

Physics 37100 Advanced Physics Laboratory I

Lab #3

(PART I: Single measurements)

- 1) Create a sketch to measure the light output of a PWM LED using pin 9.
 - a. Use the brightest LED with corresponding series resistor from previous Lab. Set the brightness of the LED to 128 using analogWrite.
 - b. Use the photoresistor in series with a resistor to measure the light output on A0. It might be useful to put the LED and photoresistor into a tube to eliminate outside light.
 - i. What resistance did you use? Why?
 - c. Output the value of A0 to the serial port every 1/10 of a second for 10 seconds.
- 2) Repeat for brightness 0, 1, 2, 31, 32, 64, and 255.
- 3) Analyze the data.
 - a. Copy and paste the data from the serial monitor.
 - b. Import to Matlab or other data analysis program.
 - c. Find and report the mean and standard deviation (STD) for each of the 8 brightnesses.
 - i. Which has the largest STD? Why?
 - ii. Is 128 twice as bright as 64? Explain.
 - iii. What is the smallest difference in brightness you can measure? Explain.
 - d. Plot the 8 voltages versus time.
 - i. Are there any trends? Explain.
 - e. Repeat the measurement for brightness 128, three more times. Are the results repeatable?

(PART II: Time resolved measurements)

- 4) Modify your sketch to measure the detailed time dependence of the light output of a PWM LED using pin 9.
 - a. Create a 512 element unsigned int array Vs to hold the time series data.
 - b. Acquire the data in a for loop with n running 0-511. Only use Vs[n]=analogRead(inPin) inside the loop so that we can get the data as fast as possible.
 - c. Time the loop by saving the value of micros() just before and just after the loop.
 - d. After the loop output all of the array values and the time of the loop to the serial port.
 - e. Do all of the work in setup() so that you do not fill up your serial monitor
- 5) Analyze the data.
 - a. Copy and paste the data in the serial monitor to matlab or other plotting program.
 - b. Assume that each acquisition took equal time and use the total time to find the time for each point. Is this a good assumption? Explain.
 - c. Plot the data versus time for analogWrite values of 0, 1, 32, 64, 128, and 255.
 - d. Find and report the mean and standard deviation (STD) for each of the 8 brightnesses.
 - i. Which has the largest STD? Why?
 - ii. Is 128 twice as bright as 64? Explain.
 - iii. What is the smallest difference in brightness you can measure? Explain.
 - iv. How does this help explain the data from 3c above?