

## ECE 2274 Lab 1 Notes

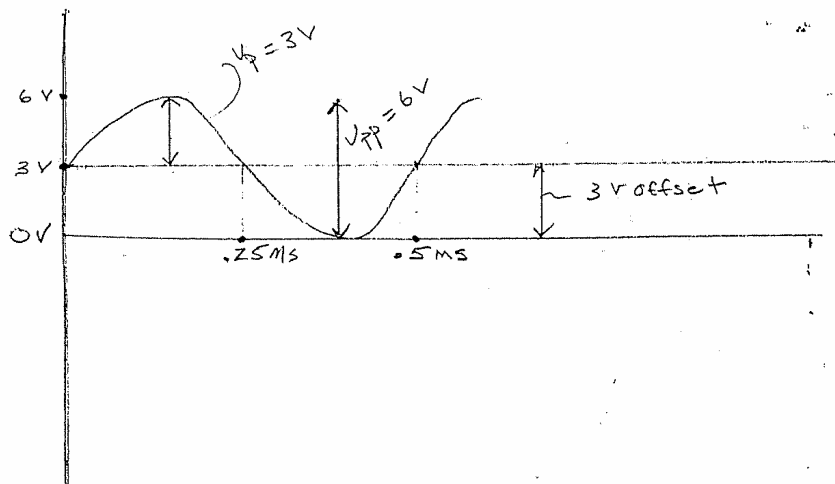
1. **What is an Oscilloscope and how does it work?** Basically a graph-display device, draws a graph of an electrical signal. Most cases show how the electrical signal change over time. "Y" axis represents voltage. "X" axis represents time. The scope can be used to determine amplitude of a voltage waveform. We can determine the peak-to-peak voltage and the offset voltage. We can also determine the frequency and period of a waveform. The scope is a valuable tool to help determine what is taking place in an electrical circuit.

Analog scopes have been replaced by digital sampling scopes, which use an A→D converter to capture the waveform. The A→D converter must be fast enough to quickly sample and store high frequency waveform data points. Scope A→D accuracy and resolution are secondary to speed. The accuracy and resolution also depend on the vertical scale because a higher voltage scale attenuates the signal down to a few data bits. For best measurement accuracy, you should always try to display the waveform as close to full scale as possible.

The A→D converter captures a series of **8 bit data points** on the waveform. 8 bits provide a resolution of 256 possible voltage levels, divided evenly over the scope's 3" vertical display. These points are stored in memory and then displayed on the screen by a processor, using interpolation to smooth the waveform shape between data points.

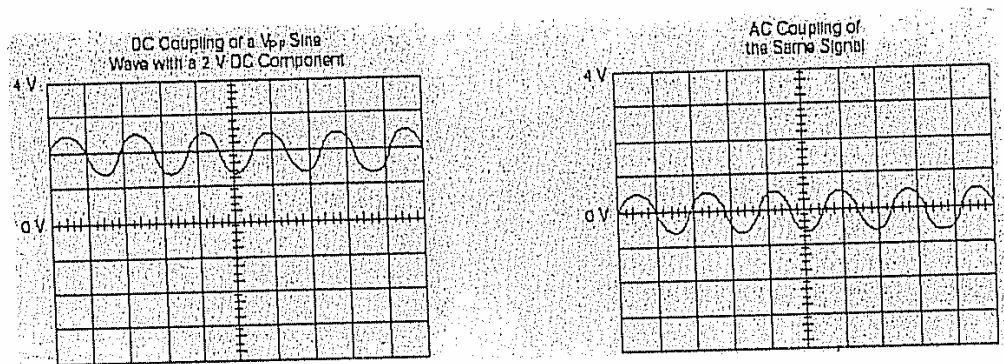
The Agilent 54622A scope display contains the reproduced waveform(s), information about the scope settings, and a soft key menu.

2. Develop an electronic signal:  $v(t) = 3 \sin(2\pi 2000 t) + 3$



How would you set-up the FG to produce this waveform? First, set the frequency to 2kHz, since the FG puts out a pp voltage signal set the output for 6v, next set the offset for 3v.

3. What do we mean by coupling? How the input signal is connected to the scopes vertical section. We can have AC, or DC coupling. Note that the dc component is blocked in the AC Coupling mode while in DC Coupling both components are present. Note the diagrams.



4. The **scope trigger** determines where on a waveform voltage and slope the display trace begins. By starting the waveform at the same place, a stable waveform will be displayed. The trigger source can come from either input channel, the external trigger input connector, or the AC power line.

Normal trigger mode freezes the display until the waveform reaches the trigger setting. Caution: Even when there is a waveform going into the scope, normal model can keep the display blank if the trigger condition is not met.

Auto mode allows the display to run even when the trigger condition is not met. If the input waveform does not trigger the scope, the display will be unstable but you can see that there is an input signal.

### Other convenient scope features:

- **Autoscale** automatically sets the horizontal, vertical, and trigger values based on a best guess of what the scope thinks is an input signal.  
WARNING: Autoscale may not display what you want, especially if the input is a DC voltage.
  - The **Quick measure button** displays values for the waveform maximum voltage, minimum voltage, RMS voltage, peak to peak voltage, period, frequency and phase.
  - There are four **Cursors** that can be used to measure time and voltage of specific points on a waveform
4. **Labview** software allows us to use the computer to change instrument, function generator, and power supply settings. Data from the meters and scope display can be captured as data points and jpeg image files. The Labview software also enables us to perform AC frequency and DC voltage sweeps, capturing a circuit's output response over an input frequency or voltage range.

The main Labview menus are:

- Wave – changes the function generator settings.
- Scope – changes the scope settings and captures waveforms.
- AC sweep – measures the circuit voltage response while varying the input frequency. Always check the measurement device and generator settings before hitting “GO”.
- DC sweep – measures the circuit voltage response while varying the input voltage.
- Buffer – displays and manipulates the captured data and waveforms.

Note: When you hit the “GO” button, the instrument settings are changed to what has been set in Labview. There are default settings in the Labview menus that will overwrite the instrument state.

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