Patrick Austin
CPE 301 – 1104
Assignment # 1
9/12/2016

Assignment description:

This lab involves learning about the uses and means of manipulating an oscilloscope. This encompasses understanding the information conveyed by the oscilloscope UI, the significance of each of the oscilloscope's controls, a theoretical understanding of what the oscilloscope is accomplishing, definition of terms, etc. All in all: an oscilloscope is a device that captures the waveform of an electrical signal and allows the user to study the properties of the signal, such as its wavelength and period. The controls enable the user to manipulate the axes of the graph in order to more clearly understand the wave behavior, and also to cause the scope to detect and draw a waveform based on a trigger condition. In this lab we answer various theoretical questions about the oscilloscope and conduct some readings using the actual device.

Problems encountered:

The manual had a bit of a learning curve for a complete novice to oscilloscopes like myself, though I was ultimately grateful to have the manual ahead of time as there was a large amount of terminology to get a handle on and it would have been a difficult experience trying to come to grips with it on the spot. Once we were in the lab we encountered a few difficulties: our USB thumb drivers were not detected by the scope, so we had to take photographs (attached). Other than that our difficulties largely concerned wiring of the scope and the function generator, though the TAs were helpful in resolving these issues and we got good data.

Lessons learned:

Acquired a significant amount of oscilloscope theory and vocabulary (bandwidth, sample rate, record length, etc.). Also firmed up recall of existing knowledge of waveform properties. Entered lab with prep work done on the topic from the manual: basic knowledge of theory underpinning the device, controls, basic calculations of bandwidth/record length/sample rate. Exited lab with a practical understanding of how the scope controls operated, how to wire the scope, and how to use it in conjunction with the function generator.

Description of completed lab:

Walked through the exercises in the lab manual up to and including the final exercise, as the forthcoming answers and photographs will show. As mentioned, our USB devices did NOT work with the scopes, so phone photographs were used instead with TA approval. Sorry for the inconvenience.

Exercise 1
Bandwidth: >= 1.25 GHz
Sample Rate: >= 1.25 GS/sec
Record Length: 1.25 GS/sec * 2 msec = 2.5 Mpoints

Exercise 2
Peak-to-peak voltage: 3.2V
Positive peak voltage: 3.2V
Negative peak voltage: 0V
Signal period: 100 µsec
Signal frequency: 9.76546 kHz

Exercise 3
Vertical axis controls are used to move and scale the waveform vertically, which will relate to the voltage parameter.

Exercise 4
A vertical scale of slightly more than 5V/div would create the highest resolution measurement. The highest resolution measurement is created when the signal almost fills the screen vertically but does not go off screen, which a 5V/div scale would create.

Exercise 5
A horizontal scale factor of 1 µsec/div would display a time window of 10 µsec.

Exercise 6
The sample rate is 500 Gs/sec. This agrees with the result from the oscilloscope.

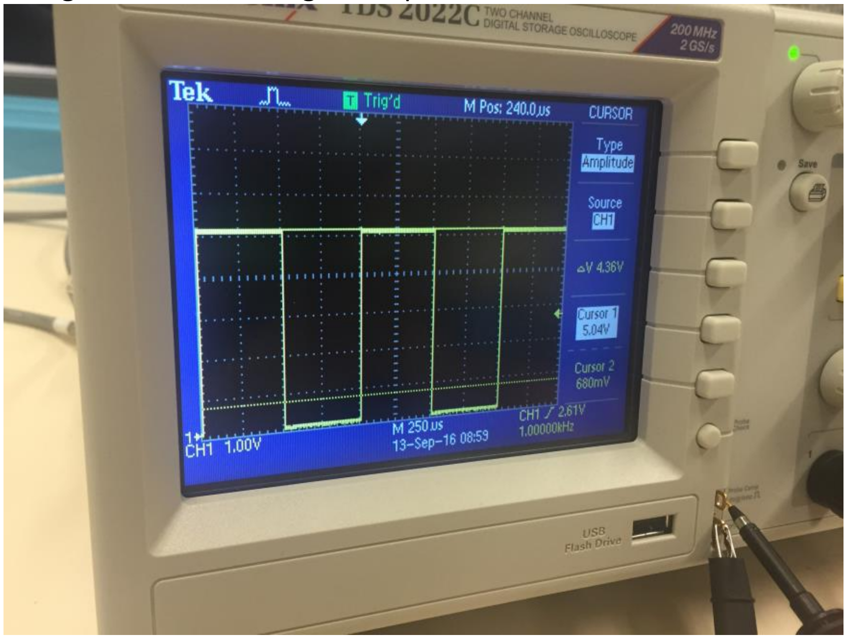
Exercise 7
Trig? (labeled as READY on the scope we used in this lab) means the scope is waiting to acquire a signal. Trig'd means a signal has been acquired, since the trigger condition has been met.

Exercise 8
To trigger on square waves faster than 500 Hz, the trigger would be set at type pulse > 250 µs.

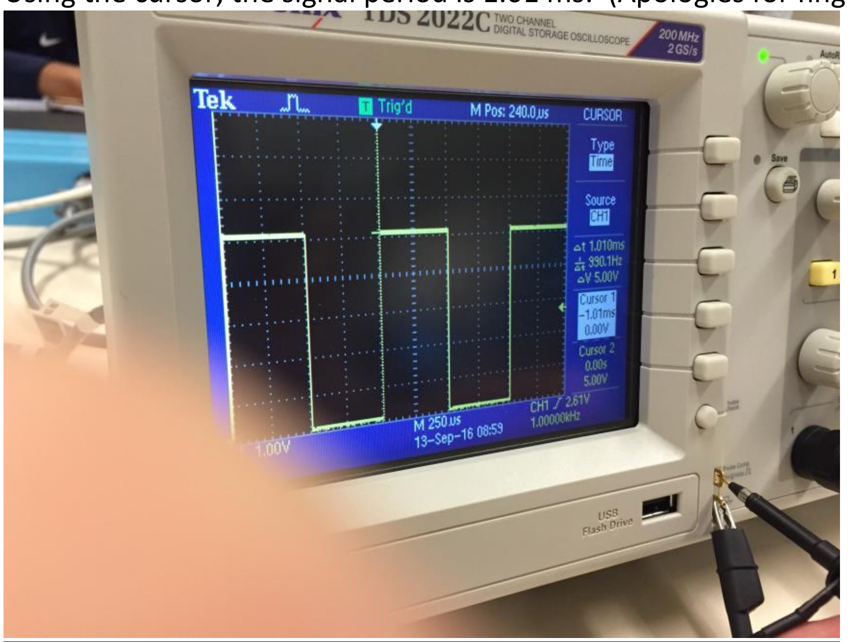
Exercise 9
By counting, the amplitude is approximately 5 V.
By counting, the signal period is approximately 1 ms.
Therefore the frequency is approximately 1 kHz.

<u>Exercise 10</u>

Using the cursor, the signal amplitude is 5.04 V.

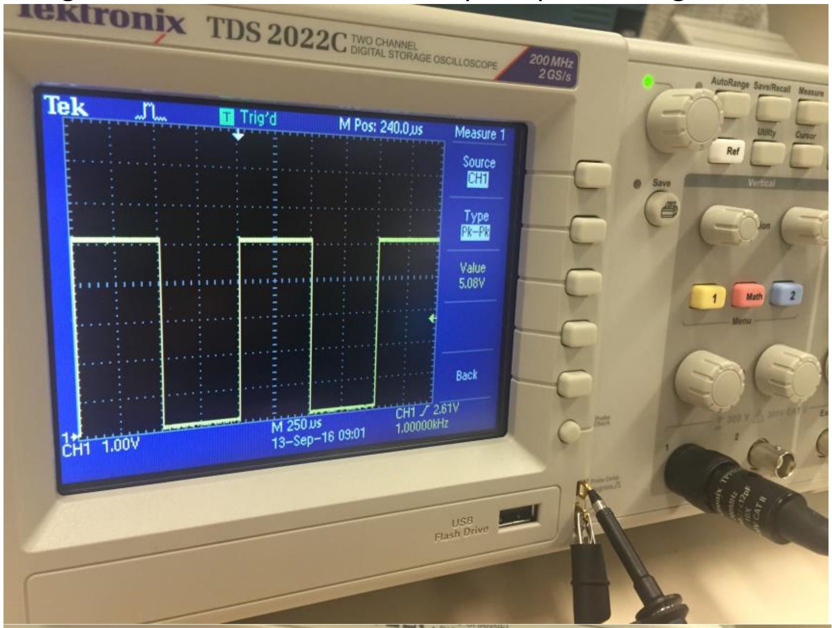


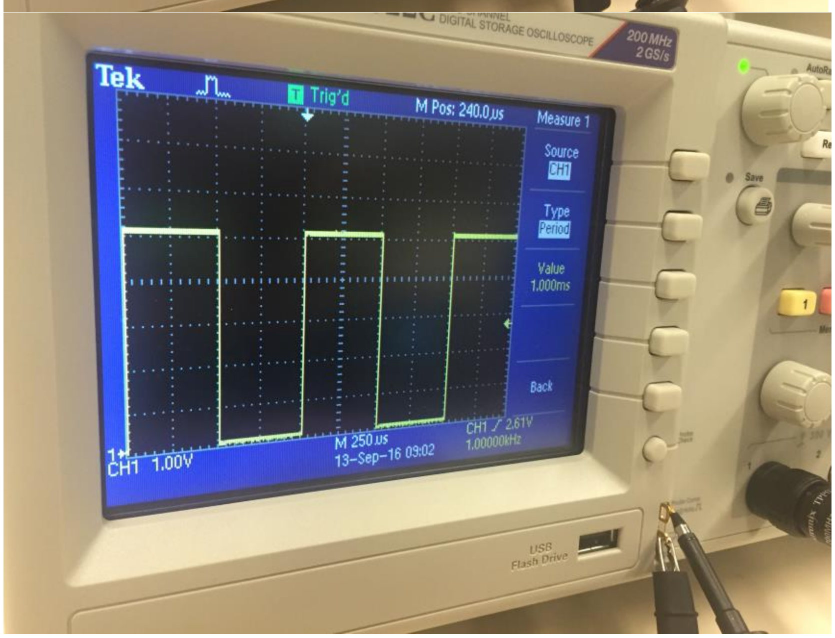
Using the cursor, the signal period is 1.01 ms. (Apologies for finger, value is still readable.)



Exercise 11

Using the automated measure, the peak-peak voltage is 5.08V and the period is 1 ms.





There is a 0.79% difference between automatic versus cursor for peak-peak voltage.

There is a 1.57% difference between automatic versus manual for peak-peak voltage.

There is a 1% difference between automatic versus cursor for period.

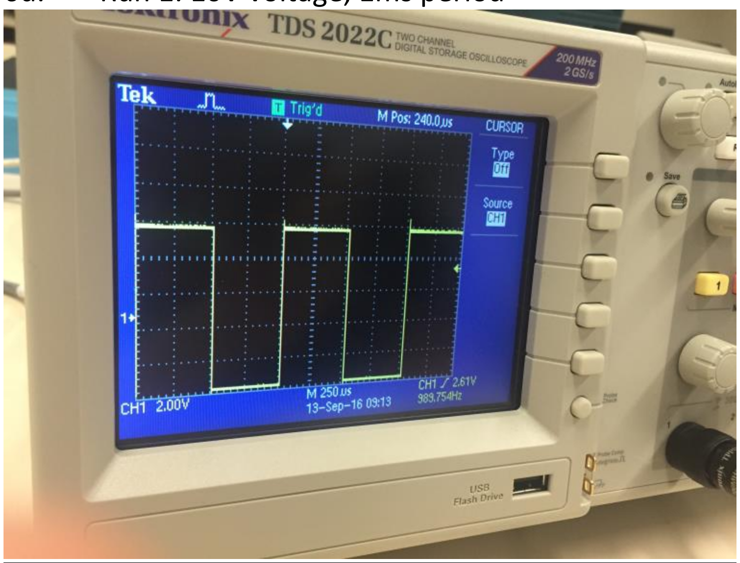
There is a 0% difference between automatic versus manual for period.

Final Exercise

1. c.
2. d.
3. d.
4. c.
5. d.

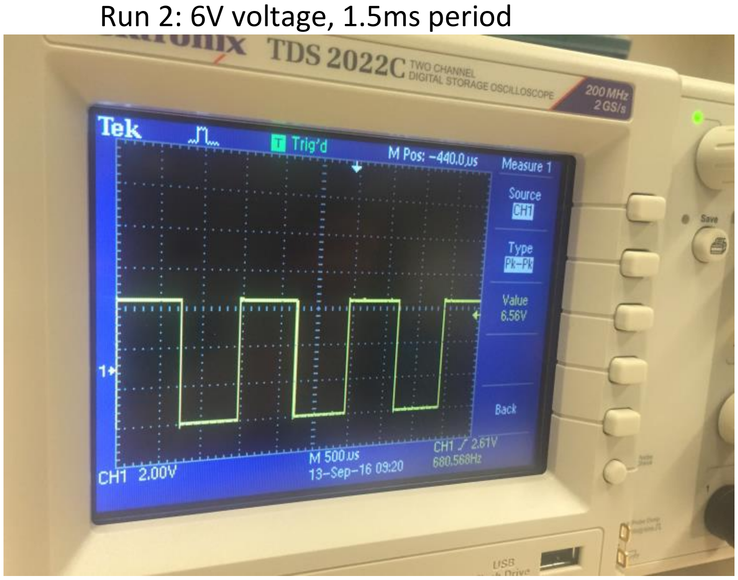
6c. We set up the wiring between the scope and the function generator, selected values on the function generator, then adjusted the vertical and horizontal scales on the scope to get a good image of the waveform. We repeated this with different function generator values for run 2.

6d. Run 1: 10V voltage, 1ms period



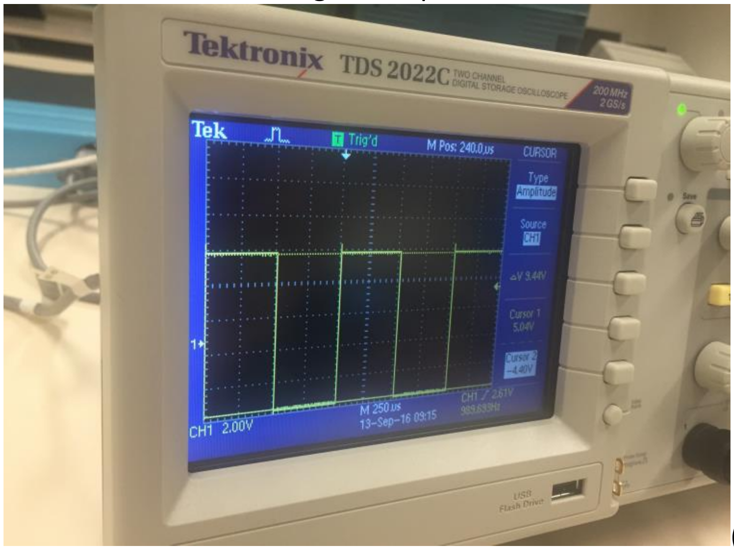
(graticule measure of voltage and period, run 1)

Run 2: 6V voltage, 1.5ms period

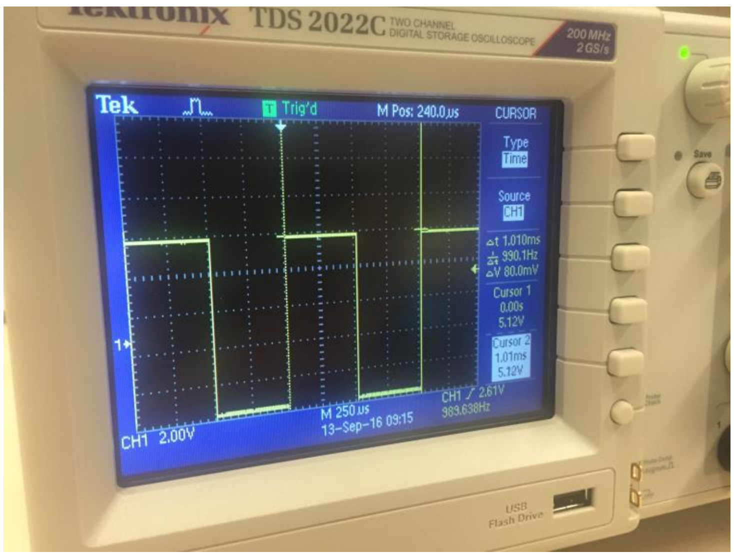


(graticule measure of voltage and period, run 2)

6e. Run 1: 10V voltage, 1ms period

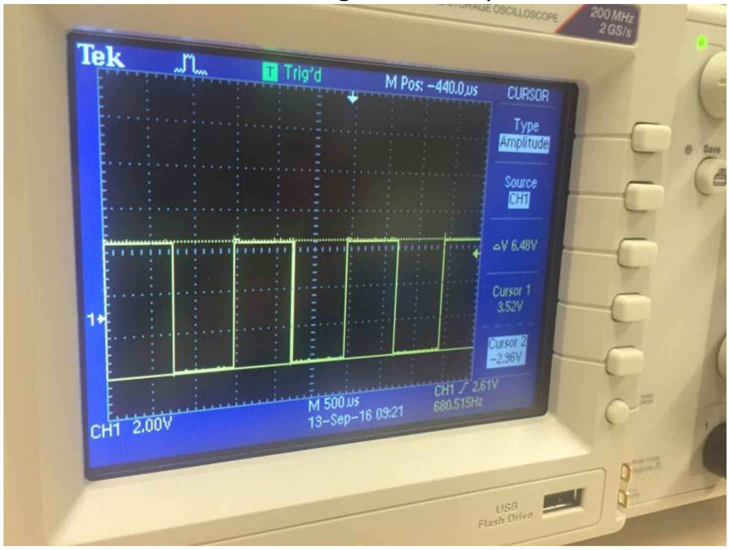


(cursor measure of voltage, run 1)

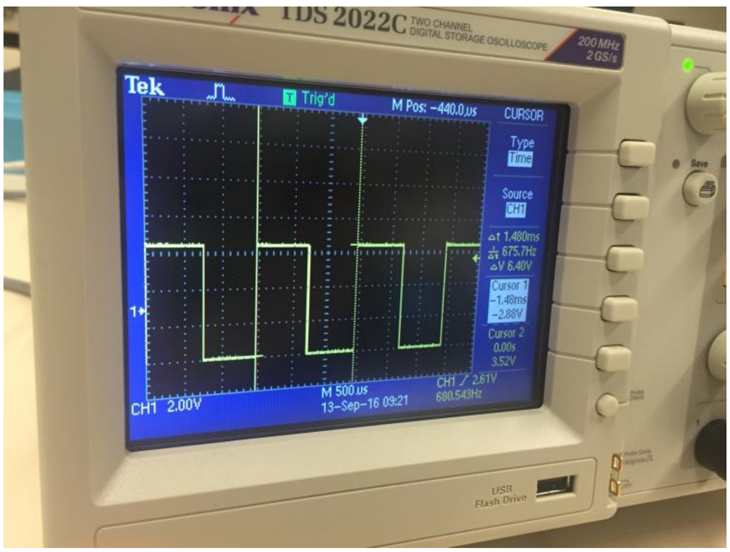


(cursor measure of period, run 1)

6e. Run 2: 6.48V voltage, 1.48ms period

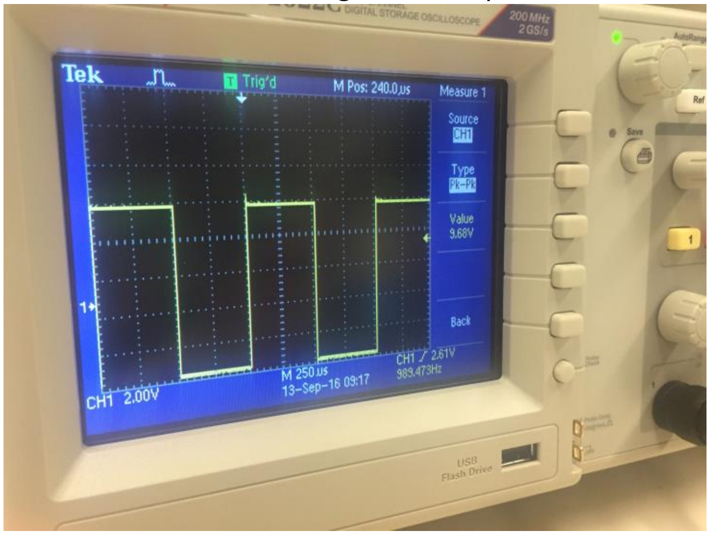


(cursor measure of voltage, run 2)

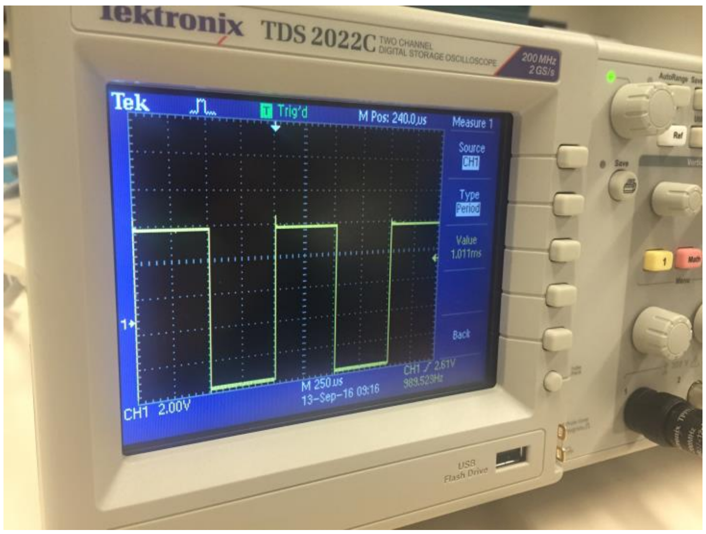


(cursor measure of period, run 2)

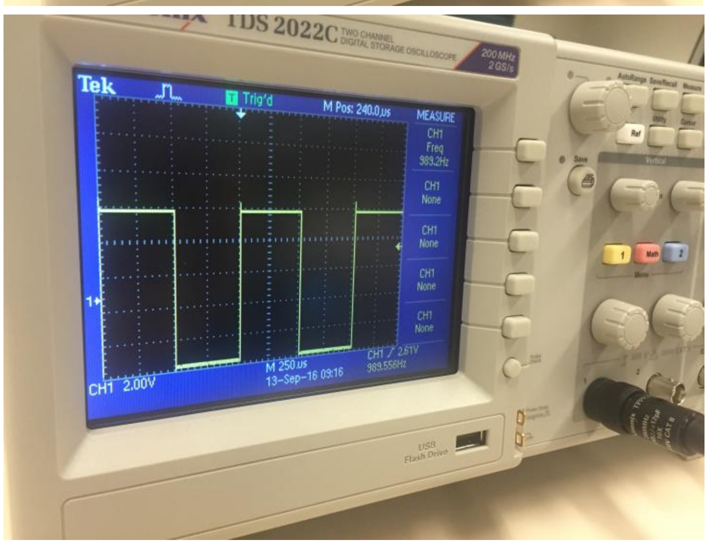
6f. Run 1: 9.75V voltage, 1.01ms period, 990hZ frequency.



(auto measure of pk-pk voltage run 1)

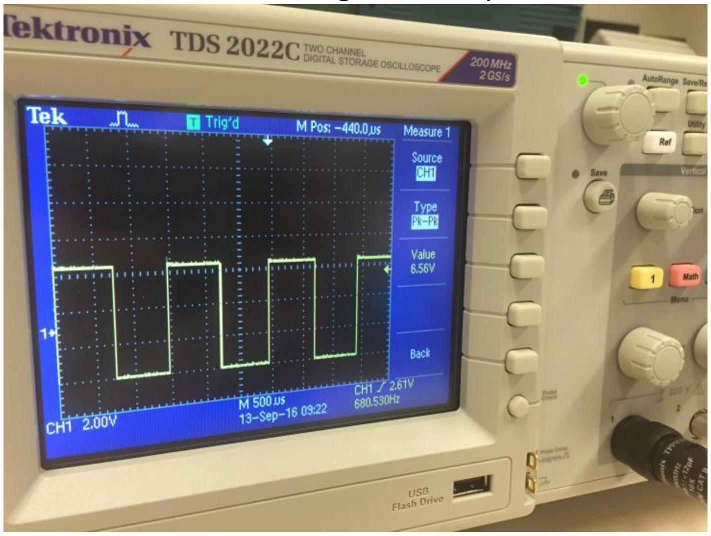


(auto measure of period run 1)

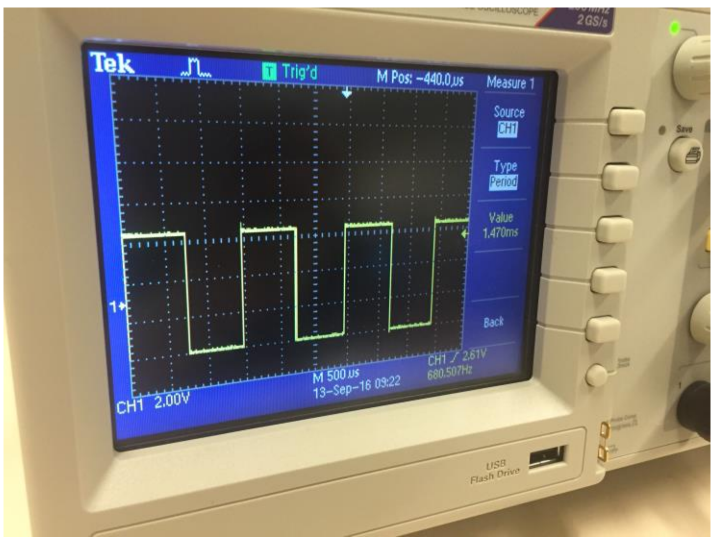


(auto measure of frequency run 1)

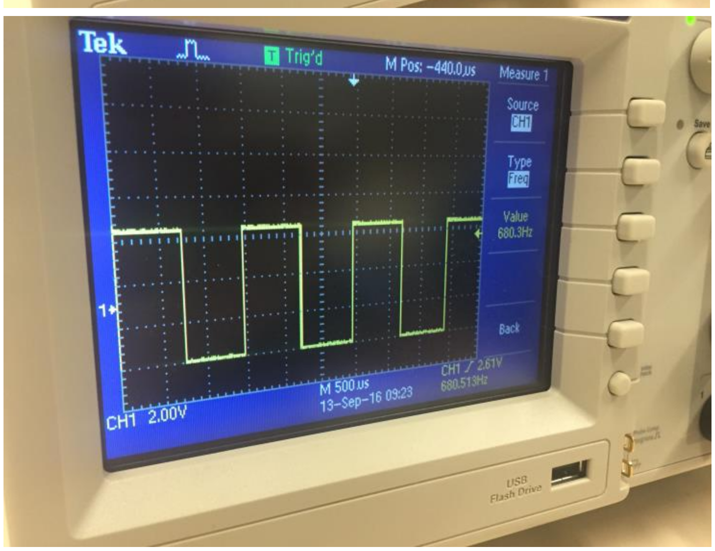
6f. Run 2: 6.56V voltage, 1.47ms period, 680 hZ frequency.



(auto measure of pk-pk voltage run 2)



(auto measure of period run 2)



(auto measure of frequency run 2)