

Experiment 2: Data Acquisition with Matlab

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This experiment will make us more familiar with matlab and Simulink. The actual experiment itself takes an analog input and converts it into a digital signal. Voltage supply, wires, a breadboard and a NI USB-6008 are used to convert the data onto a scope and graph to see the changes of voltage with time. In the last part of the experiment, a graph will be created with two potentiometers for axes.

I. INTRODUCTION

The purpose of this lab is to become more familiar with Matlab and Simulink. Another objectives were to convert an analog input to discrete digital output. The other objective was to become more familiar with breadboards, digital power supply, wiring, digital multi-meters, and other lab skills.

II. METHODS

This experiment had little in the way of analysis but more work on the learning how the tools worked, like the breadboard, NI USB-6008, and the potentiometers. In the experiment, a simple angle sensor (angular potentiometer) will be connected to the NI USB-6008 data acquisition device and will collect data using a Simulink graphical program.

In our first step, we created a Simulink program to display and record data from the NI USB-6008. We will use the Simulink program so that data from the analog input will be converted to the digital output. In the Simulink program, we selected Data acquisition blocks. We will select Analog Input, selector, reshape, and scope so that the data is converted from analog to digital. With the sample rate creating plot on the scope, we expect that the more samples are taken the smoother the plot will be due to the smaller increments of time between the samples.

Next, in the experimental process we will connect the angular potentiometer to the NI USB-6008 using a breadboard. The breadboard will also be attached to a power source. The setup, will have the positive and ground cord attached to the breadboard. The potentiometer will be attached to the breadboard and the the NI USB-6008 will be connected to the computer(Simulink) and the breadboard. The potentiometer has a special connector that allows it to be attached to the breadboard, as does the power supply, but wires must be used to connect the NI USB-6008 to the breadboard.

The next step is running the program on Simulink so that data will appear on the scope. The plan is that the program will run and collect data which will be displayed on the scope. The data will be analyzed for changes in voltage.

On the final step, a second angular potentiometer will be attached and the Simulink program and an xy graph will be added since the second potentiometer will add a new dimension. Before the program runs, we must select a stop time to tell the program when to stop collecting data and for this experiment we will use 10 seconds. While the program runs, we will rotate the angular potentiometer from one

extreme to the other. Since, the potentiometer has variable resistance, rotating it will increase or decrease the voltage sampled.

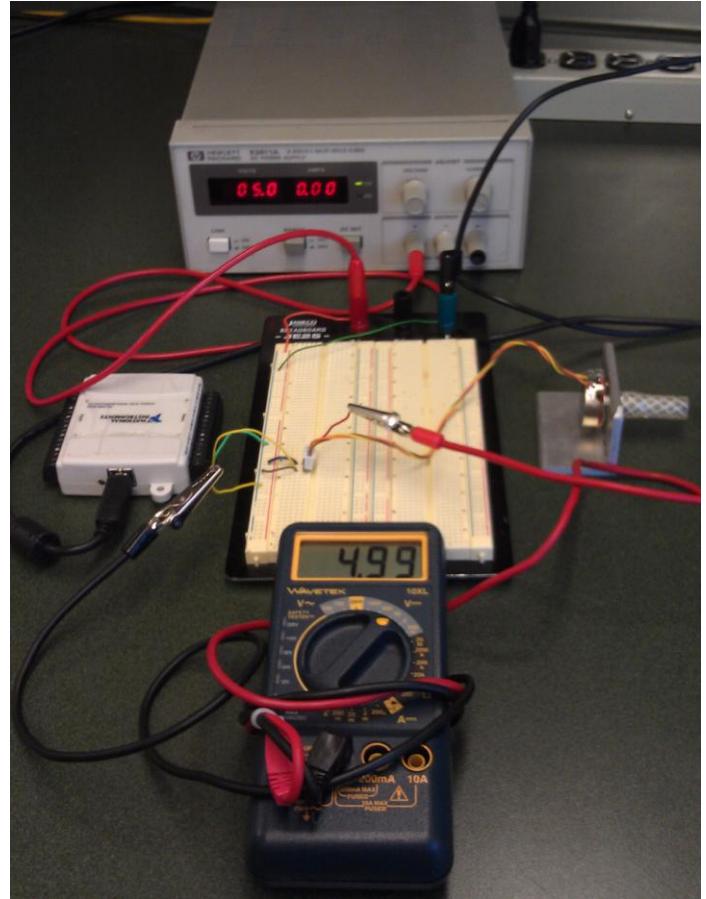


Figure 1. An example figure. Our setup with a digital multimeter showing that our setup was receiving 5V from the power source. Our setup has the NI USB-6008 attached to the computer offscreen.

A. Experimental Program

When the experiment had only one potentiometer, the Simulink was setup so the data acquisition blocks were organized so that the analog input was attached to the selector, then the reshapener, and finally to the scope so that data could be visualized. When the data starts to appear on the scope, the sample rate will be set at 200. The hardware channels used for the connection with the NI USB-6008 will set at 0 for AI0 and the input range will be set at -5V to 5V. The data for the workspace will be set as an array.

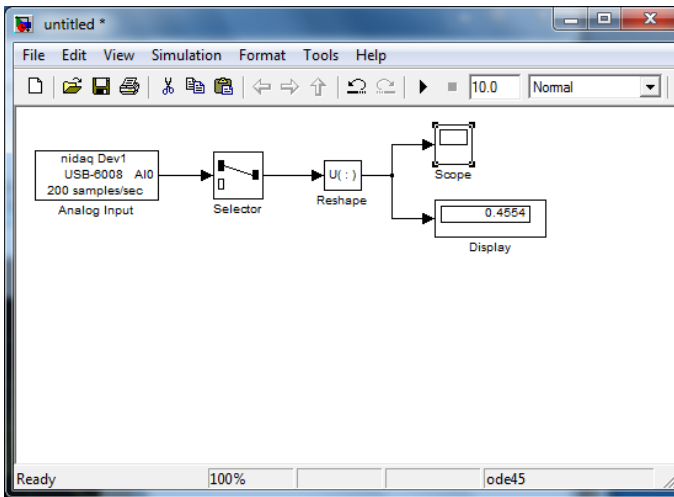


Figure 2. In this figure, the Simulink program is displayed that we used when there was only one potentiometer attached.

When we run the Simulink program, the simulation stop time will be set at 10 seconds. During the running time of the program, the potentiometer will be rotated so that 5 values will be calculated along with a minimum value and a maximum value, these values will then be recorded on a table with the help of the DMM.

When a second potentiometer is added, the Simulink program is changed so that the data is put onto an xy plot.

III. RESULTS

For results, we gathered data of the DMM voltages and the Simulink voltages at the 5 different positions. These are our values:

Position	Simulink Voltage(V)	DMM Voltage (V)
Minimum	-.001067	0
1	.8507	.86
2	1.993	2.00
3	2.852	2.86
4	3.352	3.36
5	4.203	4.22
Maximum	4.977	4.99

Fig 3: Table of the voltage when the potentiometer was rotated to different positions.

The values on the DMM and the Simulink change and are similar in voltage.

The following picture is of our experiment setup, wires were chosen by certain lengths to ensure that the different parts were not cramped together.

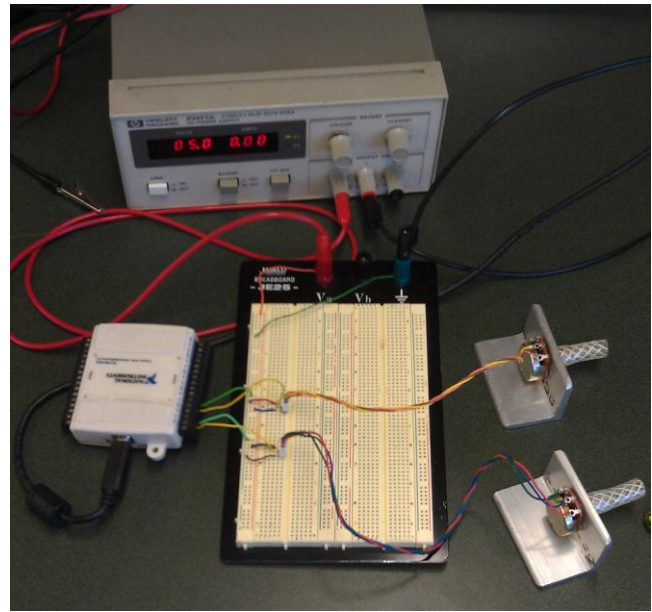


Figure 4: This was our experiment setup, the only difference between this setup and the setup with one potentiometer was that there was only one potentiometer.

In our results we had were able to record samples at multiple heights and view them on our scope as shown in the following figure. We also were able to see samples being analyzed by the Simulink program because of the display acquisition block.

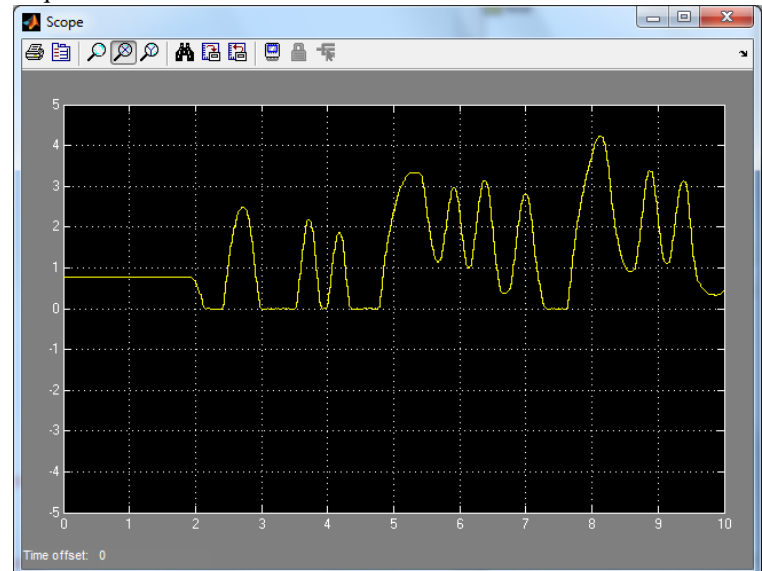


Figure 5: This image is a screenshot of the scope and of some of the heights that data was captured.

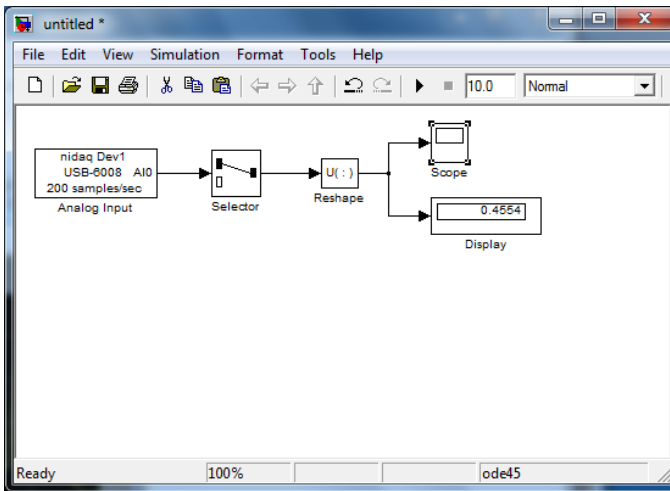


Fig 6: The Simulink program showing that the program is sending samples to the scope and the display.

When we collected data on the scope we exported them onto graphs with the given axes to show the change in voltage with the rotation of the potentiometers. The first plot (Figure 7), has the potentiometer voltage versus time over the course of 10 seconds. The second plot (Figure 8) contains the axes of the two potentiometers, allowing the plot to go anywhere on the xy plane for 10 seconds.

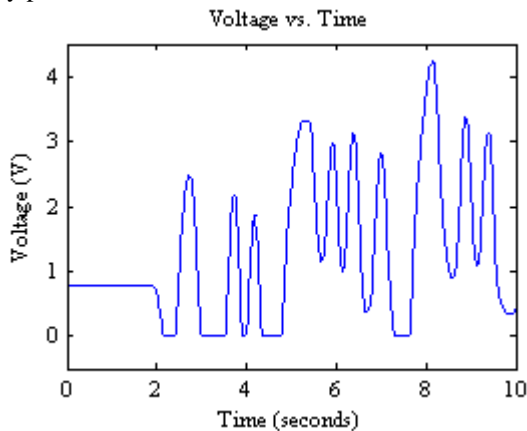


Fig 7: This graph displays the relationship of the voltage change due to the potentiometer versus time. The time that the program runs is for 10 seconds.

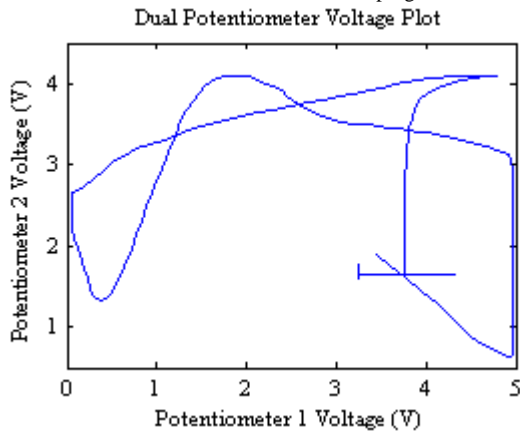


Figure 8: This plot shows Potentiometer 1 versus Potentiometer 2 over the course of 10 seconds.

IV. DISCUSSION AND CONCLUSIONS

This experiment shows that the potentiometer can be used as a sensor. Whenever, the potentiometer experiences rotational motion, the voltage changes which could be used for when measuring the deflection or rotation of a shaft. The range of the potentiometer would depend on the range that the potentiometer could rotate and how much voltage is supplied.

The values for the DMM and Simulink were similar when the 5 different positions were sampled along with a maximum and minimum.

Changing the input range in the experiment just changes the range of voltage determined in the data. Changing in the sample rate makes the plotted data smoother because the increments of time between the plotted data points are smaller.

The values of the DMM and Simulink program are very similar. However, since the DMM is connected to the wires which means that there is possible error due to contact, I trust the Simulink program more.