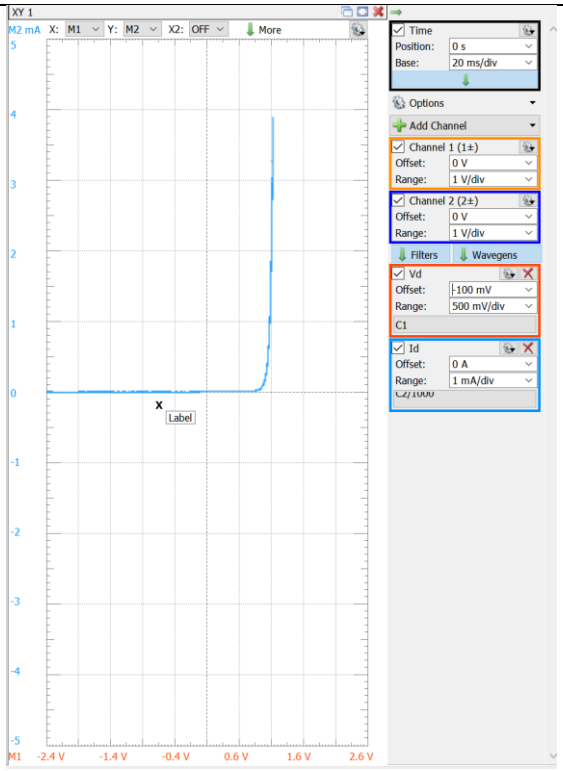
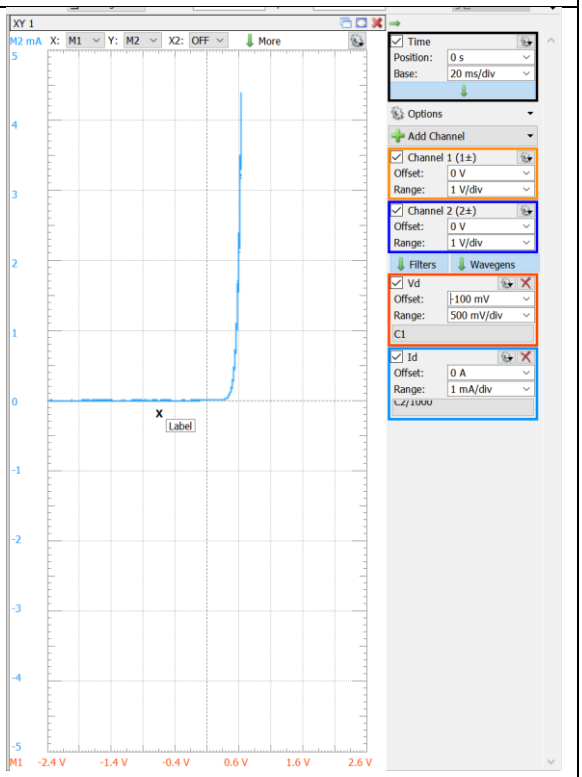
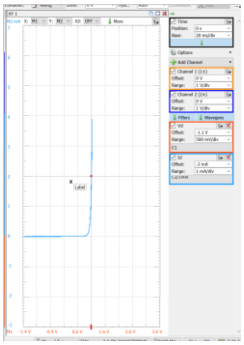
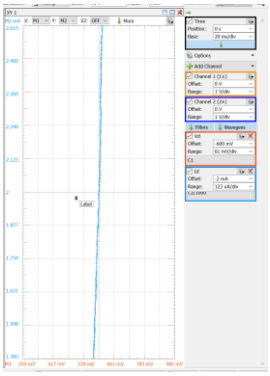
Jimmy Woelke, Michael Vladimirsky

1. ***Using the I-V curve tracer circuit used in part 1 of Project 4, characterize the IR LED and IR Photodiode. (hopefully you saved your workspace!)***

A and b.

	IR Led	IR Photodiode
IV graph	 *Figure 1: IV curve for IR LED*	 *Figure 2: IV Curve for IR photodiode*
Froward bias turn on voltage	~1.12V  *Figure 3: Zoomed in IV curve (Forward bias)*	~598mV  *Figure 4 IR PHOTODIODE:Figure 3: Zoomed in IV curve (Forward bias)*

2. ***Next, while measuring the I-V curve of the photodiode, we want to shine IR light onto the photodiode and we expect to see a downward shift of the I-V curve. To do this, as shown in Fig. 5.0, wire up a separate circuit using a 5V DC source in series with a 100Ω resistor such that the LED is under steady illumination. Now, aim the top of the IR LED toward the top of the photodiode. You should see the I-V curve shift downward. Quantify the changes observed in the I-V characteristics of the IR photodiode with the IR light on and off (or by blocking the light path with an opaque object).***

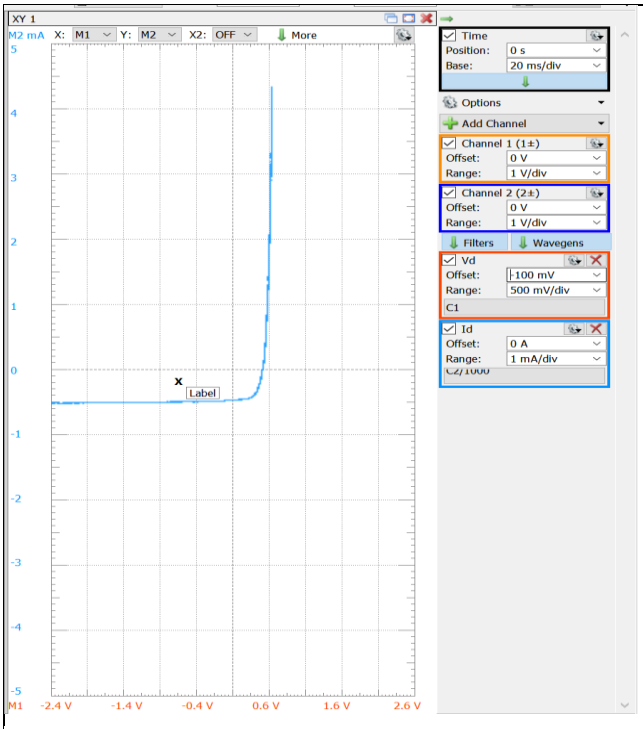


Figure 5: IR LED on

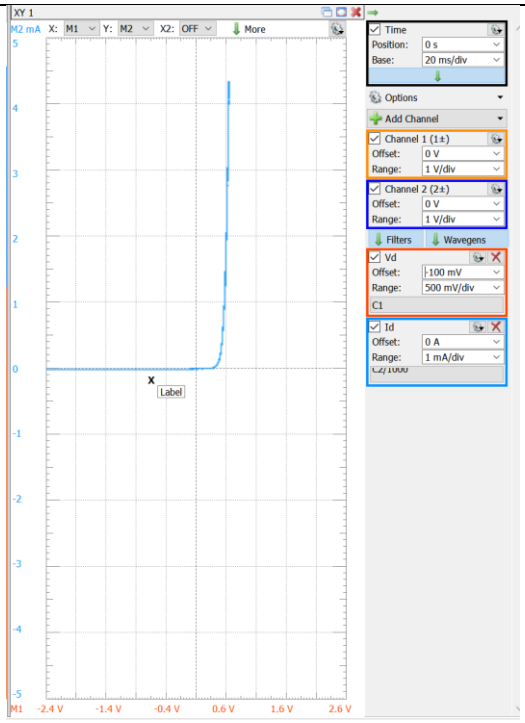


Figure 6:IR LED off

We can clearly see the IV curve shifting down by -0.5mA

Part II: Infrared Signal Reception

1.

a. Like you did in Part 1 Question 2, aim the IR LED at the IR Photodetector and turn the LED on/off (or intermittently block the light) and monitor the voltage across the resistor, to see if your IR receiver circuit is

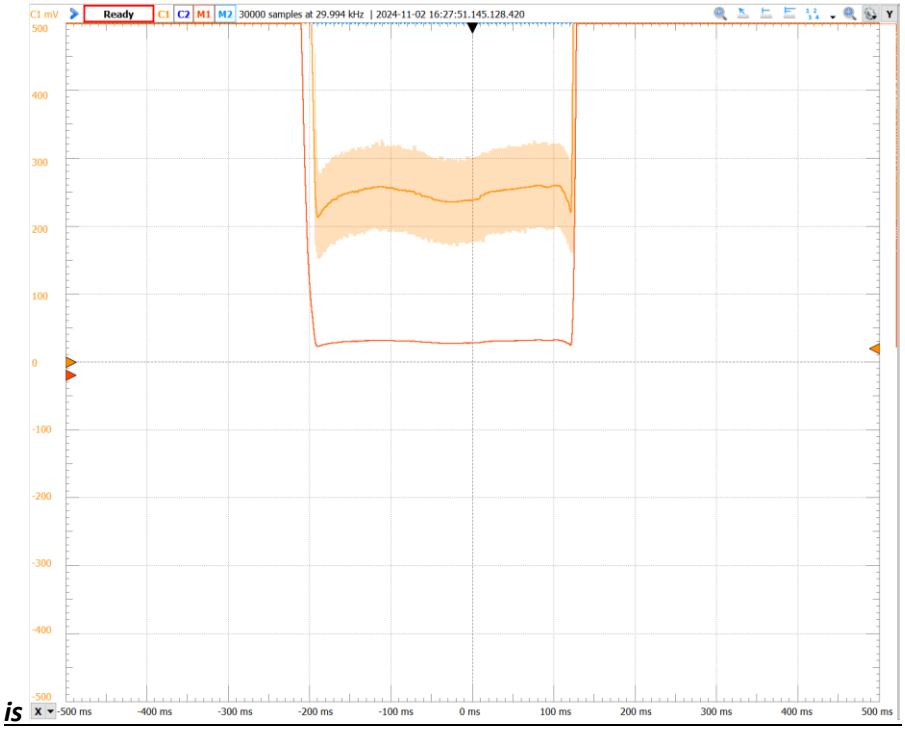


Figure 7: The IR diode is blocked temp with paper and then the paper is removed

b. Next, find an infrared remote control, any remote control will do. While directing the remote control towards the photodiode, push a button and look at the channel 1 waveform. Describe what you see. Play with the range, time base, and trigger options (change mode back to "Repeated" to repeatedly freeze the triggered waveform on the screen), so that you can capture one pulse train

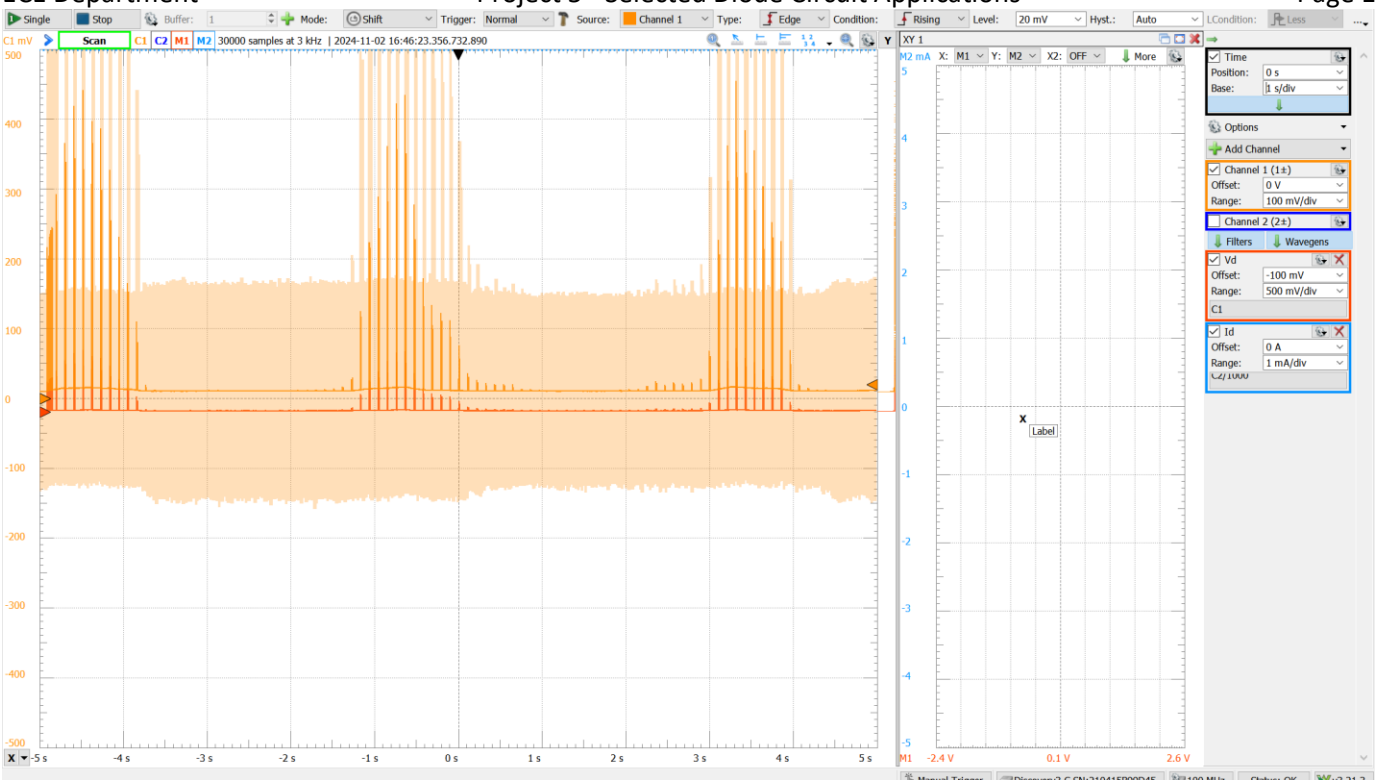


Figure 8: Proof of working circuit with IR remote

c. How does the waveform vary depending on the proximity of the remote control? Do you have to aim the remote control carefully? Does the waveform vary when different buttons are pressed on the remote control?

The remote control must be about 5 feet to have a noticeable reading on the graph. We do not need to aim carefully but rather somewhere in the proximity of the IR photodiode (give or take about 15 degrees in every direction). Yes, the waveform varies when different buttons are pressed on the remote control, slightly.

d. Capture a sample waveform using your oscilloscope and paste the image.

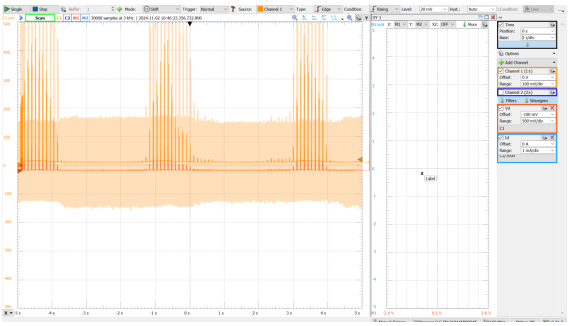


Figure 9: sampled waveform using IR remote

Part III: Heartrate Monitor Circuit

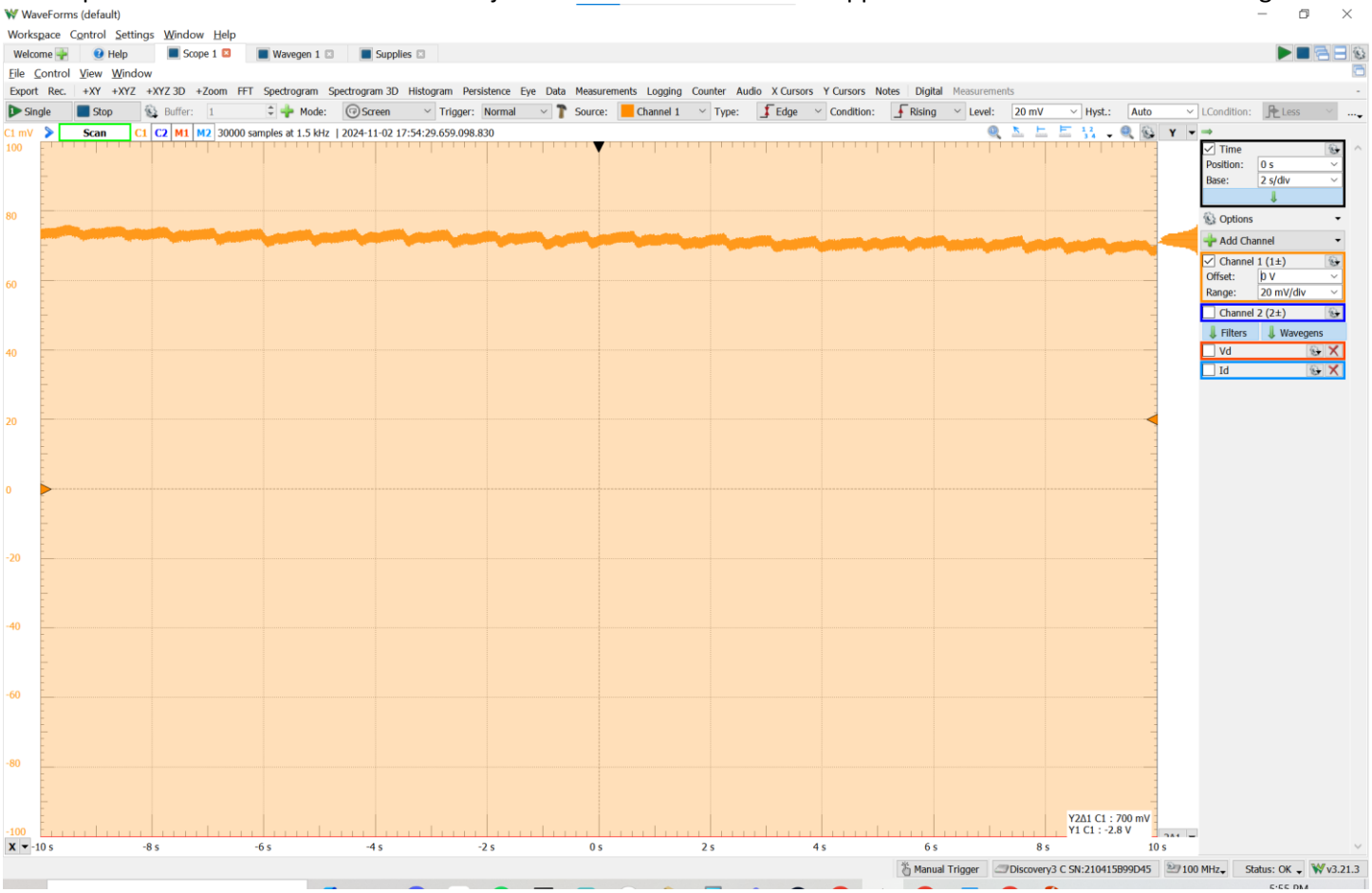


Figure 10: Resting heart rate

1/(6-5)= 1
1*60= ***60 BPM***

$$f = \frac{1}{\Delta t}$$

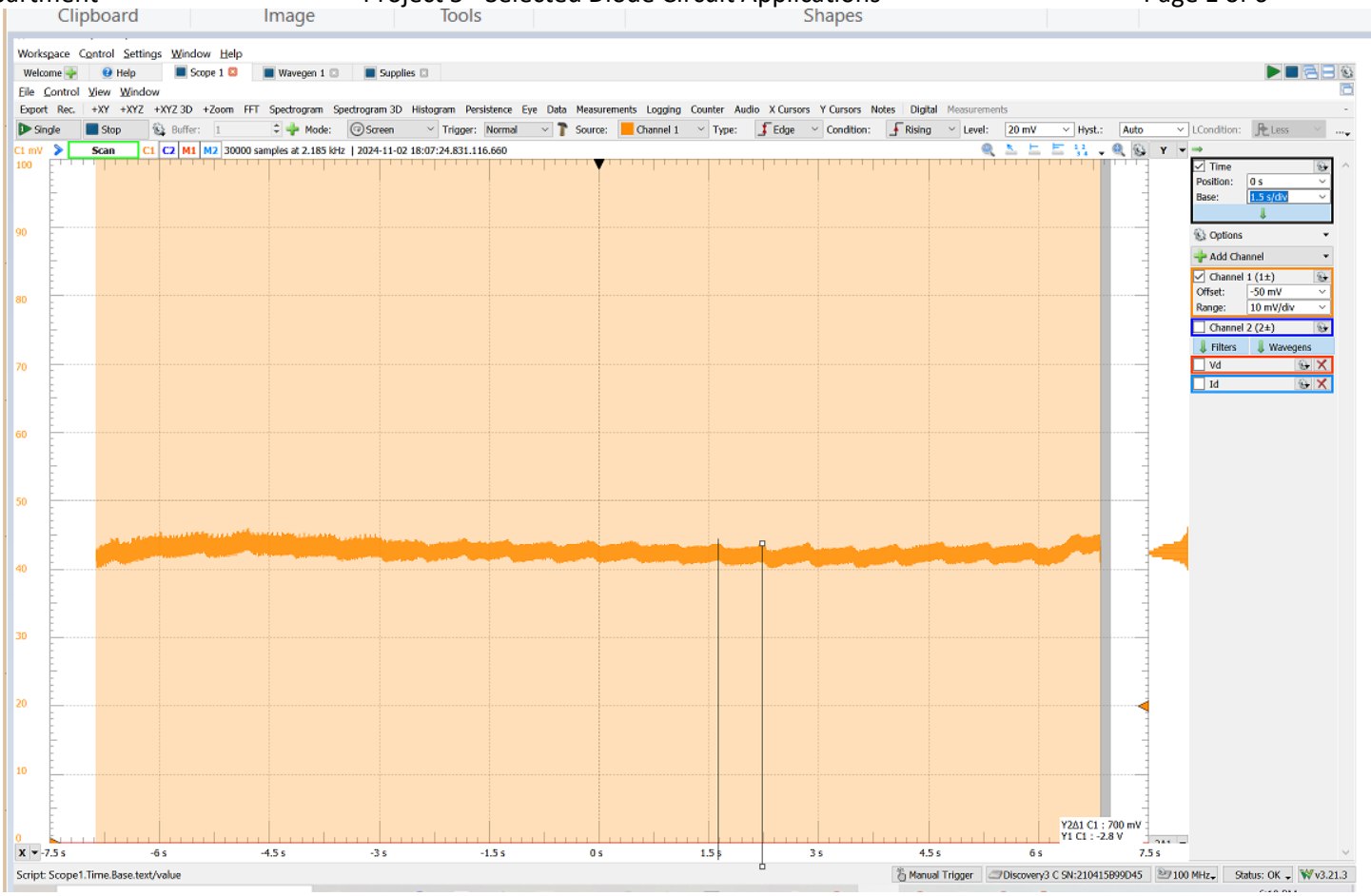


Figure 11: Elevated heart rate

1/(2.25-1.65) = 1.66666666667

1.6666667*60 = ***100BPM***