

Oscilloscope Basics

(Source: <https://www.cs.tcd.ie/courses/baict/bac/jf/labs/scope/oscilloscope.html>)

What is an oscilloscope?

The oscilloscope is basically a graph-displaying device - it draws a graph of an electrical signal. In most applications the graph shows how signals change over time: the vertical (Y) axis represents voltage and the horizontal (X) axis represents time.

This simple graph can tell you many things about a signal, for example:

- The time and voltage values of a signal.
- The frequency of an oscillating signal.
- If a malfunctioning component is distorting the signal.

How can you measure signals using an oscilloscope?

Basically you need to adjust three settings to accommodate an incoming signal:

- The attenuation or amplification of the signal. Use the volts/div control to adjust the amplitude of the signal displayed on the screen.
- The time base. Use the sec/div control to set the amount of time per division represented horizontally across the screen.
- The triggering of the oscilloscope. Use the trigger level to stabilize a repeating signal, as well as to trigger on a single event.

What is triggering? What are trigger modes?

Triggering allows you to stabilize repeating waveforms and capture single-shot waveforms on the oscilloscope. Edge triggering is the most common type of trigger logic. For edge triggering, you choose the edge (rising or falling) and voltage level that you want the oscilloscope to look for in the incoming signal. When the incoming signal matches your specified trigger settings, the oscilloscope generates a trigger.

The trigger mode determines whether or not the oscilloscope outputs a waveform. If the trigger mode is Normal, then only when the incoming signal matches your trigger settings will the oscilloscope draw the incoming signal on the display. If the trigger mode is Auto, then the oscilloscope will continue to sample even without a trigger. Both modes are useful because Normal is more versatile and Auto requires fewer adjustments.

How do you use the Hewlett Packard 1662AS Logic Analyzer/Oscilloscope to capture a signal for Lab 1?

- 1) Press the white button next to the screen to turn it on.
- 2) The scope is currently in Analyzer mode, so we need to switch to Oscilloscope mode. Press the Select button to open the "Analyzer" box on the top-left corner.
- 3) Use the down arrow button to scroll down to Scope.
- 4) Press Select. The box now reads Scope, and the display has changed into the oscilloscope mode.
- 5) Connect a black BNC to SMA coaxial cable from Channel 1 of the scope to the signal that you want to look at.
- 6) The coaxial cable that you are using has a 1:1 attenuation. Using the arrow buttons, move to the Probe box, press Select, and change the value in the Probe box from 10 to 1. (Use the keypad to type 1 and press Done).
- 7) Make sure that Coupling is set at 1MOhm/DC.
- 8) Make the scope sample continuously. Do this by pressing the blue (shift) button followed by the Run button. Now the green light next to the Run button should be

- on continuously and the display should continuously refresh.
- 9) Now start the Matlab script. While the Matlab script is running, use the arrows to move to Autoscale, and press Select twice. The oscilloscope now autoscales itself to produce a nice image of the input signal. Additionally, you may zoom in and out by changing the values in the V/Div, Offset, and s/Div boxes.

How do you measure captured signals using the 1662AS?

When you have successfully captured a signal on the oscilloscope display, move to the Scope Channel box. Press Select and change the box to Scope Auto Measure (Scroll down using arrow buttons to Scope Auto Measure and press Select). Now you can read off the period, peak-to-peak voltage, etc. directly from the scope. Additionally, you can go into Scope Marker and use the round dial to move the V and T markers around to manually measure the signals.

How do you set or change the triggering on the 1662AS?

The default trigger on the 1662AS is set to Auto mode. To adjust the trigger, scroll to Scope Trigger in the Scope Channel box and press Select. For Normal mode, turn off Auto-Trig and change the Mode, Source, Level, and Slope boxes accordingly.