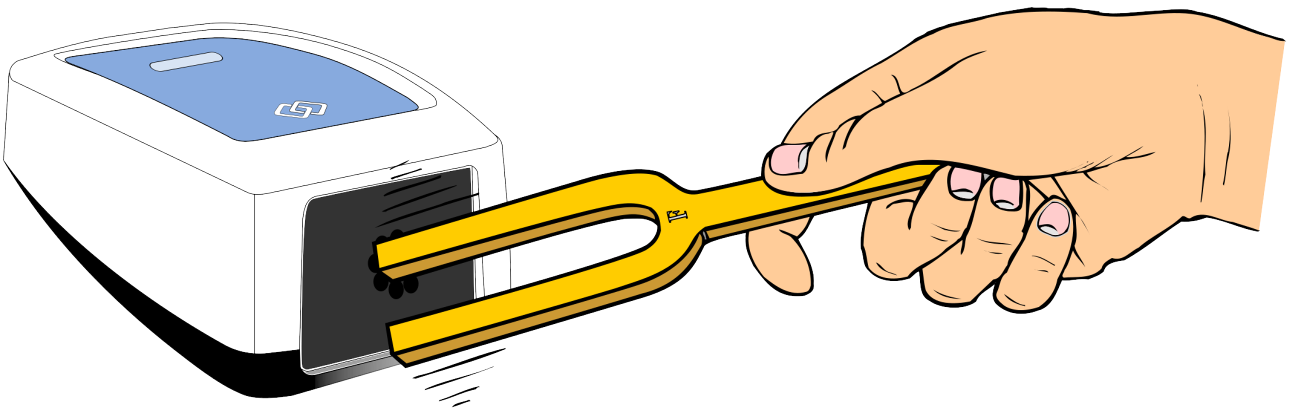
Introduction.

A tuning fork is a two pronged resonator, they produce a pure tone once the initial overtones from striking the fork have died away.

You are going to use a tuning fork of known frequency to record and analyse a waveform.

You will calculate and prove

1. Frequency of the Fork.
2. Time of one period by calculation and practical work.
3. How frequency of the fork is affected by temperature.



Method.

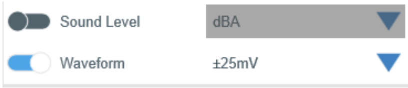
There is a technique to using tuning forks effectively.

First is the strike, it needs to be short, sharp and against a soft surface. A strong strike will damage the forks.

Second is the position of the fork to the sensor to capture the waveform. You can either hold the fork in front of the sensor (as shown in the diagram) or strike the fork, wait a second and place on the sensor. Placing the fork on the sensor allows the body of the sensor to act as a sound board. Either way, it is recommended to practice before use and understand how your equipment works together.

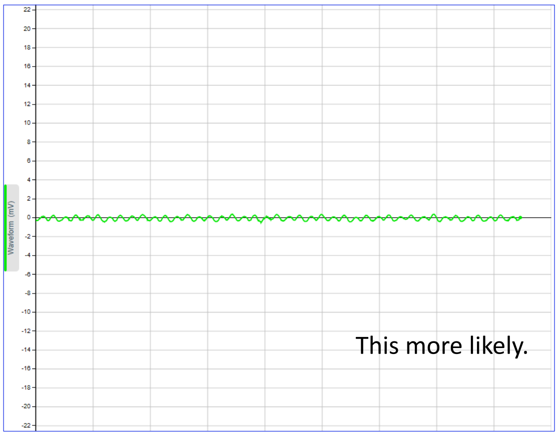
Tuning forks are a precision instrument, but they can become damaged with over striking, there is a strong possibility that any forks you are using will not show the exact frequency stamped on the fork anymore.

You will need a few runs of data before you capture something you can work with.



1. Connect the sensor to the software and change the range to waveform.
2. Change the set up to record as fast as you can, this should be 50us intersample time. Leave all other settings as their defaults.
3. You need to strike the Fork to set them resonating, place them very close to the sensor then click on start. Amost immediately click on start.
4. Use scale min to max to show the waveform.
5. Repeat if necessary to get a usable pattern.

This is a a very good example of what can be collected.



This more likely.

Analysis of the collected data.

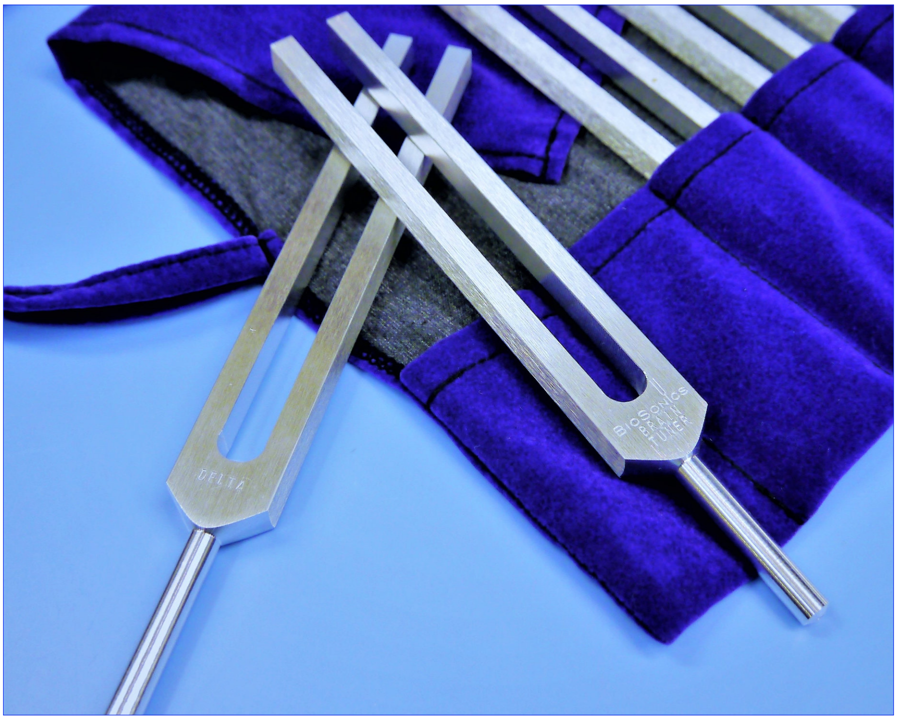
1. If not already done, re-scale the y axis using Min to Max.
2. Use the Interval tool to find the time for 10 periods (cycles) of wave recorded.
3. Find the average time of 1 period.
4. Calculate the frequency using 1/T, where T is the time of one period.
5. Repeat using the cross hair tool that lets you interpolate the data values.
6. Compare the two methods, which is closer to the stamped frequency value on the Fork used.

Extension.

1. Use a second fork and repeat. Do you get a closer match to the stamped value on the fork?
2. Cool the fork down and repeat, how has frequency changed?
3. Try heating the fork and finding the frequency.
4. Although the heating and cooling of the fork is not very well controlled, what is the effect of temperature on the frequency? What is it in the fork that is changing with the temperature?
5. Use a tuning utility on a smart phone or a tuning tool for something like a guitar to check the frequency of the fork(s) you worked with.

Questions.

1. If we assume that your practical measurement of the forks frequency did not match the indicated frequency, what would be the source of the differences noticed?
2. What is the relationship between frequency and Time (period)?
3. Calculate the expected period of the fork from its frequency.
4. Calculate the % difference form the indicated to practical frequency values.
5. what else are tuning forks used for apart form tuning instruments?



Plot a graph Distance against resistance. Draw a best fit line for the data and extrapolate back to the x/y axis

Calculate the gradient / slope of the best fit line. What does it represent?