Data Memo for: Team 4, TI Oscilloscope
From: Ray Montgomery
Eric Taylor
To: Professor Yoder
Date: 1/26/2015

Context:

This experiment was conducted on Wednesday January 28, 2015 by Raymond Montgomery and Eric Taylor in B200 on the west-most lab bench on the southern wall of the room (closest to the doorway).

Procedure:

Two input signals are averaged and are compared to a trigger level voltage controlled by a disk potentiometer. Power supplies of -5V and +5V are used. The averaged output voltage, trigger level voltage, and the output voltage of the system (output of comparator) are measured using an oscilloscope. These measurements help prove the ‘linearity’ of the trigger level voltage, the limits of the input range, and the propagation delay.

Presentation of Data/Description of Data and How to Use It:

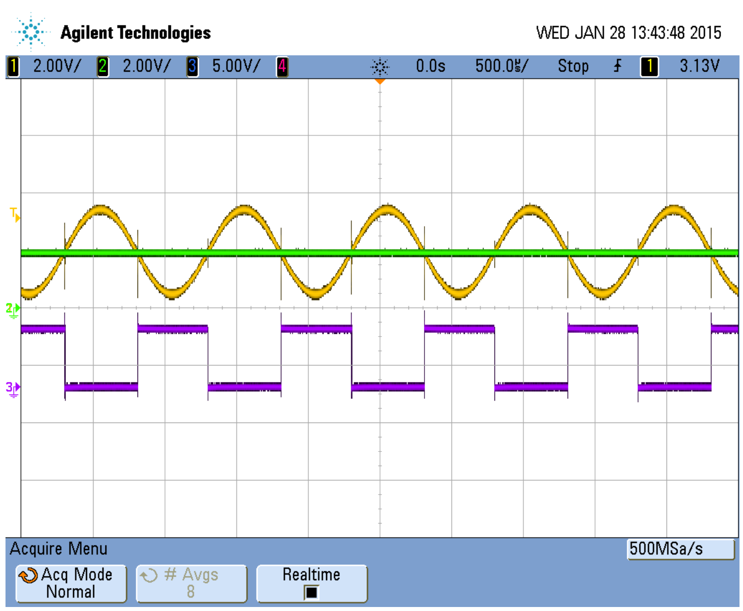

Figure 1: Highest input voltage. Both input signals have f = 1 kHz and their values range from -1.5V to +1.5V.

The averaged output has an appropriate frequency (f = about 1 kHz) and an appropriate amplitude (about 3Vptp). These results agree with the requirements and expectations of the system. The trigger level voltage is correctly shaping the logical output of the comparator.

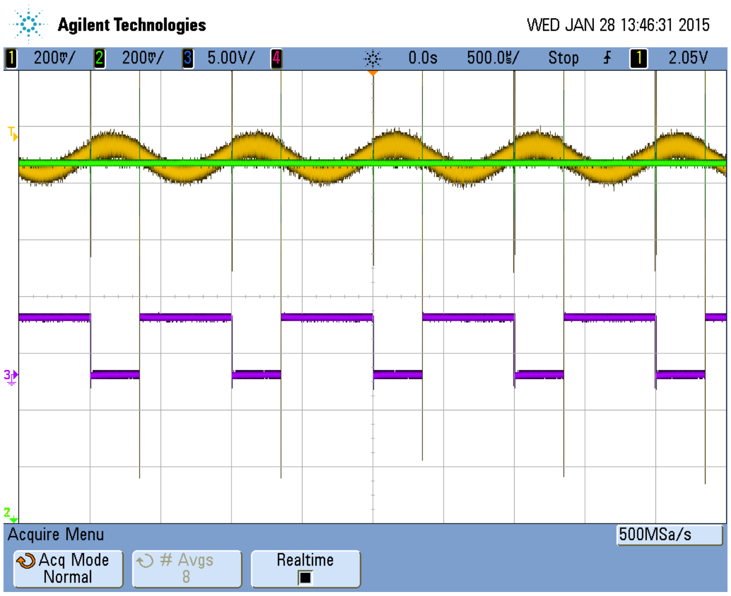

Figure 2: Lowest input voltage. Both input signals have f = 1 kHz and their values range from -50mV to +50mV.

The averaged output has an appropriate frequency (f = about 1 kHz) and an appropriate amplitude (about 100mVptp). These results agree with the requirements and expectations of the system. The trigger level voltage is correctly shaping the logical output of the comparator.

Graph for Trigger Level 'Linearity':

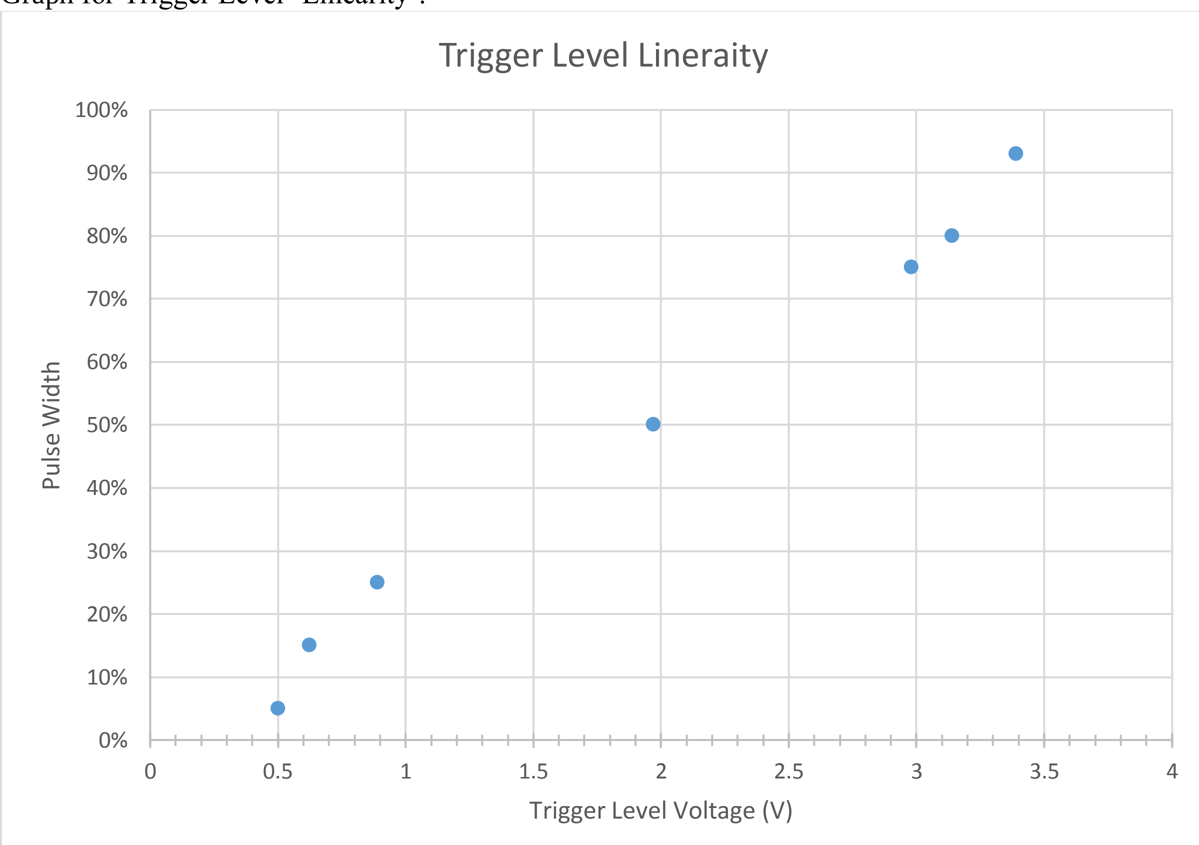

Table for Trigger Level 'Linearity':

Trigger Level Voltage	Duty Cycle
500mV	5%
624mV	15%
890mV	25%
1.97V	50%
2.98V	75%
3.14V	80%
3.39V	93%

Figure 3: Data is taken of the pulse width of the logical output by varying the resistance of the potentiometer.

The variation of the pulse width of the logical output of the comparator shows that the trigger level voltage can appropriately be compared with the averaged output signal at all (numerous) values of the trigger level voltage.

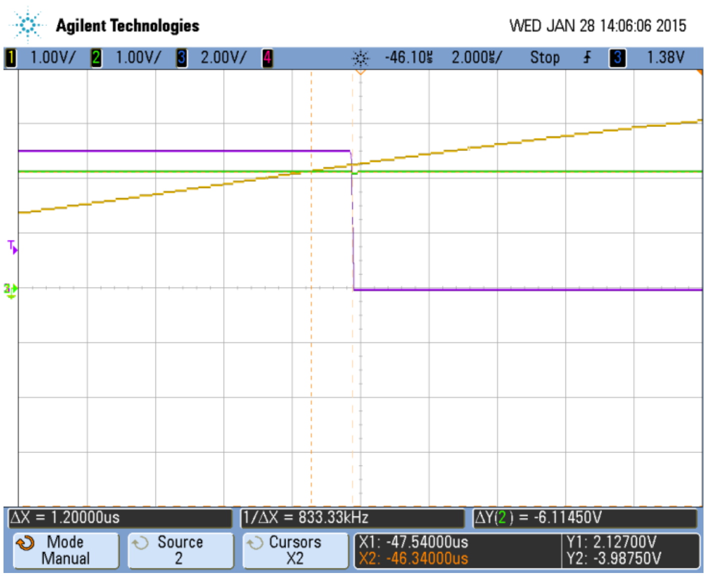

Figure 4: The propagation delay of the logical comparator output voltage is shown.

The propagation delay is shown to be ΔX = 1.2 us. This propagation delay is too high because our oscilloscope should measure signals up to 7 MHz whose period is shorter than the propagation delay which causes a problem with sampling the signal at inappropriate times.

Figure 5: The result of having the maximum input frequency is shown.

The maximum frequency that the system can handle and still maintain desired operation is 150 kHz. This much too low of a frequency (150 kHz << 7 MHz). This low maximum frequency is caused by the slew rate on the comparator amplifier. The limits of the comparator amplifier also affect the propagation delay.

Conclusions:

The comparator amplifier can be replaced with the amplifier that used to average the input signals. This will improve the propagation delay to an appropriately small value. This will also increase the maximum operation frequency of the system.