



Electricity and Magnetism
Lab 5
Learning to Use an Oscilloscope

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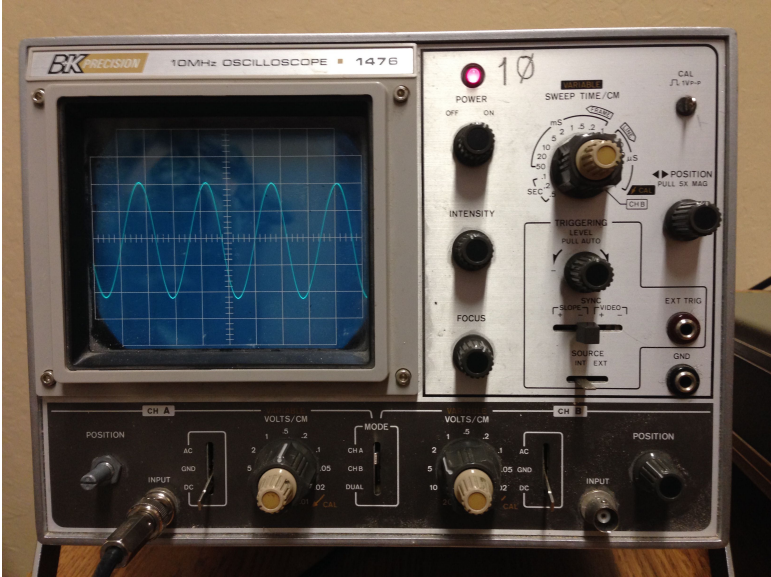
De Anza College

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Overview

- introducing the oscilloscope
- waveforms
- making measurements

The Oscilloscope



The Oscilloscope

A device for measuring potential difference as a function of time.

It produces a 2-D plot of ΔV against t .

Very useful for time-varying circuits!

It can also be used to analyze other vibrations or oscillations that are not electrical: the oscillation under study is converted to an oscillation of electrical potential.

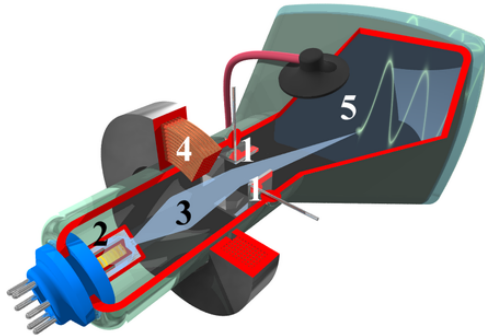
The Oscilloscope

Some things that can be determined from a plot of potential difference as a function of time:

- amplitude
- frequency
- time period
- rise time (a measure of how fast the voltage increases)
- distortion

The produced plot is usually a waveform.

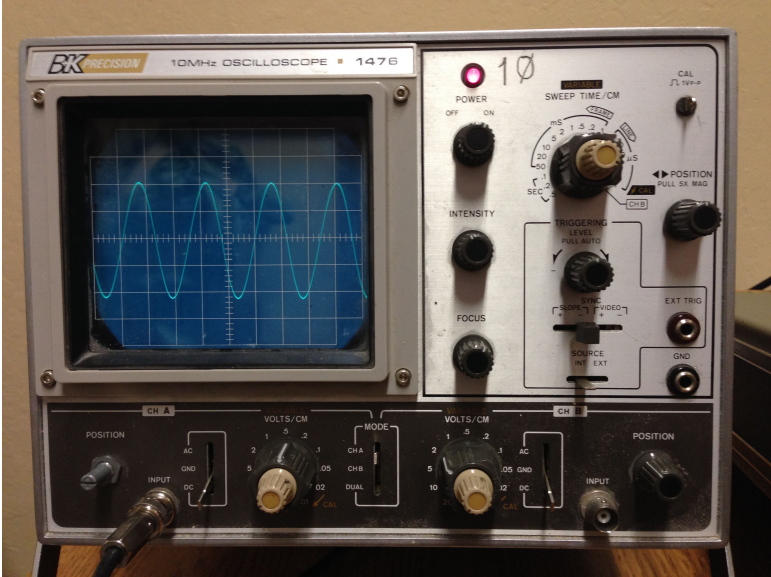
Inside



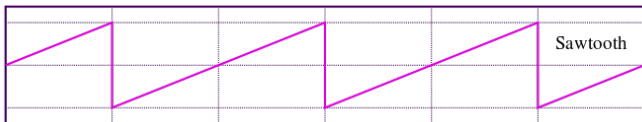
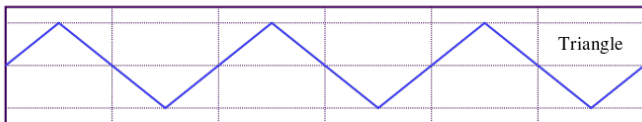
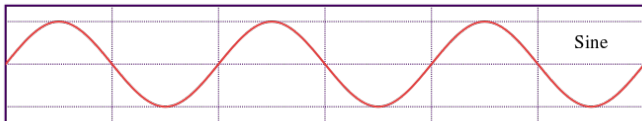
1. Deflection voltage electrode
2. Electron gun
3. Electron beam
4. Focusing coil
5. Phosphor-coated inner side of the screen

¹Figure from Wikipedia

Controls on the Oscilloscope



Waveforms



Definitions

amplitude

The height of the waveform from the middle to the top. Half the peak-to-trough (“peak-to-peak”) difference. For plots of potential, the units of amplitude are volts.

time period

The time for one complete cycle. A peak goes through a trough and comes back to a peak. Usually measured in seconds.

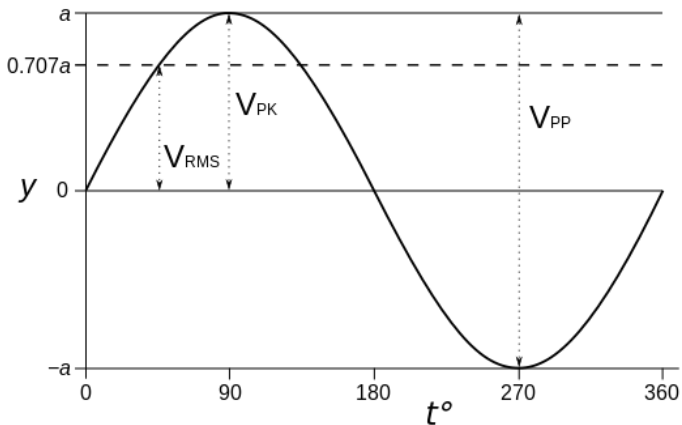
frequency

The number of complete cycles per unit time. Usually the time unit is seconds. Then frequency is measured in Hertz, Hz.

$$f = \frac{1}{T}$$

$$1 \text{ Hz} = 1 \text{ s}^{-1}$$

Measures of amplitude-type quantities



¹Figure from Wikipedia by AlanM1.

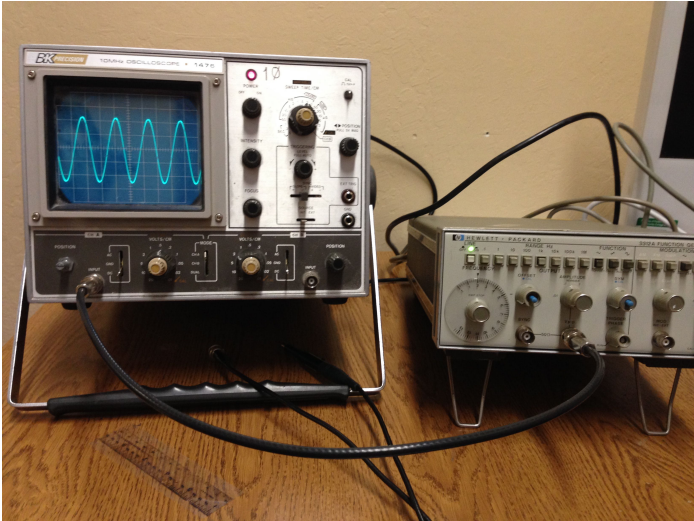
Calibration Signal



HP-Function Generator



Measurements with the Oscilloscope



Measurements with the HP-DMM



Measurements with the Hand-Held DMM as Frequency counter

