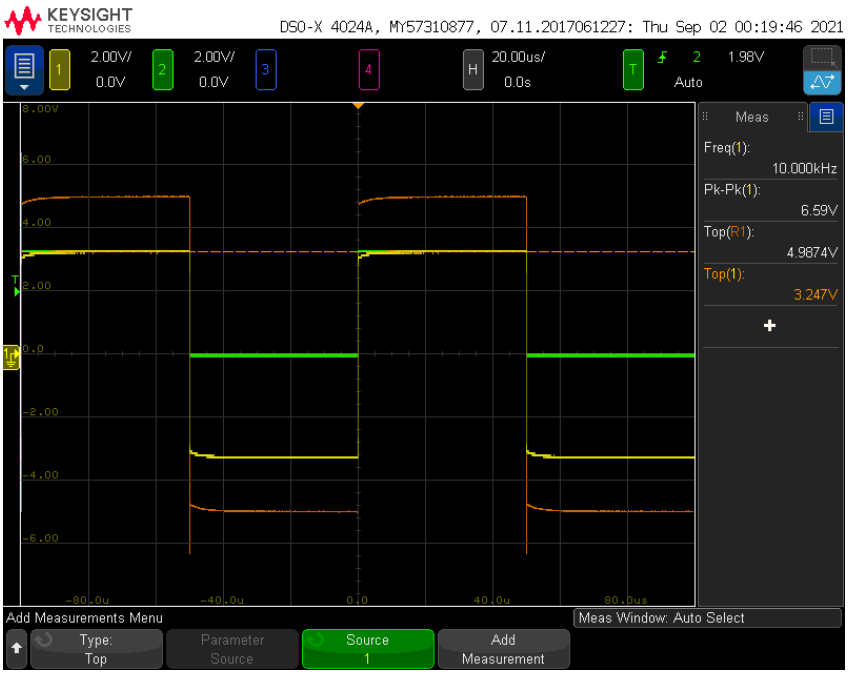
Lab Report 2 - Sam Freed

This lab first reintroduced scope and function generator skills and then allowed us to experiment with induced noise between two loops. Instead of using a 555 timer as we did in the last lab, we created a more precise square wave using the function generator. We first used this wave to determine the Thevenin output resistance of the function generator. Then, the function generator output was shorted to form a loop. Making a similar loop using a 10x probe created an aggressor/victim system, and the effects of various loop structures could be seen.

The screenshot to the right shows the process used to determine the Thevenin resistance. The orange line is a reference snapshot of the unloaded square wave, the yellow line is the live output of the square wave loaded with a 100-ohm resistor, and the green line is the trigger output of the function generator.

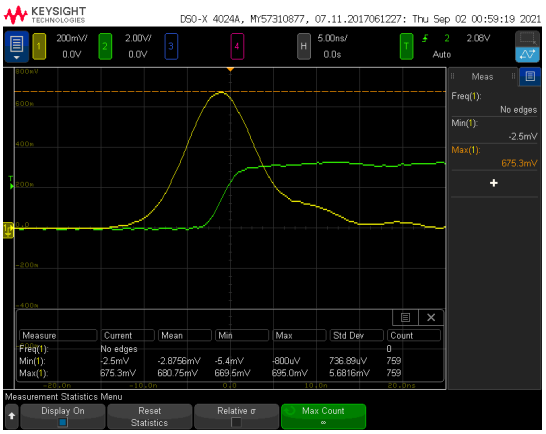


The unloaded voltage, 4.987V, the loaded voltage, 3.247V, and the load resistance, 100 ohms, can be used to determine the Thevenin output resistance:

$$R_{Th} = R_L * \frac{V_U - V_L}{V_L} = 100\Omega * \frac{4.987 - 3.247}{3.247} = 53.5879\Omega$$

This resistance lines up with the expected result and does not change when the function generator's output load setting is changed, as the function generator compensates for the loads internally.

For the second half of this lab, we were experimenting with the different layouts of the two loops. Overall, the smaller the loops were and the further they were apart, the less effect the aggressor had on the victim. Three scenarios can be seen below:



Large loops with overlapping signal and return lines

Large loops with overlapping return lines

Large loops with aggressor return line overlapping victim signal line

These examples show the different geometries and the different resulting effects. Having opposite flow, as in the last example, creates negative voltage noise in contrast to the positive of the others. And while none of these show smaller loops, the smaller size creates less inductive interference, meaning the crosstalk is also minimized.