

California State University, Fresno

Department of Electrical and Computer Engineering

ECE 1L – Introduction to Electrical and Computer Engineering Laboratory

Laboratory 3: Introduction to Servo Motors

(The Boe-Bot, Board of Education, HomeWork Board, BASIC Stamp 2, and BASIC Stamp Editor are registered trademarks of Parallax Inc.)

1. Background Information

Work through Chapter 2 of the “Robotics with the Boe Bot” manual (Pages 41-85). You may skim through the first couple of sections, since you have already learned how to turn LEDs on and off, and do not need to center the servos, since they should already be centered for you (Sections 3 and 4). However, you do to verify that they are indeed centered, so run the appropriate programs in Sections 3 and 4 to verify this. If you notice a problem with one of the servos, contact the lab instructor.

When you get to Page 81, be sure to completely fill out the Table **in your lab book**. This will provide a reference for future labs, so be sure that you fully understand the behavior for each of the pulse durations as it relates to the direction that the servo turns.

2. Design Problem

Determine the pulse duration necessary to create exactly 1 revolution per second on each of the servos. Demonstrate this to your lab instructor by integrating a button onto your board so that when pressed, your servos activate with P12 turning clockwise, and P13 turning counterclockwise. After the button is pressed, they should complete one complete revolution in exactly 1 second and then stop. If you press the button again, the servos should rotate again and then stop. Use the table you developed in your lab notebook from Page 81 as a starting point for determining your pulse durations.

Once you demonstrate your program to your lab instructor, modify your program using a loop so that when your button is pressed, the servos rotate 10 times, which should take exactly 10 seconds. Setup an LED for each of the servos so that they blink at a rate of once per second (0.5 s on, and 0.5 s off) whenever the servos are turning. When the button is pressed, the servos should rotate 10 times, the LEDs should blink on and off 10 times (each taking 10 seconds to do so), and then everything should stop. Use a watch to verify this. Tweek your code until you can demonstrate this reliably to your instructor.

What happens if you now make P12 turn counterclockwise and P13 turn clockwise? Do your pulse durations need to change so that the servos still rotate 10 times in exactly 10 seconds? Why? Adjust your code (under a different filename) until you can reliably demonstrate this as

well to your lab instructor.

Lastly, create a program so that the first time the button is pressed, P12 and P13 rotate 5 times in 5 seconds, with P12 turning clockwise, and P13 turning counterclockwise. When the button is pressed again, P12 should now turn counterclockwise and P13 clockwise (with 5 rotations in 5 seconds). The behavior should then alternate back and forth each time the button is pressed. Be sure that the LEDs turn on and off appropriately.