

Week 1 Experiment #2

Aim: Boe-Bot Mechanical Assembly

Chapter #1: Assembling and Testing Your Boe-Bot

This section breaks assembling the Boe-Bot into steps. In each step, you gather a few of the parts, and then assemble them so that they match the pictures. Each picture has instructions that go with it; make sure to follow them carefully.

Mounting the Topside Hardware

Figure 1 shows the Boe-Bot chassis, topside hardware and mounting screws.

Parts List:

- (1) Boe-Bot Chassis
- (4) Standoffs
- (4) 1/4" 4-40 Screws
- (2) 9/32" Rubber grommets
- (1) 13/32" Rubber grommet

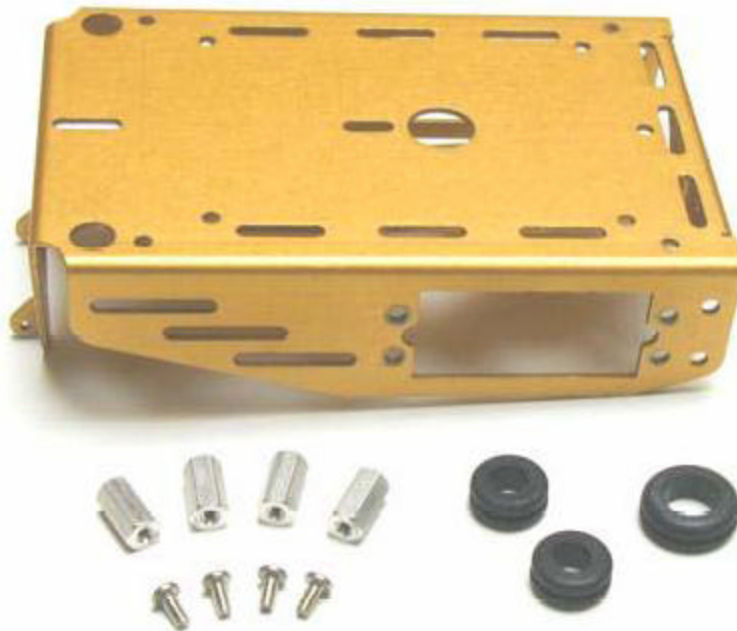


Figure 1: Chassis and topside hardware.

Assembly:

Figure 2 shows the topside hardware attached to the Boe-Bot chassis. Each rubber grommet has a groove in its outer edge that holds it in place in a hole on the top of the Boe-Bot chassis.

1. Insert the 13/32" rubber grommet into the hole in the center of the Boe-Bot chassis.
2. Insert the two 9/32" rubber grommets into the two corner holes as shown.

3. Use the four 1/4" 4-40 screws to attach the four standoffs to the chassis as shown.

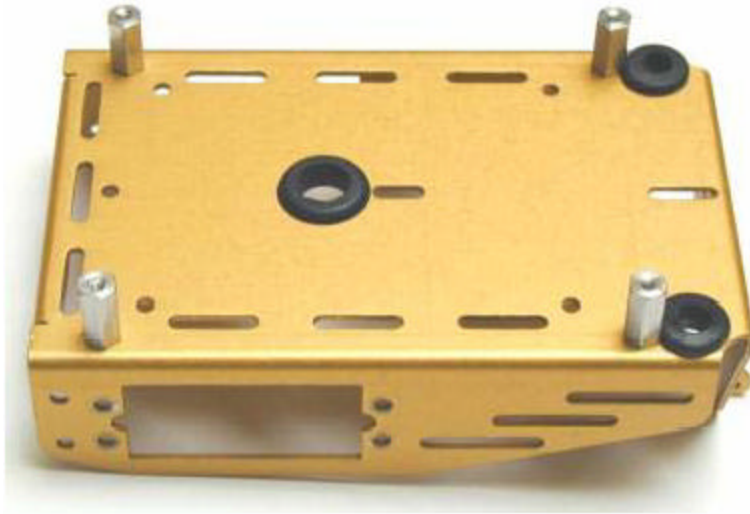


Figure: Topside hardware assembled.

Removing the Servo Horns

Get the two Parallax pre-modified servos from your parts kit, shown in Figure 1.5. Each servo has a horn attached to its output shaft by a Phillips screw.

Parts List

(2) Pre-modified servos

Unscrew each of the Phillips screws, then pull each servo horn upwards and off of the servo output shaft. Save the screws for attaching the Boe-Bot wheels.



Figure 3: Pre-modified servos dehorned.

Mounting The Servos

Parts List:

Figure 4 shows the pre-modified servos and servo mounting hardware.

- (1) Partially assembled Boe-Bot chassis
- (2) Servos
- (8) 3/8" 4-40 screws
- (8) 4-40 locknuts



Figure 4: Servos and mounting hardware.

Figure 5 shows the servos mounted on the chassis.

Use the eight 3/8" 4-40 screws and locknuts to attach each servo to the Boe-Bot chassis as shown.

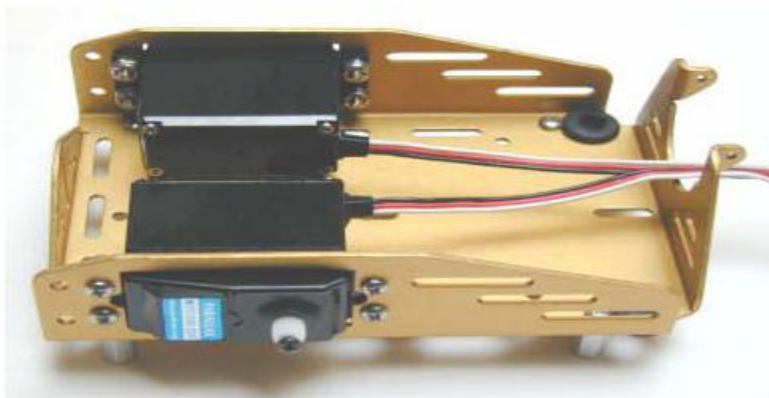


Figure 5: Servos mounted on chassis.

Mounting the Battery Pack

Figure 6 shows the battery pack and mounting hardware to be added next.

Parts List:

- (1) Partially assembled Boe-Bot chassis.
- (1) Empty battery pack
- (2) Flathead 4-40 screws
- (2) 4-40 locknuts



Figure 6: Battery pack and mounting hardware.

Assembly

Figure 7 shows the Boe-Bot chassis with the battery pack mounted (a) from the underside and (b) from the topside.

1. Use the flathead screws and locknuts to attach the battery pack to underside of the Boe-Bot chassis as shown in Figure 1.10 (a). Make sure to insert the screws through the battery pack then tighten down the locknuts on the topside of the chassis.
2. Pull the battery pack's power cord through the hole with the largest rubber grommet in the center of the chassis.
3. Pull the servo lines through the same hole.
4. Arrange the servo lines and supply cable as shown in Figure 1.10 (b).

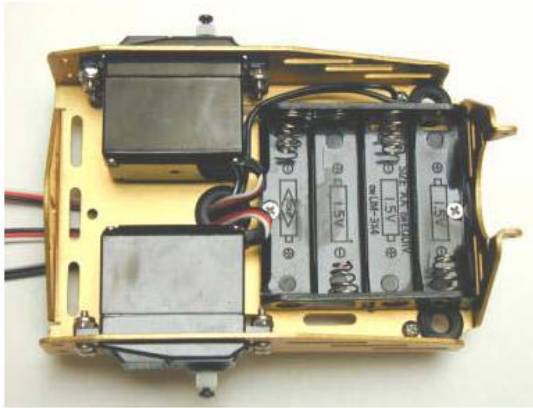
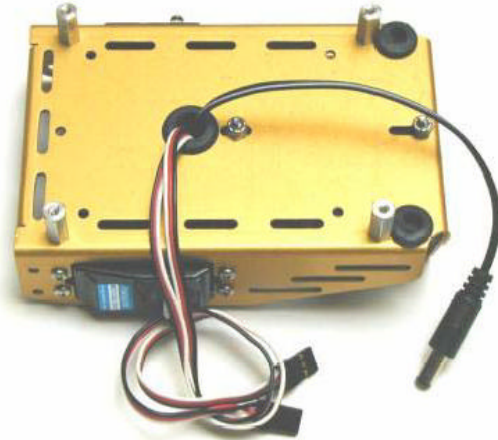


Figure 7: a) Battery pack installed



b) wires pulled through

Attaching the Board of Education to the Boe-Bot Chassis

Figure 8 shows the Board of Education, BASIC Stamp and mounting hardware.

Parts List:

- (1) Partially assembled Boe-Bot (not shown)
- (1) Board of Education with BASIC Stamp 2
- (4) 1/4" 4-40 screws

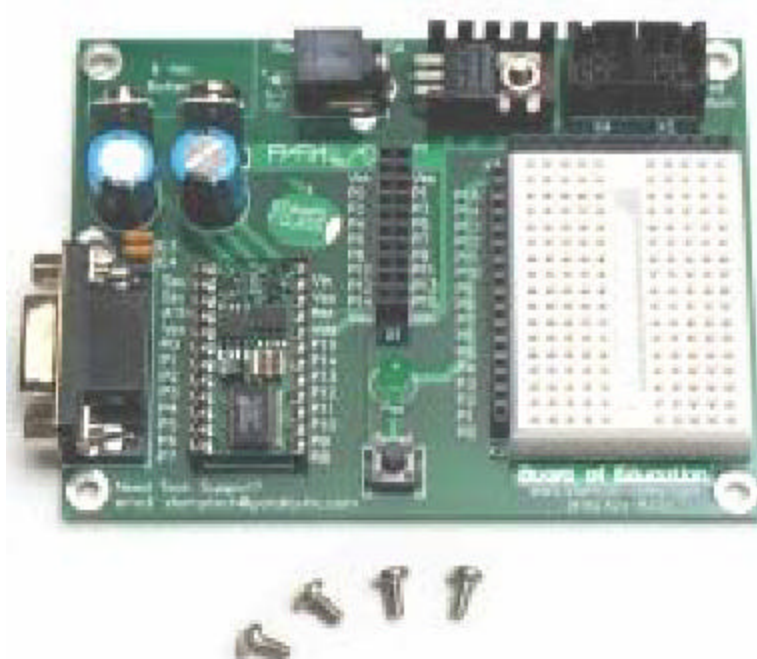


Figure 8: BOE with BASIC Stamp and mounting screws

Assembly:

Figure 9 shows the Board of education attached to the Boe-Bot chassis with the servos plugged into the servo ports.

1. Make sure the white breadboard on the Board of Education is above where the servos are mounted on the chassis.
2. Use the four 1/4" machine screws to attach the Board of Education to the standoffs.

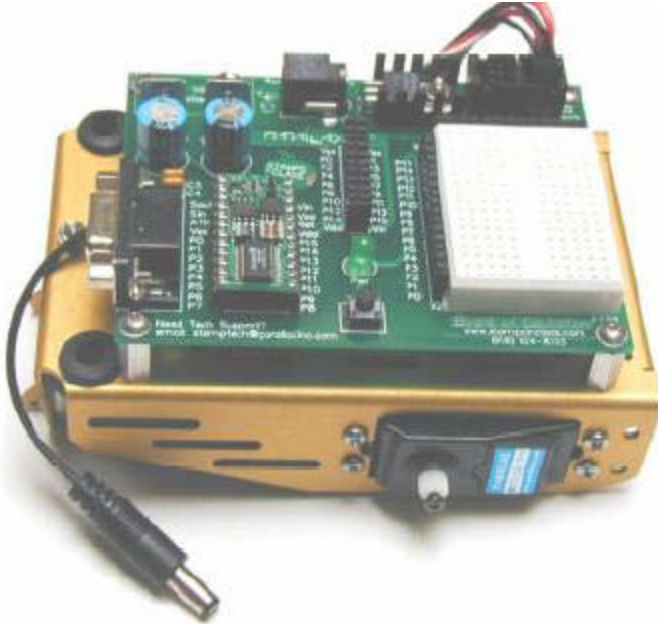


Figure 9: BOE attached to chassis.

Figure 10 (a) shows a close-up of the servo ports on the BOE Rev B. The numbers along the top indicate the servo port number. If you connect a servo to servo port 12, it means the servo's control line is connected to I/O line P12. I/O line P12 is a metal trace on the BOE that connects the top servo port pin to the BASIC Stamp's I/O pin P12.

The labels to the right of the servo port are for making sure your servo gets plugged in properly. Figure 10 (b) shows a servo plugged into servo port 12 so that the black wire lines up with the "Black" label, and the red wire lines up with the "Red" label. Although the topmost wire is labeled "White" in Figure 10 (b), it could either be white or yellow.

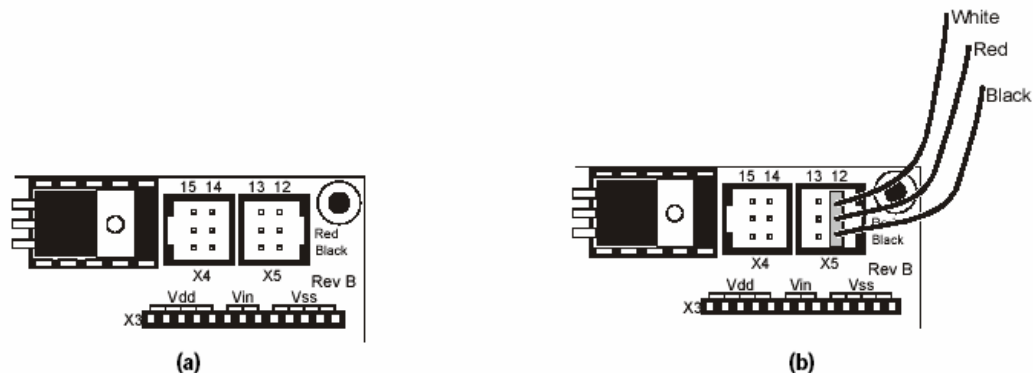


Figure 10: Servo ports on the BOE Rev B (a) before, and (b) after plugging in servo port 12.

3. Plug the servo that you can see in Figure 1.14 into servo port 12, and plug the other servo into servo port 13.

Make sure the “Black” and “Red” labels to the right of the servo port line up with the servo connector’s black and red wires before plugging it in a servo.

The Wheels

Figure 11 shows the Boe-Bot’s wheel parts and mounting hardware.

Parts List:

- (1) Partially assembled Boe-Bot (not shown)
- (1) 1/16” Cotter pin
- (2) O-ring tires
- (1) 1” Polyethylene ball
- (2) Plastic machined wheels
- (2) Screws that attached the servo horns, which were set aside in the Removing the Servo Horns step.



Figure 11: Wheel Parts

Assembly:

Figure 12 (a) shows the tail wheel attached to the Boe-Bot chassis with a cotter pin, and Figure 1.2 (b) shows one of the front wheels attached to a servo's output shaft.

1. The plastic ball is used as the Boe-Bot's rear or tail wheel, and the cotter pin is its axle. Run the cotter pin through the holes in the tail of the Boe-Bot chassis so that it holds the one-inch plastic ball in place as shown in Figure 12 (a).
2. Seat each o-ring tire in the groove on the outer edge of each plastic wheel.
3. Each plastic wheel has a recess that fits on a servo output shaft. Press each plastic wheel onto a servo output shaft making sure the shaft lines up with and sinks into the recess.
4. Use the machine screws that you saved when you removed the servo horns to attach the wheels to the servo output shafts.

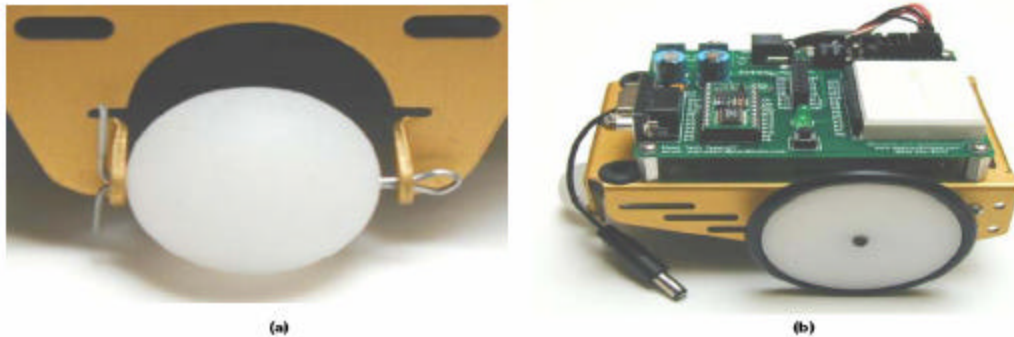


Figure 12: (a), Tail wheel mounted on Boe-Bot chassis, and (b), front wheel mounted on servo output shaft.

Figure 13 shows the parts you'll need to make your PC communicate with your BASIC Stamp 2.

Parts List:

- (4) 1.5 V AA batteries
- (1) Serial Cable
- (1) Parallax CD



Figure 13 : Part required for programming.

Assembly:

Figure 14 shows the battery pack before and after the batteries are loaded.

1. Load the batteries into the battery pack so that the polarity symbols on each battery match those printed on the inside of the battery pack.



Figure 14: **Battery pack without/with batteries.**

Figure 15 shows (a), the serial cable connected to a COM port on the back of a PC, and (b) the serial cable and battery pack connected to the BOE.

2. Plug the female end of the serial cable into one of your computer's unused serial ports.
3. Plug the male end of the serial cable into the DB9 socket on the BOE.

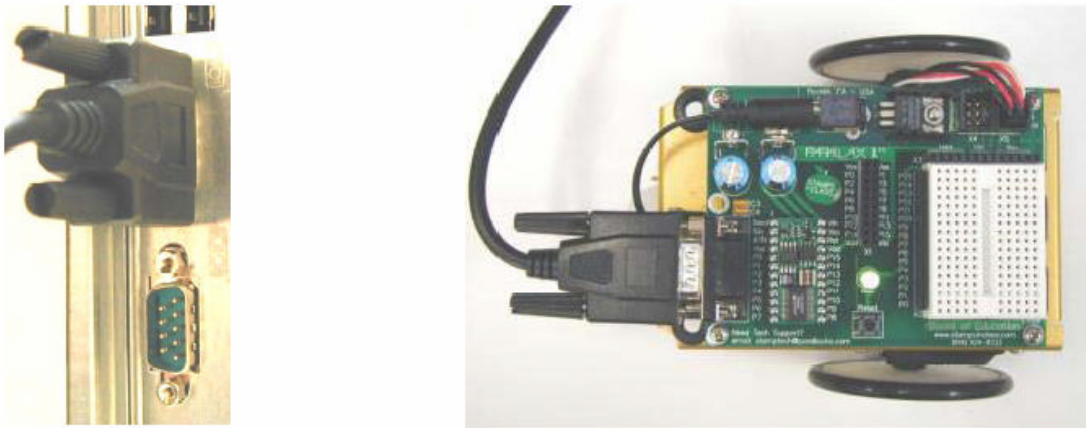


Figure 15: a) Serial cable connected to com port, (b) BOE connected to serial cable and battery pack.

4. Plug the battery pack back into the BOE while watching the green light on the BOE for problems. Unplug the battery pack immediately if you see any of the warning signs listed below.