ece340_lab1

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Part I

Objective

In this lab, we will ensure the oscilloscopes and probes are setup and working properly and in the process become familiar with its operation. Measurements by the oscilloscope on the built-in function generator's output will verify the datasheet's claimed performance specifications.

Part II

Procedure

Keep a running log of your responses and measurements in a Word or Google Docs document as you complete and check-off the following steps. Add an appropriate title page, including all group members, and turn in by Monday as your "lab report". Later lab reports will have an official format.

- Power on your oscilloscope and open both the oscilloscope manual and datasheet from Blackboard.
- Take out all four porbes and attach the appropriate color clips to each end of the cables.
- Attach the channel 1 probe.
- **Press and hold** the "Default Setup" key. This hold feature pops up a short description of the key's function. Try this for several keys which are unfamiliar. This is typically the first key to press when you begin using the scope to ensure it always starts in a known configuration.
  - Write down which keys you pressed and your interpretation of their function.
- Press the "Utility" key and nagivate to the "Service" -> "About Oscilloscope" sub-menus using the bottom softkeys.
  - Write down the installed licenses.
  - For each license, use the manual to determine what each one means. This includes a short description of the significance of the feature: Not just:

"SGM - Segmented Memory." If it is an upgrade, what was the original state and what does the feature do or enhance?

- Attach probe 1's tip to the "Demo 2 / Probe Comp" post on the bottom and its ground lead to the middle post.
- Adjust the horizontal and vertical scales and adjust the trigger level to view 1-2 cycles of the square wave, filling the screen vertically.
- Take out the black plastic screwdriver and turn the yellow slotted screw on the probe.
  - Observe and write down what happens to the shape of the square wave. Adjust for the best square wave shape. This is "*compensating the probe*".
- From the channel 1 menu (press the "1" key), under the "Probe" submenu, activate the Probe Check function and follow the prompts.
- Do this probe compensation procedure for all four probes in their respective channels.
- Measure the following parameters of the "Probe Comp" square wave:
  - Frequency
  - Amplitude: low level, high level, peak-to-peak
  - Duty cycle
  - 10%-90% rise time and fall time
  - 0%-100% rise time and fall time

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- Reconnect channel 1 to the probe compensation square wave.
- Connect channel 2 to the "WaveGen" jack using the BNC probe tip.
- Press the "WaveGen" key and setup the function generator for the same parameters as measured above. Display the waveform on channel 2.
  - Measure this waveform's 10-90% and 0-100% rise/fall times.
  - Compare these rise/fall times to those claimed in the datasheet for the signal generator.

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- Press the "Analyze" key and turn on the DVM feature.
- Setup the function generator to output a $0.5\,\mathrm{V_{p-p}}$ sinusoid with zero offset. Continue viewing the signal on channel 2.
- Use the measurement functionality of the scope to verify that the signal generator is indeed outputting the correct peak-to-peak amplitude.
- Calculate the expected RMS value of this signal $(0.5/\sqrt{2})$. Decide, using the manual to assist, which RMS measurement to perform with the scope and verify the expected and measured values are the same.
- Use the "To add noise to the waveform generator output" part of the "Waveform Generator" section in the manual to add white noise to your sinusoid.

  - The amount is given as a percentage. Of what? **It is your task to figure this out**. Report how you did this and what you measured to arrive at your conclusion.
  - Use RMS measurements to extract this information.
  - Remember, RMS measurements do not add algabraically, but as vectors. For a sinusoid and noise, the signals are *uncorrelated*, so their amplitude vectors ("phasors") are at right angles, therefore the RMS values sum per Pythagoras (remember to use the RMS instead of peak or peak-to-peak value for the sinusoid):

$$v_{total}(RMS) = \sqrt{v_1(RMS)^2 + v_2(RMS)^2 + \cdots}$$

  - Describe why using peak-to-peak values when measuring noisy signals can be a poor choice.

- Continue to "play" with the scope.
  - Measure and verify at least two more specifications from the datasheet with the scope itself.

Hand in your written observations and measurements.