Name _____

Lab Day _____Lab Time_____

Temperature Controlled Fan

Lab 8

Introduction: In this lab you will design and document a simple cooling fan controller. This project combines the hardware developed in the Op Amp lab and the code developed in the Analog-to-Digital (ADC) to Pulse Width Modulation (PWM) lab.

Lab Requirements:

1. Demonstration of a cooling fan control system that is capable of setting the speed of a fan using Pulse Width Modulation (PWM). The controller must contain a 2sec burst cycle and at least 8 different speeds.

   Idle Duty Cycle _____

   Temperature at First Speed Above Idle *(90°F Target)* _____

   Temperature at Final Speed - PWM ≥ 99% *(150°F Target)* _____

   Demo Check (JK) **_____**

2. Submission of a schematic diagram of your hardware drawn in Mentor Graphics Design Capture or other schematic capture package.

3. Submission of cleanly formatted source code for your fan controller.

Setup: Insert your thermistor into the left side of the thermal test fixture (figure 2) and the K-type thermocouple from the Amprobe TMD-56 thermometer into the right side of the fixture. The Amprobe thermometer will be used to monitor temperature and for evaluating the performance of your design. To obtain repeatable results make sure the thermocouple and thermistor are fully seated against the bottom of the thermal measurement tube. Connect the output of the sensor amplifier designed in Lab 3 into the microcontroller and configure the pin as an input into the analog to digital converter (figure 1). Do not connect your amplifier to the same pin that is being driven by the trim pot that we used in Lab 6.

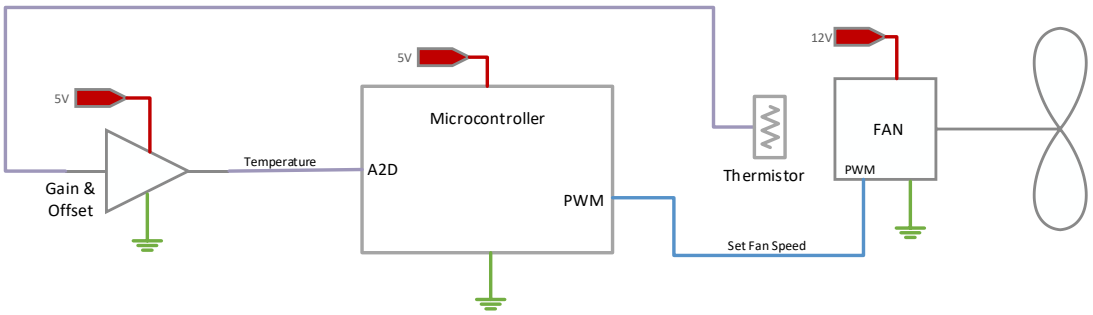

Figure 1 – Fan Control Block Diagram

Controlling the Fan: The Fan should be powered using a 12V DC power supply capable of delivering at least 500mA of current. The speed of the fan can be directly controlled by connecting a 5V Pulse Width Modulation signal from your microcontroller to the Yellow PWM control jack. Your microcontroller must have a common ground connection with the 12V supply powering the fan. A single 5V supply should be used to power your microcontroller and instrumentation circuitry. A third power supply will connect to the heater in order to change the temperature on the test fixture. To ensure that the fan spins up at power up you must provide a burst period where you run the fan at full speed for a few seconds. After the burst period, your fan should slow down to an idle speed however the fan must always remain spinning. After testing the burst and idle speed apply a current to the heater and slowly increase the temperature of the test fixture. When the fixture temperature reaches 90°F the fan should start to increase in speed. As the test fixture heats up the fan should continue to increase in speed until it reaches 150°F where the fan should be at full speed (PWM ≥ 99% duty cycle). The actual RPM of the fan can be monitored through the open-collector "TACH" port on the test fixture where the speed is represented a 4 ticks per rotation.

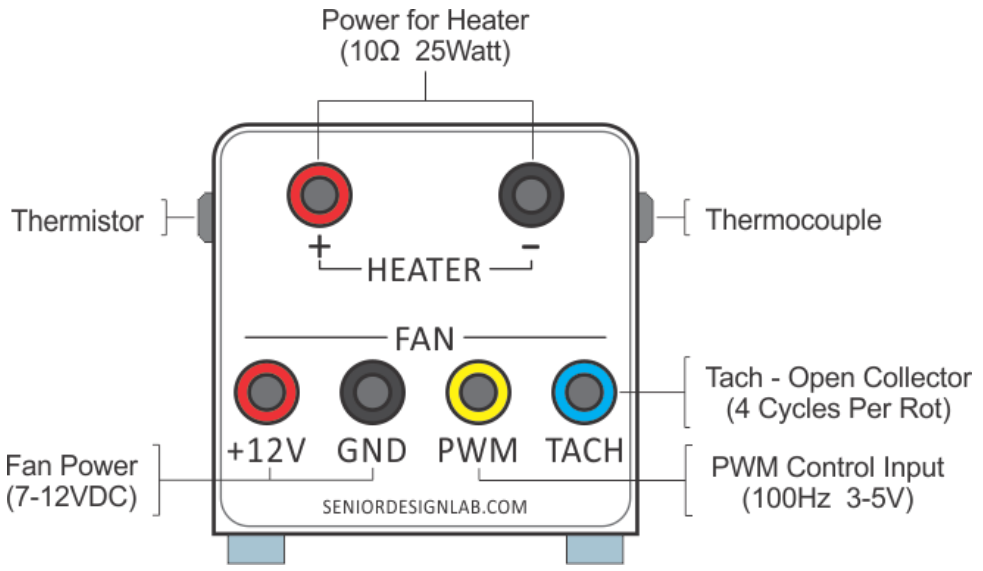

Figure 2 – Fan Control Test Fixture