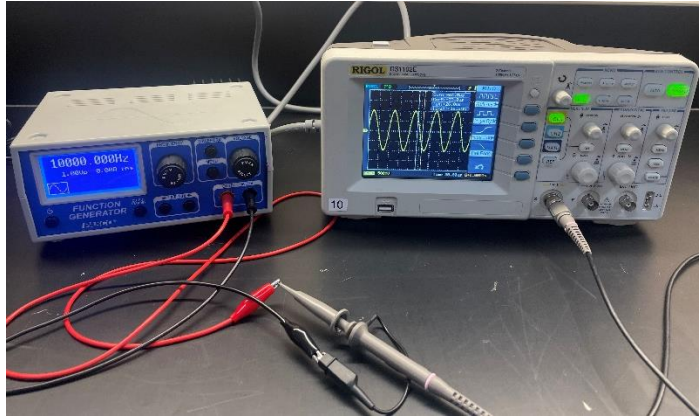


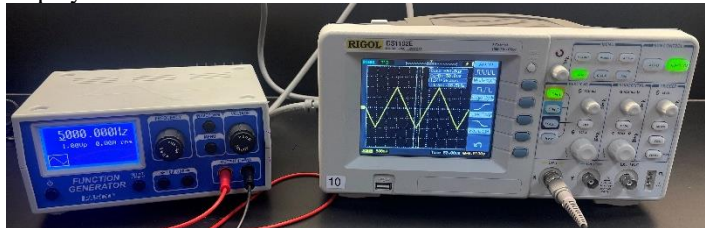
Physics 196 Extra Credit Lab: Function Generator and Oscilloscope

The purpose of this Extra Credit activity is to gain familiarity with two very important pieces of instrumentation, namely a Function Generator and an Oscilloscope. A function generator has an output which can be controlled to give a particular voltage signal as a function of time, which can then be applied to a circuit. It is possible to change the shape of the waveform, and some standard waveforms which will be explored in this activity are a sine wave, a square wave, and a triangle wave. It is also possible to change the peak to peak voltage and the offset voltage of the output. Finally, the frequency at which the waveform repeats can be controlled. The frequency f , measured in cycles per second or Hz, is equal to $1/T$ where T is the period of the waveform in seconds.



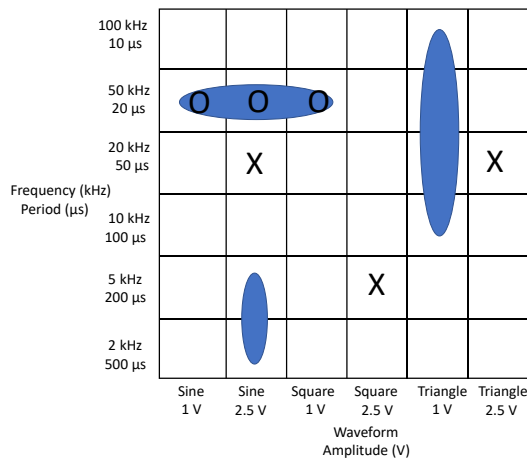
The picture at the left shows a function generator on the left, which is set up to output a sine wave at a frequency of 10,000 Hz (10 kHz). The output of the function generator is carried on two wires. A black wire is typically designated as the ground and assigned a voltage of 0V by convention. The red wire then carries the voltage waveform output. The piece of equipment on the right, showing a sine wave on the screen, is an oscilloscope. An oscilloscope is an important piece of equipment which can measure a voltage as a function of time. It is connected using an Oscilloscope probe. The vertical direction on the display gives the

voltage, and the scale (or magnification) can be adjusted. The front panel of the oscilloscope will show the scale in V/div. and for the display above there are 8 vertical divisions. The horizontal direction gives the time, and the scale can be adjusted for that as well, and will be shown on the front as ms/div or some other time unit/division. In the display above there are 10 horizontal divisions.



The picture at the left gives an example of a triangle wave at a frequency of 5 kHz.

For this activity, two teams will play a game of Battleship. (Depending on the amount of equipment, the teams may either have 1 or 2 students.)



Using a grid such as the filled in one on the left (the next page has six empty grids), both teams will mark in 3 ships, of lengths 2 squares, 3 squares or 4 squares (on different grids). These should be horizontal or vertical and be separated by at least one empty square. One team will then set up the function generator with a waveform, voltage and frequency corresponding to a square of the other team which they wish to probe. The second team will read the parameters off of the oscilloscope (without seeing the function generator) and announce them. If they agree with what the first team intended, the second team will then say if the probe was a hit (on a ship) or a miss. If it was a hit, the first team goes again. If it was a miss, the second team goes, etc. Teams take turns until one team has hit all of the squares with a ship in it. In the example at the left, the “O”s indicate a hit and the “X”s indicate a miss. The team being probed needs

to keep track of these hits and misses. The ship which is 3 units long has been sunk in the example above. Have fun, and make sure that all participants get a chance to make adjustments on both the function generator and the oscilloscope. More advanced functionalities to explore include using cursors to measure times and voltages.

