



## Assignment #1

Due date: \_\_\_\_\_

## Testing BOE-BOT Servos

### Reading Assignment:

1. Refer to the following section in Robotics Version 2.2 student manual
  - a. Chapter 2, Activity 2 – Connecting The Servo Motors (page 58 – 70)
2. Refer to various sections of BASIC Stamp Syntax and Reference Manual, Version 2.1 for information of PBASIC commands
3. BOE-BOT Lecture #2 – Servos and the BOE-BOT Presentation

### Work Assignment:

1. Power Connection and Set-up
  - a. Find and confirm your board type on main circuit board (should be “Board of Education Rev C”)
  - b. Make sure power switch is off
  - c. Ensure power source pin switch is in its correct position
  - d. Test with multi-meter plug-in DC power supply to ensure connection is positive centre, with 6 – 7.5 VDC and a minimum of 800 mA ratings
  - e. Show values in an Excel sheet with the following column titles Power Supply Output, Current, Voltage, DC Centre Postive and under Power Supply Output create the rows Required Ratings, Actual Written Ratings, and Measured Ratings. Under cell Current –Measured Ratings put “not req”, then fill in the rest of the required values
  - f. Connect to board as the last step, once all below set-up is done with three position switch in the off position
2. Connecting the Continuous Servos
  - a. Identify and connect your servos to your output pin connection as shown in diagram
  - b. Ensure you have your servos marked left and right for testing, as you will need this information when installing them on Boe-bot
3. Connect up LED circuit as you did earlier using P12 and P13

Select Vdd if you are using a DC supply that plugs into an AC outlet (AC adapter).

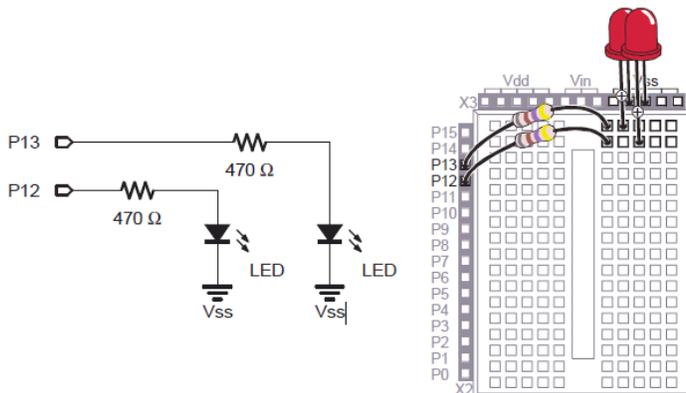
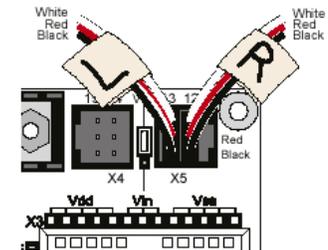
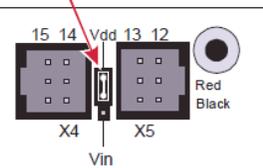
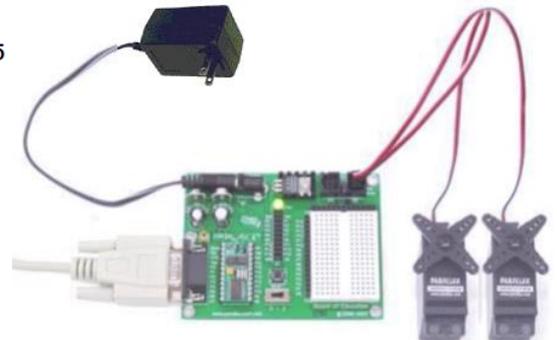


Figure 2-15 LED Servo Signal Monitor Circuit





4. Write “CenterServoP12” program

- a. Save appropriate file name with similar identification comments at the beginning showing:
  - i. course code and subject title
  - ii. team number
  - iii. BOE-BOT number
  - iv. the program number (Program 2A, etc)
  - v. the filename (last initial-first name-related project) Example: b-joe-boebot-2a.bs2

```
' Robotics with the Boe-Bot - CenterServoP12.bs2  
' This program sends 1.5 ms pulses to the right servo connected to P12 for manual centering.
```

```
' {$STAMP BS2}  
' {$PBASIC 2.5}
```

```
DEBUG "Program Running!"
```

```
DO
```

```
    PULSOUT 12, 750  
    PAUSE 20
```

‘Type here why 750 is used

```
LOOP
```

```
END
```

- 5) Connect power to board for servo testing
  - a) Send program to Boe-bot
  - b) Ensure servos are clear in case they start turning
  - c) Run program (make sure your three position switch is in position 2) and carefully check current result.
  - d) Use a small Philips screwdriver carefully to test/adjust the servo and make sure it is centered, i.e. it is not moving and aligned centre between speed/direction/rotations
  - e) Show instructor to get checked off





# Technology Education

Western Technical-Commercial School

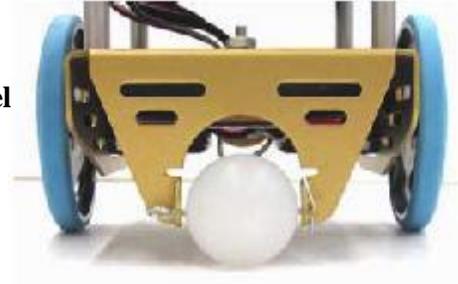
Name:

Date:

Name

- 6) Attach the servos
- Connect the two servos to the BOE-BOT as shown in the diagram below. Remember that the ping-pong ball wheel on the BOE-BOT is a rear wheel when you determine which is the left wheel and which is the right wheel.

Left wheel



Right wheel

- 7) Testing the left servo

- Turn the servo on its side with the left wheel facing up. Put a piece of tape on the wheel to assist you in counting wheel revolutions. Use the program below to test the servo.

Rear wheel

Specifically:

- Check one more time to ensure both servos are still properly centered at the PULSOUT 12, 750
  - Then begin by using DURATION of 650.
  - Run the program and count the number of wheel revolutions (to the nearest  $\frac{1}{4}$  revolution) that occur in 15 seconds (use a watch). You may need to increase the final value (50) in the FOR loop if the servo doesn't run long enough. Record the value in the table for the LEFT SERVO.
  - Repeat the step above for each line in the table. If for some reason the servo doesn't seem to have reached its max speed using DURATIONS of 650 and 850, you may need to extend the range.
  - Find the value of DURATION (or perhaps a range) where the servo is stopped and record it in the last line of the table.
- b) Ask your instructor to look over your table and verify that the information looks correct before proceeding.

## Programming Code

Counter VAR WORD	'Add plenty of comments to this program (see Report requirements)
FOR Counter = 1 TO 1000	'Adjust this number to that the servo will run for at least 15 seconds
PULSOUT 13, DURATION	'Change DURATION from 650, 660, 670, etc.
PAUSE 20	
NEXT	



- 8) Testing the right servo
  - a) Repeat the last step for the right servo. Be sure to change the output pin in the program from P13 to P12.
- 9) Analysis
  - a) Type the two tables into Excel. Include information such as course number, team assignment number, BOE-BOT number, your team number, a descriptive title, and the filename (using an appropriate filename). Columns to include Pulsout Duration, # Rev in 15 s, RPM, and CW or CCW. With Pulsout row values starting at 650 ending with 850 in increments of 10 and final row 0
- 10) Graph CW RPM versus PULSOUT for each servo (use a separate graph for each servo). An example is shown below:



- a) If the BOE-BOT is to travel in a straight line at full speed, what values should be used for DURATION1 and DURATION2 in the program shown below?

Counter VAR WORD

```
FOR Counter = 1 TO 5000
  PULSOUT 13, DURATIONLEFT
  PULSOUT 12, DURATIONRIGHT
  PAUSE 20
NEXT
```

- b) For the program above, how fast is the BOE-BOT travelling in in/s and ft/s? Assume that the wheels have a diameter of 2.5 inches and include in data table for each pulsout by creating two more columns.
- c) For the program above, how long will it take the BOE-BOT to travel 10 feet? Show work in Excel sheet
- d) Copy the Excel table above to another sheet. Add columns for velocity in in/s, and ft/s. Show what Excel formulas were used for the first line of calculations under the table.



## Excel Chart Recording format

Left Servo Wheel			
PULSOUT Duration	# Rev in 15 s	RPM	CW or CCW?
650			
660			
670			
680			
690			
700			
710			
720			
730			
740			
750			
760			
770			
780			
790			
800			
810			
820			
830			
840			
850			
0			

Left Servo Wheel			
PULSOUT Duration	# Rev in 15 s	RPM	CW or CCW?
650			
660			
670			
680			
690			
700			
710			
720			
730			
740			
750			
760			
770			
780			
790			
800			
810			
820			
830			
840			
850			
0			