

UNIVERSITY OF LOUISIANA AT LAFAYETTE

MEASUREMENTS AND INSTRUMENTATION

MCHE 357

Lab 9

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Contents

List of Symbols	1
Introduction	2
Theory	2
Procedure & Analysis	2
Conclusion	5

List of Figures

1 Thermo-couple	3
2 Reference Thermometer	3
3 Labview System Diagram	4
4 Labview Control Panel	4
5 Recorded Data & Results	5

List of Symbols

None

Introduction

This lab consisted of using Labview to create a program which reads data from a thermo-coupler to measure the temperature of an environment. The program was used to measure the ambient temperature of a room, the temperature between two fingers, and the temperature of a cold cup of water.

Theory

Labview can be used in conjunction with physical instruments in order to control a system or take data in from a system. Reading data from an instrument can be done by referring to the documentation of the instrument in order to map voltage readings to the desired measurement, while also considering the sensitivity of the instrument.

A thermo-couple is a device used to measure temperature by use of material which changes resistance as its temperature changes. This changing resistance results in different voltages being outputted by the device which can then be mapped to temperatures. The mean voltage outputted at different temperatures is tabulated and can be read in the instrument's documentation. The user can simply interpolate to get temperatures that correspond to voltages that lie between the tabulated values.

Procedure & Analysis

The program used in this lab would read the voltage outputted by the thermo-couple, shown in Figure 1, and map it to a temperature value by linearly interpolating the voltage with the data tabulated in the instrument's documentation. The temperatures recorded with the thermo-couple were compared to a reference thermometer, shown in Figure 2. The system diagram and control panel for the Labview program can be seen in Figure 3 and Figure 4, respectively. The data mentioned throughout this section can be seen tabulated in Figure 5.

The temperature of the room was first measured and recorded with a physical reference thermometer. The thermo-couple was then used to measure the ambient temperature against a zero reference to determine the instrument's error. The error was then accounted for by the Labview program and the ambient temperature was measured again, this time resulting in the correct room temperature.

The reference thermometer was then used to measure and record the temperature between one lab member's finger tips. The same temperature was then measured with the thermo-couple. As can be seen in Figure 3, the temperatures closely match.

The reference thermometer was then placed in a cup of cold water and the temperature was recorded. The temperature was then measured again using the thermo-couple. Again, the temperatures closely matched, as can be seen in Figure 3.



Figure 1: Thermo-couple

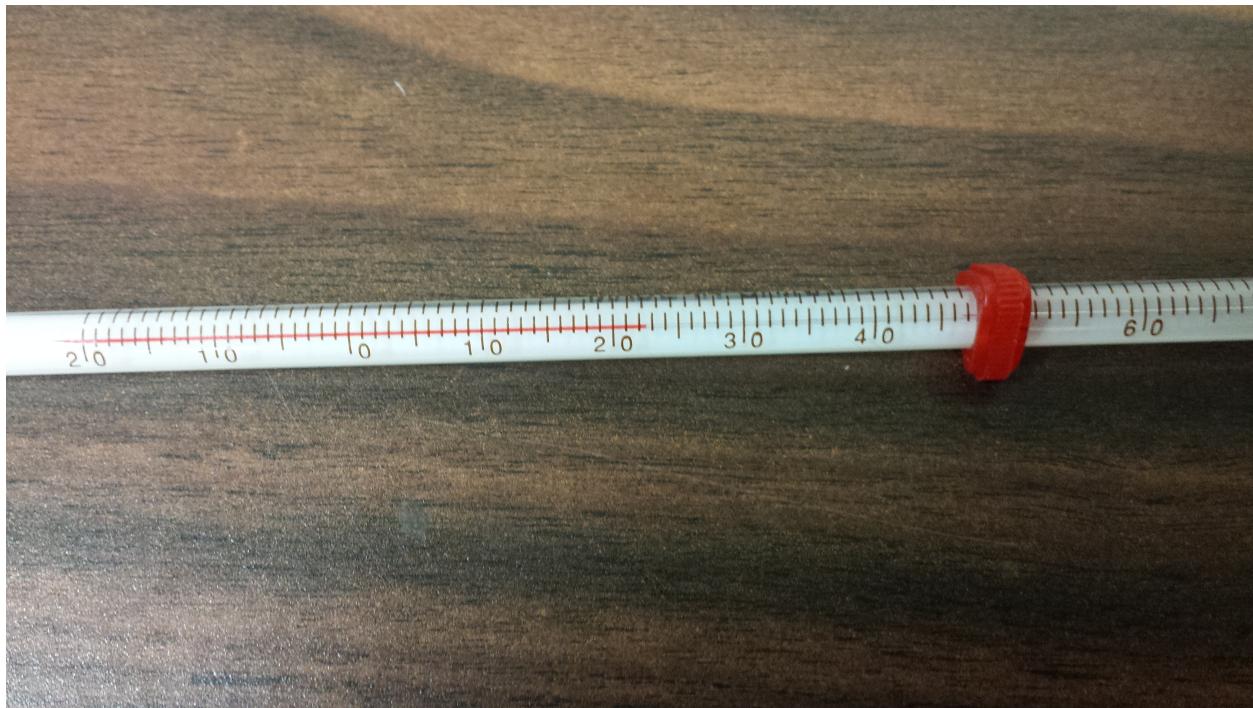


Figure 2: Reference Thermometer

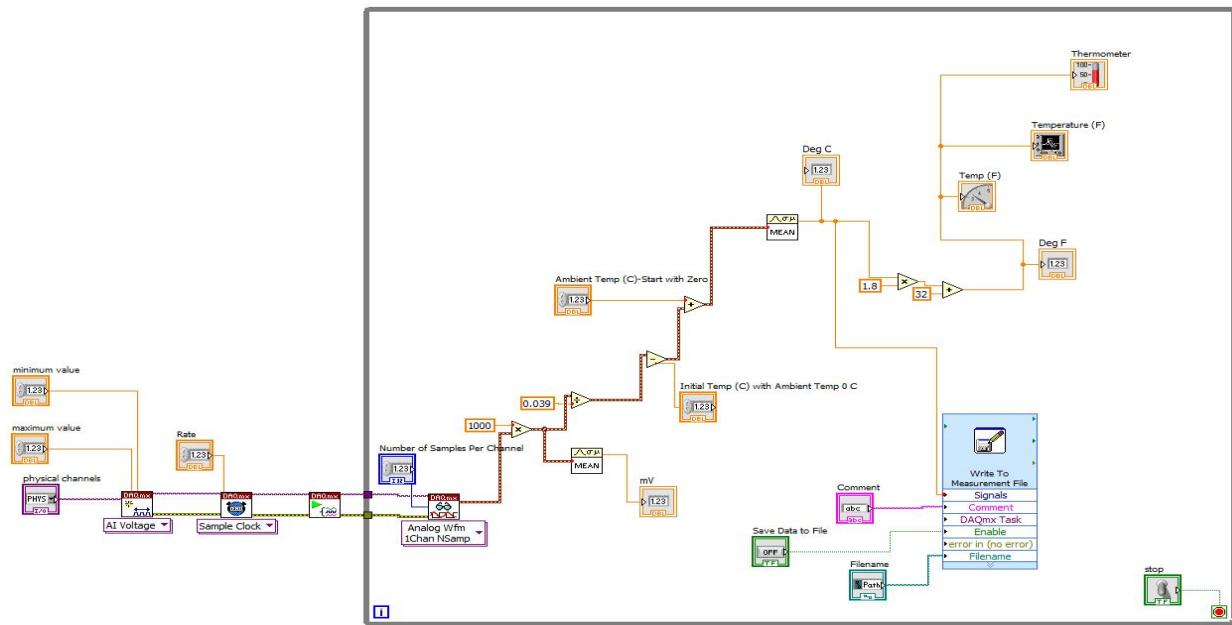


Figure 3: Labview System Diagram

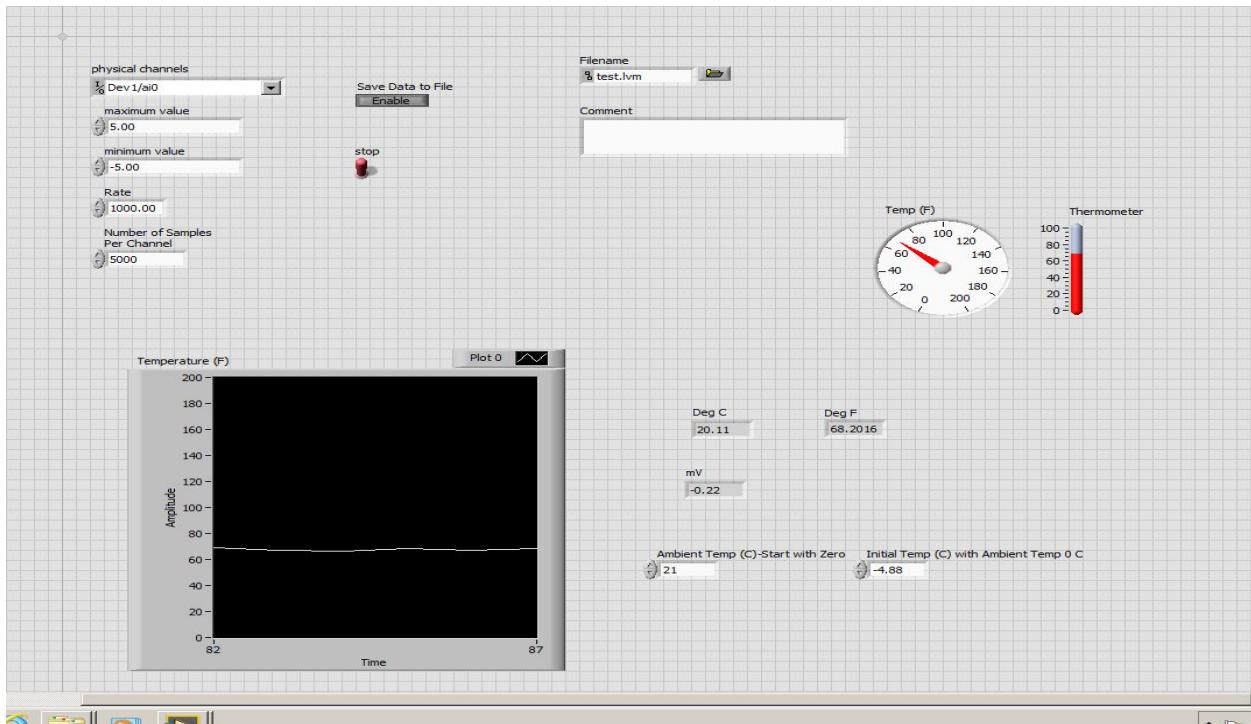


Figure 4: Labview Control Panel

Type K: sensitivity: 0.039 mV/°C

Deg C = -4.88

Ambient ≈ 21 °C

Labview Ambient Temp = 20.59 °C

B/w fingers: reference thermometer = 24 °C
Labview + probe = 24.13 °C

Cold water : reference thermometer = 20 °C
Labview + probe = 19.8 °C

Figure 5: Recorded Data & Results

Overall, the thermo-coupler performed pretty well. However, for more accurate measurements, it would be wise to increase the sensitivity of the device because there was noticeable fluctuation every iteration of the Labview program reading the outputted voltage. The thermo-coupler also has a much higher range than necessary for the measurements made in this lab. A device with a smaller range would be more effective, as more resolution could be achieved across the spectrum of voltage readings.

Conclusion

The exercises conducted in this lab demonstrated using a Labview program to acquire data. It was shown that reading data from sensors is typically done by mapping the voltage reading from the sensor to a measurement value by using documentation on the specific sensor being used. This is how most measurement systems work, and it is important that students are exposed to using these sensors as they will likely use them in their careers in the industry. Exhibiting this method by use of a temperature measuring device is good because these types of devices are commonly used, even outside of the engineering world.