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EE 445L

Lab 9

1. **OBJECTIVES**

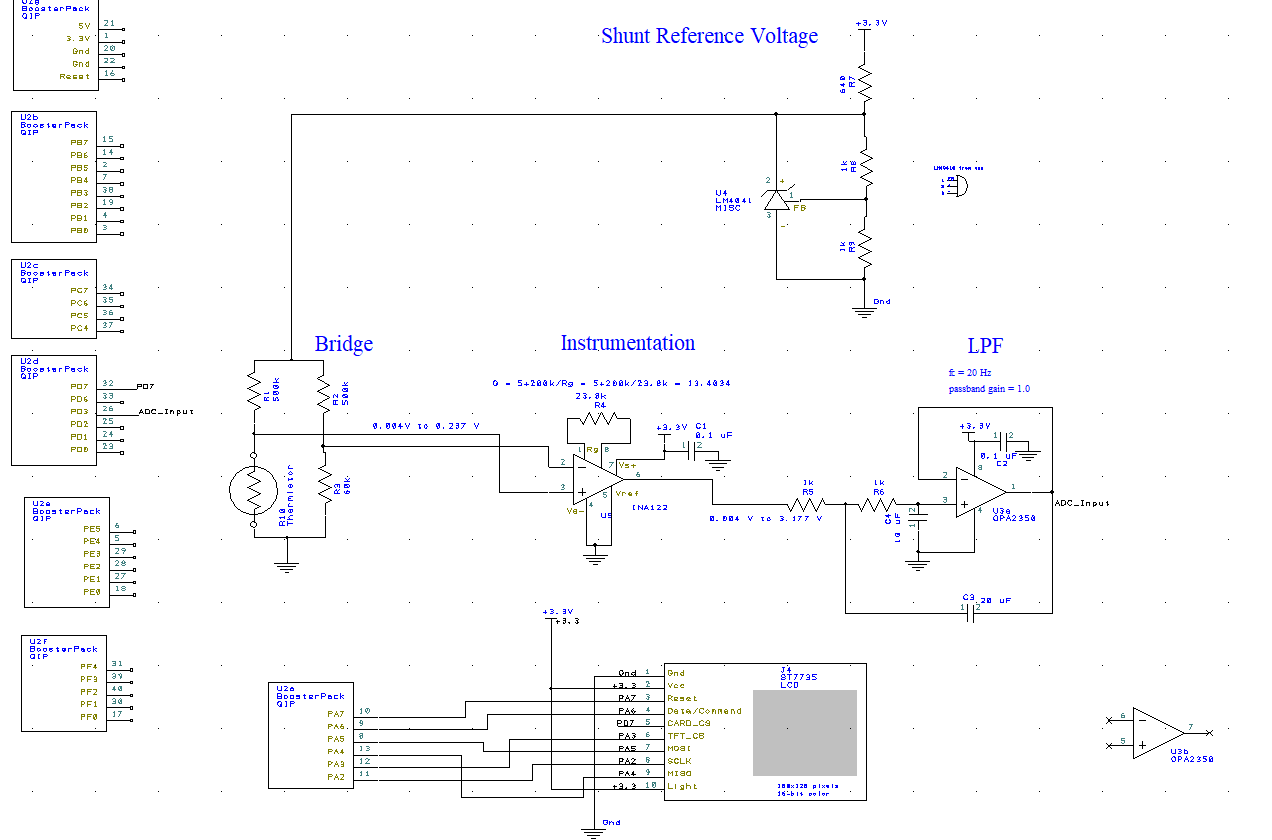
**Goals**

The goals of this lab are to study ADC conversion, the Nyquist Theorem, and to develop a data acquisition system involving transducers, instrumentation amplifiers, and filters. Specifically, the lab involves the design and implementation of a digital thermometer with a temperature range from 20 to 40 degrees Celsius with an accuracy of 1 degree Celsius and a resolution of 0.1 degrees Celsius or better. The knowledge needed to do this job include – but is not limited to – the following:

* Understanding bridge circuits for precise instrumentation
* Understanding the non-linear temperature-resistance curve of thermistors
* Ability to construct a calibration procedure for a transducer
* Signal conditioning with instrumentation amplifiers and filters
* Sampling analog signals and understanding the conditions for full reconstruction of a signal
* Time-domain and frequency domain analysis of signals, noise, and the effect of filtering while sampling
* 2-pole Butterworth LPF design for signal conditioning
* Using shunt reference voltages for instrumentation
* Performing software conversion of transducer data to a meaningful digital format using equations and/or look-up tables
* Real time sampling using a hardware timer to trigger ADC conversion
* Graphic display of temperature vs. time on LCD screen

1. **HARDWARE DESIGN**

**Circuit Schematic *(check Lab09\_Artist.sch in .zip file for better resolution)***



1. **SOFTWARE DESIGN**

**Calibration Calculations**

The NTC thermistor that we used for this lab (Part #: BC2432-ND) follows a resistance-temperature relationship that can be modeled by the following equation:

In order to obtain the β-term of the NTC Thermistor equation, I measured the resistance of my thermistor at refence temperatures

**Plots**

**LUT Generation**

**Calib.h**

**ADC.c and ADC.h**

**Main.c**

1. **MEASUREMENT DATA**

**Waveform Analysis**

**Static Circuit Performance**

**Dynamic Circuit Performance**

**Accuracy**

**Reproducibility**

1. **ANALYSIS AND DISCUSSION**