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CPE 301-1001
Assignment #1
September 16, 2016

Assignment Description:

We will be doing the Oscilloscopes Lab Experiment, which should introduce us to the basic controls of a digital oscilloscope so that we will understand how to make common electronic measurements. We will learn how to alter the size of the waveforms both in the x and y axes, and we will learn how to correctly set up a waveform for viewing, using certain equations and conventions. We will do this by calculating the bandwidth, sample rate, and record length of a certain sine wave. We will then use this calibrated wave and calculate its peak-to-peak voltage. We will calculate other properties of the wave such as pos/neg peaks. Then we will use this knowledge to decide a proper vertical scale for a Probe Comp square wave. We will be able to calculate properties such as sample rate from other properties such as horizontal scale factor. We will find out what Trig? and Trig'd mean, and learn how to set up the oscilloscope's trigger. We will finally attempt to fill as much of the screen as possible with the waveform vertically without clipping it.

Problems Encountered:

Most of the problems we encountered while performing the lab were due to the differences between the oscilloscope in the assignment and the oscilloscope we physically were interacting with. Some buttons didn't exist, some sequences of steps we just had to fully skip, etc. We were warned about this, but hopefully by the next time someone sits down and updates the material to clear up confusion. We encountered no other problems in the course of the lab.

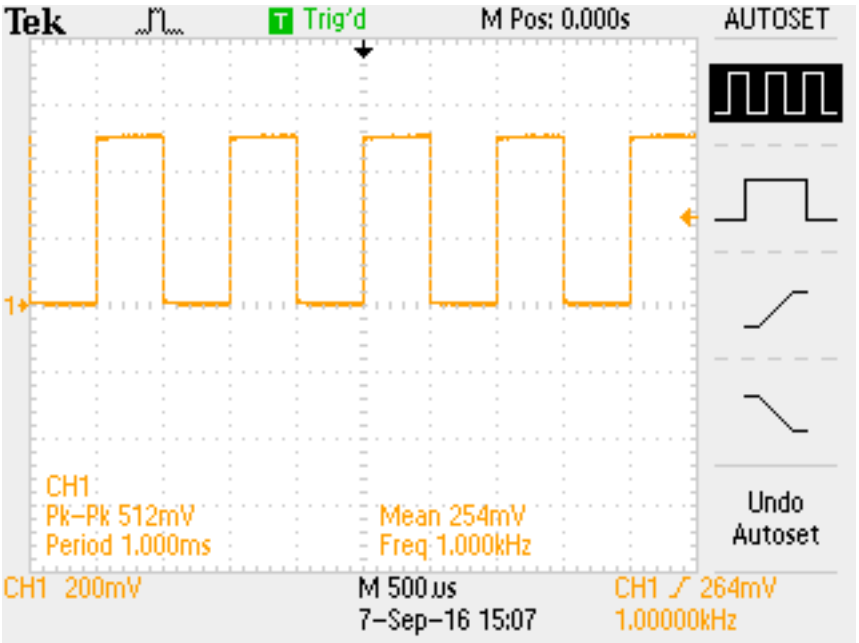
Lessons Learned:

I personally learned a lot during the lab, as I had never used an oscilloscope prior to it. I also refreshed my memory on how to visually see properties of a function such as voltage. I also learned to ask questions more during the lab, as I at many times got stuck on certain questions pertaining to the old oscilloscope. I also learned I need to time-manage better in preparation for CPE labs and during them.

Description of Completed Lab:

Exercise: What minimum scope performance is required to properly capture 2 sec of a 1V, 250MHz sine wave?

Bandwidth: 1250MHz
Sample Rate: 1.25 GS/s
Record Length: 3.5 Ms/s



At this point we had learned how to configure the scope to see a basic wave like this using DEFAULT SETUP and Autoset buttons. Autos adjusts the axes so that 4-5 cycles of the waveform are shown, with the trigger in the middle of the screen.

Exercise:

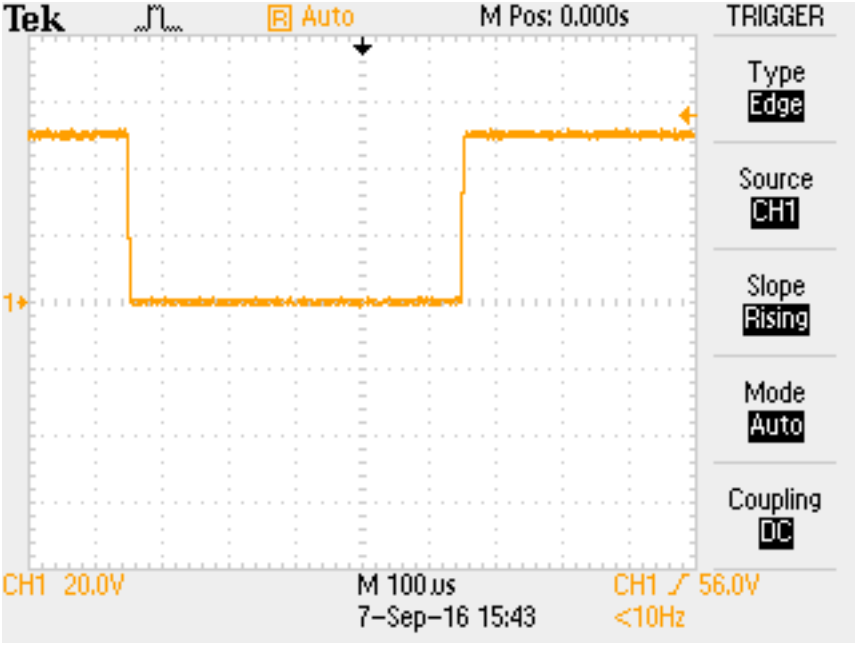
What is the peak to peak voltage of the signal?: 3.25V

What is the voltage of the signal's pos/neg peaks?: 6.5 Vpos/1Vneg

What is the period/frequency of the signal?: 100 micro seconds/10 kHz

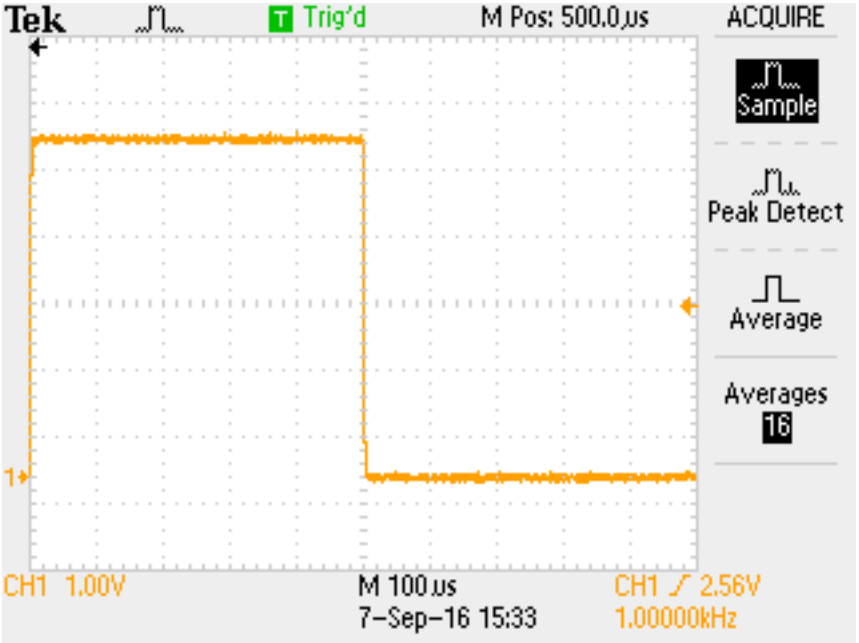
Exercise:

The scope's vertical axis controls are typically used to control: Voltage



Exercise:

To make highest-res measurement, what vertical scale should be used to measure PROBE COMP square wave?: 1V on the vertical should be used, this is because any more and the wave would go off screen. This is shown below.



Exercise:

If the horiz. scale factor were set to 1 microsec/div, the displayed time window would be: 10 div.

Exercise:

With horiz. scale factor set to 200 microsends/div and record length set to 1Mpoints, what is the scopes sample rate?:1/2000 Hz

We then used the trigger knob to see what happens when the trigger was just out of the range of the function. This resulted in a flashing of the function across the screen, such that the function was undistinguishable from what it looked like prior.

Exercise:

Using the Trigger level control, move the level out of range and note the affect this has on the displayed signal: Signal becomes unstable. The display shows AUTO when it is out of range, Trig'd when it is in range.

Exercise:

A pulse width trigger was used to capture a 1 kHz square wave. To trigger on all square waves that are faster than 500 Hz, how would you set up the scope's trigger?: We would set it to 1ms

Exercise:

Determine amplitude of the signal by counting the number of vert. div. on the graticule and multiplying that by the vertical scale factor: 50V

Calculate the period of the signal by counting the number of horiz. div. on the graticule and multiplying that by the horiz. scale factor: 1ms

Calculate the frequency of the signal: 1kHz

Exercise:

Write the signal amplitude: 25V

Write the signal period: 1ms

Exercise:

Write the results from the peak-to-peak and period automated measurements here: peak-to-peak: 51.0V, period: 1ms

Write the % diff between your manual and auto measurements: 1.9802% difference amplitude V, 0 % difference in period.

Final Exercise:

The first parameter to consider when choosing an oscilloscope is: (c) bandwidth

Oscilloscopes usually: (d) all the above

A typical digital oscilloscope: (d) all the above

The three primary sets of oscilloscope controls are: (c) Vertical, Horizontal and Trigger

Oscilloscopes can make measurements with: (d) all the above

Final Exercise 2:

Set up the scope to obtain a stable display consisting of 2-4 cycles and to fill as much of the screen vertically as possible without clipping the wave form. Write steps down here: We first plugged the function generator (50 ohms) into channel 1 and turned it on. We vertically scaled it to 2V to take up the max room possible, then vertically positioned it to the center.

Using the display's graticule, measure the following: peak to peak voltage: 17.75V, period of signal: 7ms.

Using the scope's cursors, measure the following: peak to peak voltage: 13.6V, period of signal: 7ms.

Using the scopes auto measurements, measure the following: peak to peak voltage: 13.5V, period of signal: 6.96ms, frequency: 143.7 Hz