***Notice: The numbers were purposely changed in this example report and may not be accurate for practical application**

<u>Lab Section X: Lab Title</u>
(Major Specific Project)

Student Name

ECE 201-0XX

February XX, 2010

Overview:

The purpose of this lab was to create and analyze a circuit that pertains to electrical engineering and analyze the result. The experiments conducted involve a circuit that uses a thermal resistive sensor, a motor, various resistors, and two DC power sources. A data-logging device was used to analyze the circuit created. Software tools such as PSpice and DataLogger 2.0 were used to display the data collected. The major focus of this project was to analyze thermistor's reaction to the heat dissipated off of a motor when exceeding its maximum power ratings.

Circuits created:

The circuit to be analyzed was created using a protoboard, a 30V power supply, a 20V battery pack, a 16k ohm resistor, a 100k ohm resistor, a 120k ohm resistor and a thermistor resistive sensor. Figure 1a shows the thermistor voltage divider circuit that was created[1].

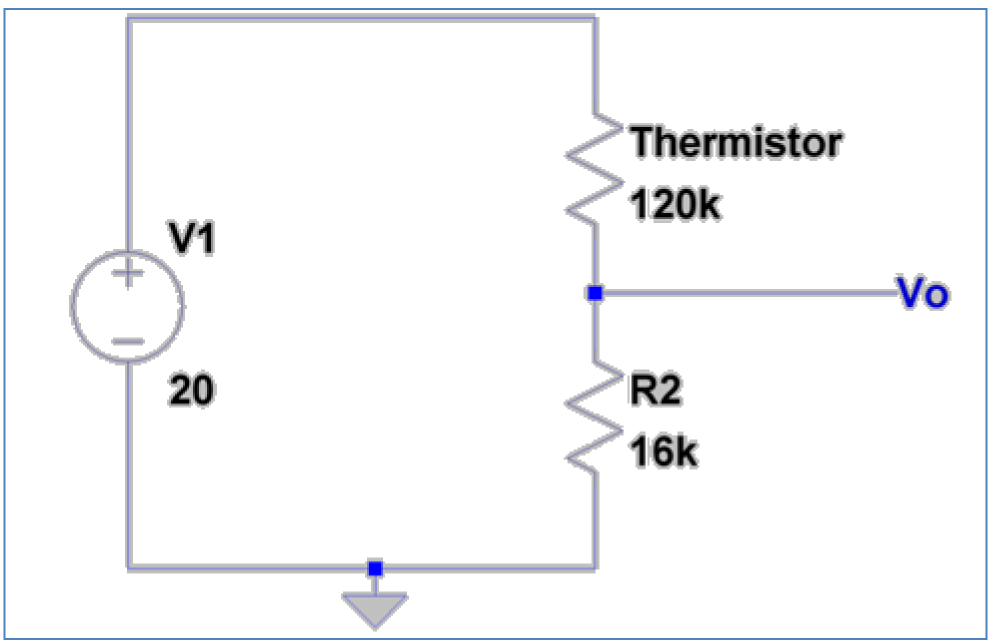

Figure 1a: Voltage divider circuit used characterize thermal reaction of the resistive sensor and limit voltage into the datalogger. Vo connects to in1 of the datalogger.

A power source of 30 volts was used to power the motor. Since 30 volts was too much for the data-logging device to handle, a voltage divider was used to lower the voltage enough for the data logger to safely operate[1]. Using the 1M ohm resistor and a

100k ohm resistor the calculated voltage[1] of approximately 3.0V, which was an adequate operating voltage for the data logging.

Figure 1b shows the modified circuit created for analyzing the thermistor-motor activity. In1 of the datalogger is connected to the thermistor voltage divider, while in2 is connected to the voltage divider in parallel with the motor.

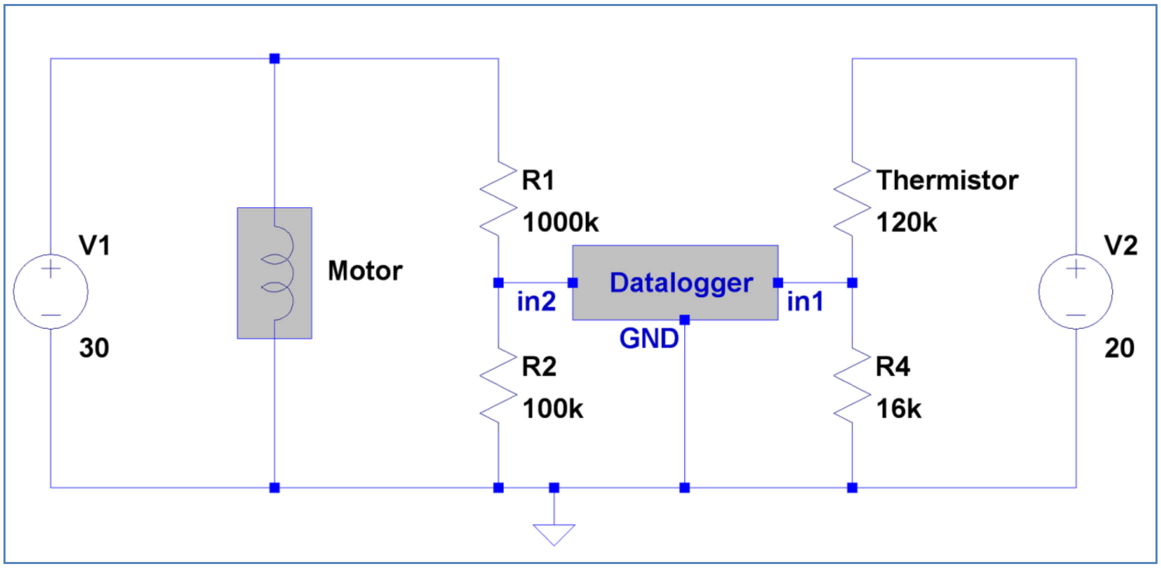

Figure 1b: This is the modified circuit used in test 1 and 2. Using voltage dividers, the voltage was lowered within safe operating conditions for the datalogger.

Equations used:

$$Vin\left(\frac{R2}{R1+R2}\right) \rightarrow 20\left(\frac{16k}{120k+16k}\right) = 2.28V \quad \textbf{(1)}$$

$$Vin\left(\frac{R2}{R1+R2}\right) \rightarrow 30\left(\frac{100k}{1M+100k}\right) = 3.00V \quad \textbf{(2)}$$

Experiments:

The thermistor and the motor were oriented so that they were close to each other to get optimal results. Once everything was situated, the data logger was turned on and the power sources were connected. For both tests, the power supply voltage of the motor was slowly increased from 0 to 25 volts and back down to 0 volts during the time that the data logger was recording the data.

Test 1:

For this test, the thermistor and motor were held against each other. The power sources were connected and the data logger was switched on. This test lasted about a minute and a half. The initial rise in voltage was from raising the input voltage of the 25-volt power source from 0 to 25. As depicted in figure 2a, when the motor started getting hot, the motor voltage began to slowly drop, while the thermistor voltage slowly started to rise. At about 55 seconds into the test, the motor was too hot to hold anymore. The motor was then placed back on the table while the thermistor still was near it. The main input voltage was then lowered to 0 volts and the logger was turned off after a few seconds.

Results & Analysis:

As expected, there was a change in voltage when the thermistor heated up. Since the data logger was connected between the 16k ohm resistor and the thermistor, there was a voltage division. While the thermistor temperature steadily rose, the resistance became lower. Since the thermistor was the upper part of a voltage divider the decrease in resistance lowered the total voltage, but raised the thermistor voltage[1]. As the thermistor cooled, the resistance began to rise and the voltage lowered back to the initial voltage. A line graph of the thermistor and motor voltage over the span of the test is displayed in figure 2a.

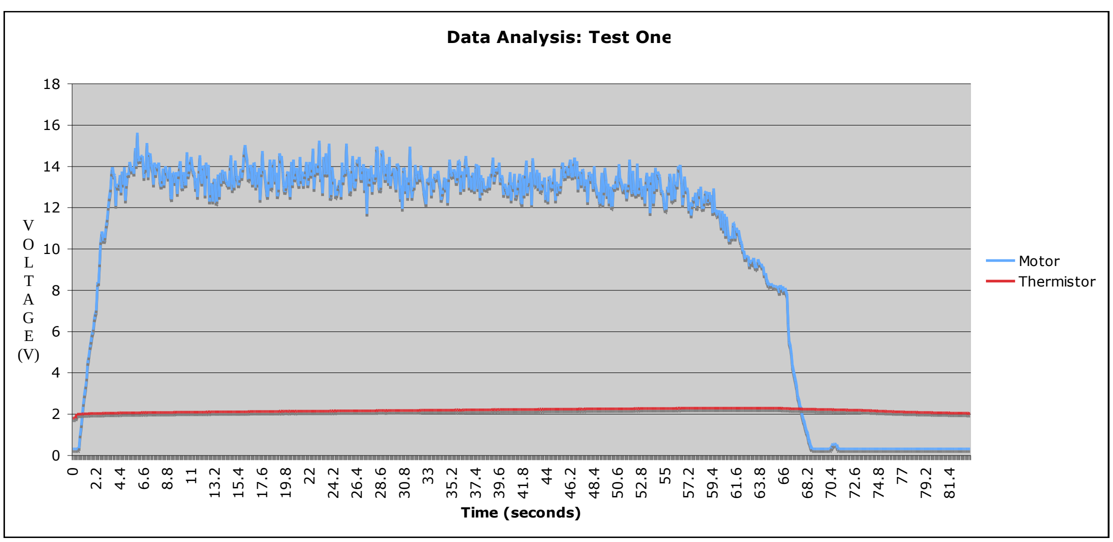

Figure 2a: This is a graph of the voltage of the thermistor and motor over roughly a minute and a half.

Test 2:

During this test, the main input voltage was raised from 0 to 25 volts more slowly than the first test, with a brief pause midway. The motor and thermistor were placed close to each other, but were not held together this time. A little after a minute and a half, the main input voltage was gradually turn from 25 to 0 volts. After a few seconds, the data logger was turned off. Figure 2b shows the graph of test 2.

Results & Analysis:

There was a much slower change in voltage of the thermistor this time. This is probably due to the reduction of the overall heater coming from the motor. There seems to be a dip in the voltage of the motor, as was to be expected, but towards the end, it seemed to have slightly increased. This was due to the realization that the maximum current had been lowered between tests, so it was set back to its original position. Since it positions of the thermistor and motor were not changed this time, the thermistor did not cool down at the end because the motor was still emitting heat.

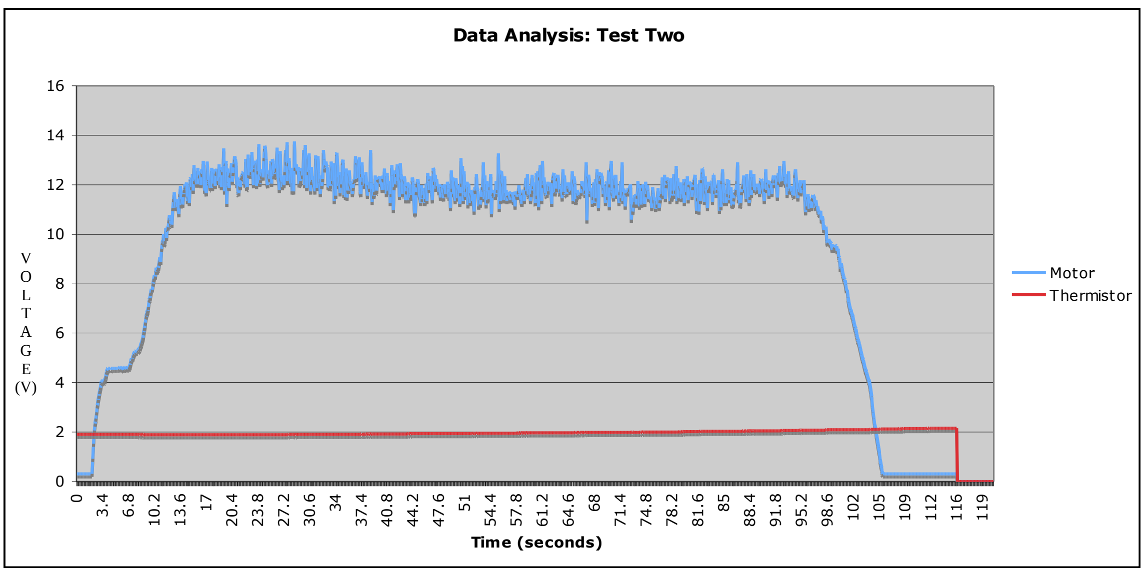

Figure 2b: This is a graph of the voltage of the thermistor and motor over a span of 2m..

Lab Questions:

Be sure to add all lab questions in to your report.

Challenge Qustion:

Challenge questions should be in their own section. Be sure to treat challenge problems like and experiment (adding schematics, graphs, tables, etc)

Conclusion:

While using a thermistor and a motor, this lab showed the thermistor resistance lowers when the motor heats up, while raising its own voltage. When manipulated correctly, the thermistor could regulate how much power goes to the motor and theoretically prevent it from overheating.

See attached for raw data collected from the data-logging device.