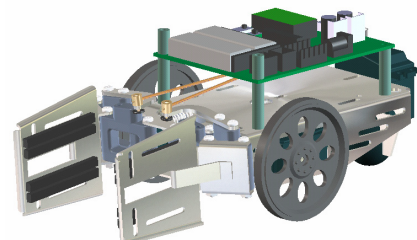


Gripper Kit for the Boe-Bot[®] Robot (#28202)

The Gripper Kit

This kit allows your Parallax Boe-Bot[®] Robot to pick up objects. The Boe-Bot robot (#28132 serial or #28832 USB) is sold separately.

Before getting started, take an inventory of the parts in your kit. Use **Fig #1** to identify each part to the parts list. Once you have inventoried your kit, proceed to **Step #1**.



Parts List

Item	Qty	Description
1	(1)	hinge mount
2	(1)	dowel pin
3	(2)	linkage plate
4	(4)	Gripper link
5	(8)	#4 x 1" spacer
6	(2)	Gripper plate
7	(8)	4-40 x 1.25" pan head screw
8	(17)	4-40 hex nut
9	(1)	spring
10	(2)	control arm
11	(1)	Parallax Standard Servo
12	(1)	actuator rod
13	(2)	Brass E-Z Connector
14	(8)	foam tape
15	(9)	4-40 x 1/4" pan head screw
16	(2)	servo bracket
17	(4)	4-40 x 3/8" pan head screw
18	(2)	lock nut (not shown)
19	(4)	#4 x 1.25" standoff (not shown)

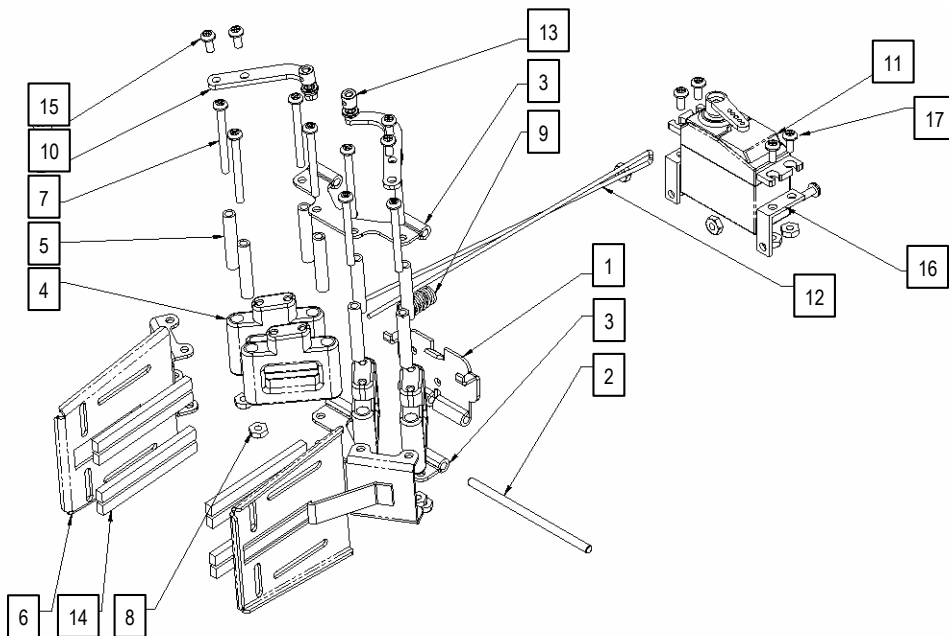


Fig #1

Recommended Tools

- Small needle nosed pliers
- Phillips #2 point screwdriver
- Small flat-blade screwdriver
- A sharp-tipped hobby knife, such as an X-Acto[®] knife
 -OR-
 A hand drill with 5/64" bit

WARNING!

DO NOT use electric screwdrivers with this kit. Please assemble using hand tools only to avoid damaging your Gripper.



Step #1: Spacers

<u>Item</u>	<u>Qty</u>	<u>Description</u>
4	(2)	Gripper link
5	(2)	#4 x 1" spacer

- Insert spacers into plastic Gripper links.
- Use **Fig #2** as a guide to install the spacers. When done, the pieces will appear as shown in **Fig #3**.

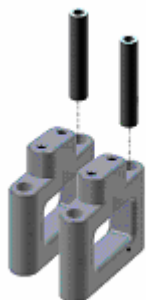


Fig #2



Fig #3

Step #2: Gripper Links

<u>Item</u>	<u>Qty</u>	<u>Description</u>
6	(1)	Gripper plate
7	(2)	4-40 x 1.25" pan head screw
8	(2)	4-40 Hex Nut

- Be sure the angled portions on top of the plastic links match the angles on top of the Gripper as shown in **Fig #5**.
- Move links and spacers into the Gripper plate, then secure with 4-40 screws and nuts as shown in **Fig #4**.
- Tighten securely.
- Before continuing, double check your work to ensure that the pieces are angled as in **Fig #5**.

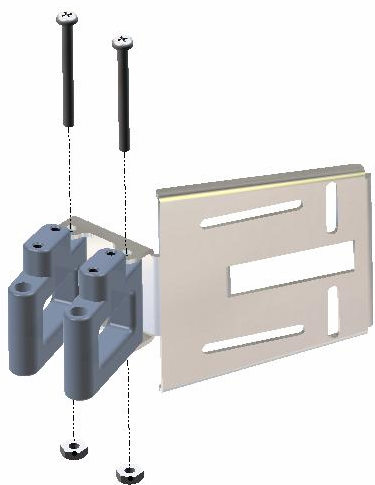


Fig #4

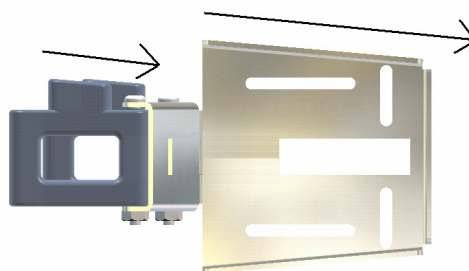


Fig #5

Step #3: Foam Tape

<u>Item</u>	<u>Qty</u>	<u>Description</u>
14	(4)	foam tape

- Cut four pieces of foam tape, each 2 inches long.
- Apply foam tape to the Gripper plate as shown in **Fig #7**.

This completes the left-side Gripper sub-assembly.

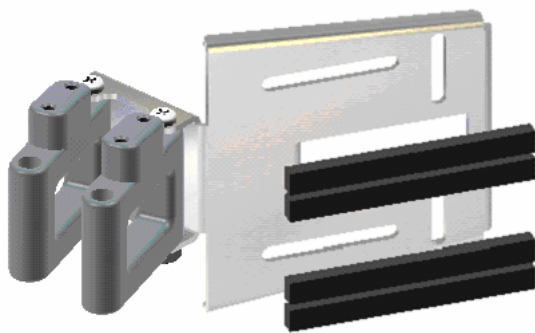


Fig #6

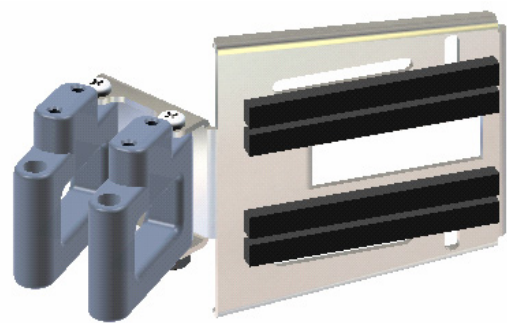


Fig #7

Step #4: Second Gripper Sub-assembly

<u>Item</u>	<u>Qty</u>	<u>Description</u>
4	(2)	Gripper link
5	(2)	#4 x 1" spacer
6	(1)	Gripper plate
7	(2)	4-40 x 1.25" pan head screw
8	(2)	4-40 hex nut
14	(4)	foam tape

- Repeat **Steps #1** through **#3** to build the right-side Gripper sub-assembly in a similar fashion.
- Be sure the angled portions of the links match with the Grippers face to face. Position the pieces exactly as they appear in **Fig #8**.
- Double check your work, then proceed to **Step #5**.

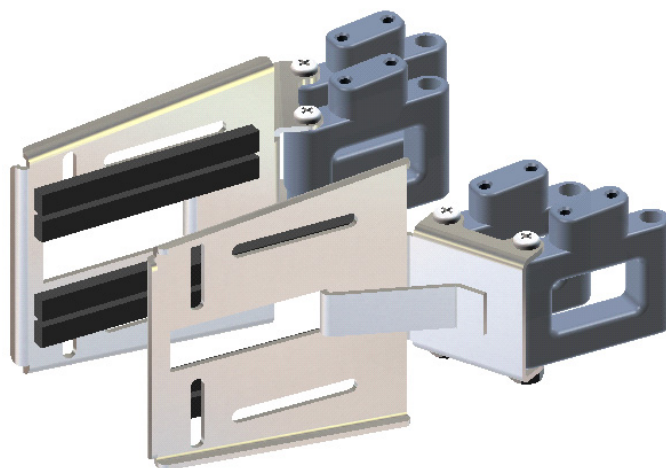
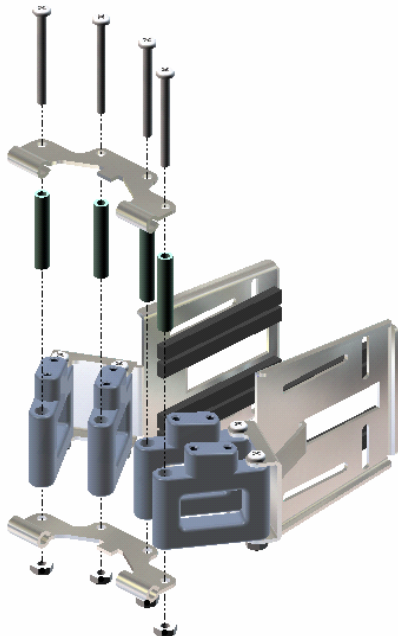


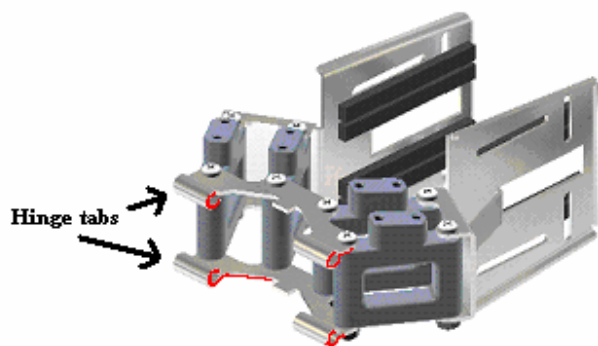
Fig #8

Step #5: Linkage Plates

Item	Qty	Description
3	(2)	linkage plate
5	(4)	#4 x 1" spacer
7	(4)	4-40 x 1.25" pan head screw
8	(4)	4-40 hex nut



- Assemble the Gripper sub-assemblies to the upper and lower linkage plates as shown in **Fig #9**. In turn, insert each plastic link, a spacer, and secure with 4-40 screws and nuts.
- When all four plastic links are installed, tighten securely.
- Double check your work against **Fig #10**. Note that the hinge tabs on the bottom plate face up, while hinge tabs on top plate face down.



Step #6: Control Arms

Item	Qty	Description
10	(2)	control arm
15	(4)	4-40 x 1/4" pan head screw

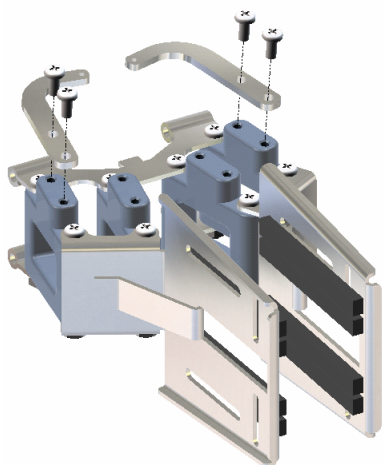


Fig #11

- Attach control arms with 4-40 x 1/4" screws as shown in **Fig #11**.
- Final assembly must match **Fig #12**. Double check your work, then proceed to **Step #7**.

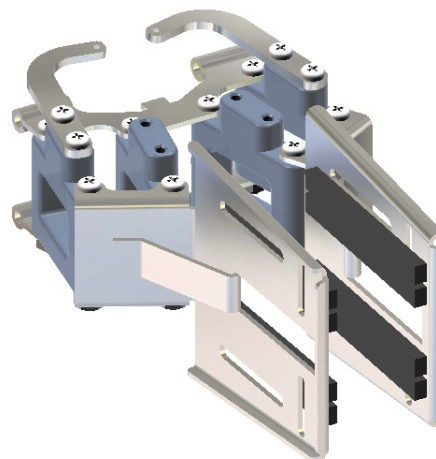


Fig #12

Step #7: E-Z Connectors

<u>Item</u>	<u>Qty</u>	<u>Description</u>
13	(2)	Brass 0.072 E-Z Connector

- Follow the directions on the package to install the E/Z Connector into the control arms. Use the nylon washers, but set the screws aside for now.
- Check your work; your final assembly should match **Fig #13**.

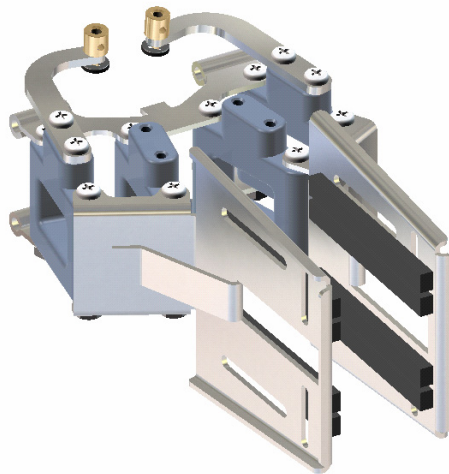


Fig #13

Step #8: Install Gripper Hinge Plate

<u>Item</u>	<u>Qty</u>	<u>Description</u>
1	(1)	hinge mount
15	(3)	4-40 x 1/4" pan head screw
8	(3)	4-40 hex nut

- Attach hinge mount to the Boe-Bot with the 4-40 x 1/4" screws and nuts as shown in **Fig #14** and **Fig #15**.
- Double check your work against **Fig #16**.

Note: It is recommended that the servos and tires on the Boe-Bot be installed with the wheels biased toward the front of the unit as shown below. This will prevent the Boe-Bot from tipping when it picks up objects.

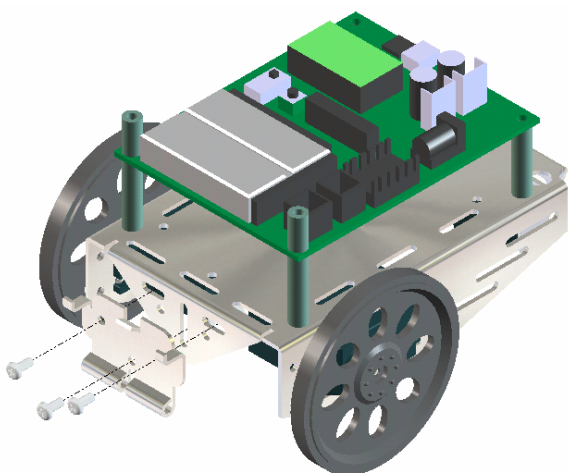


Fig #14
Top View

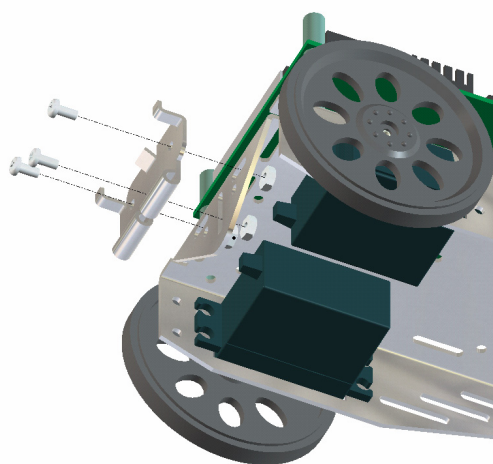


Fig #15
Bottom View

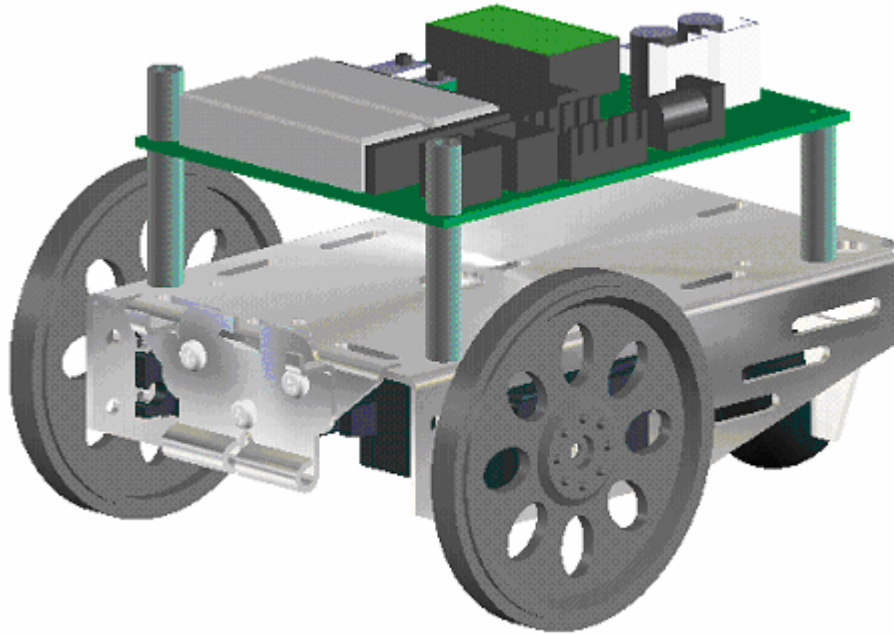


Fig #16
Assembled View

Step #9: Position Gripper on Boe-Bot

<u>Item</u>	<u>Qty</u>	<u>Description</u>
(1)		Gripper assembly
(1)		Boe-Bot robot

- Remove one wheel to allow for dowel pin installation in the next step, **Step #10**.
- Position the Gripper assembly onto the hinge mount as shown in **Fig #17** below.
- Place the top hinge tabs over the tabs on the hinge mount so the top of the Gripper stays on the hinge mount.

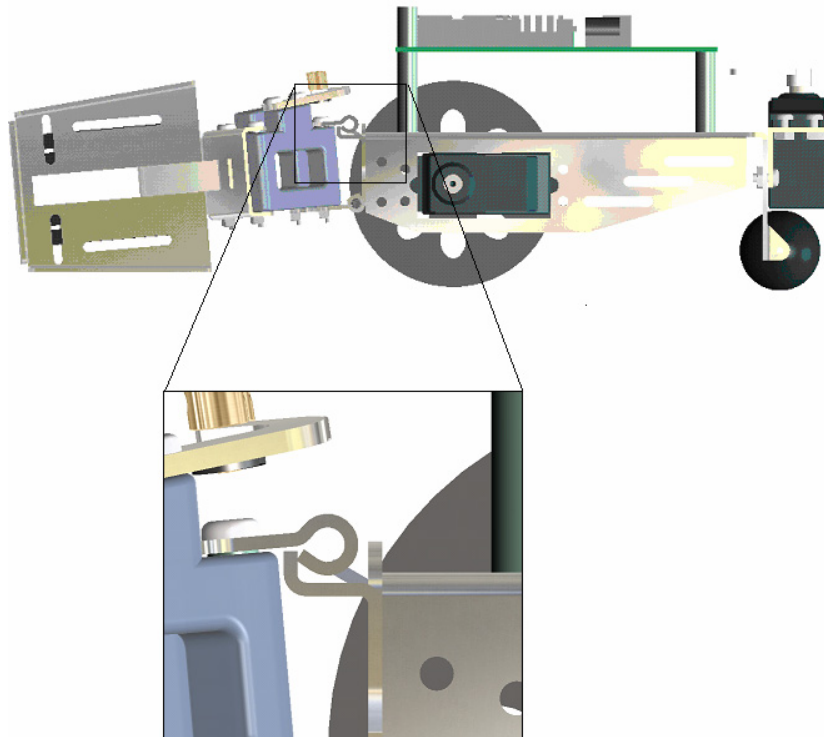


Fig #17

Step #10: Insert Dowel Pin

<u>Item</u>	<u>Qty</u>	<u>Description</u>
2	(1)	dowel pin

- Insert dowel pin.
- If dowel pin slips in very easily, use needle nose pliers to slightly crimp the center of the hinge plate.
- Replace wheel.

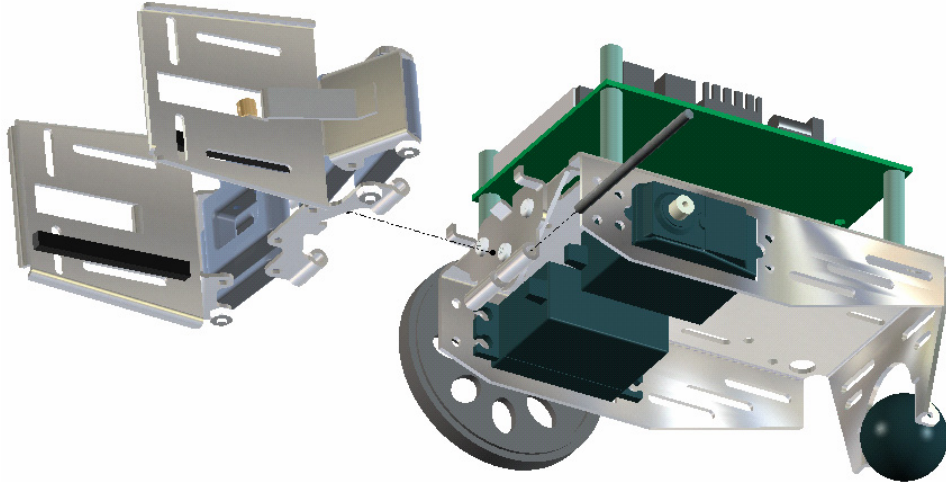


Fig #18

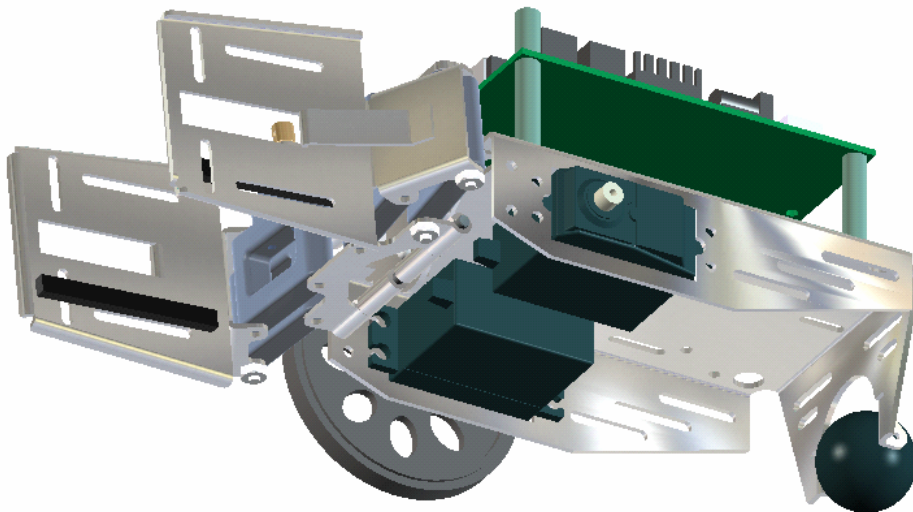


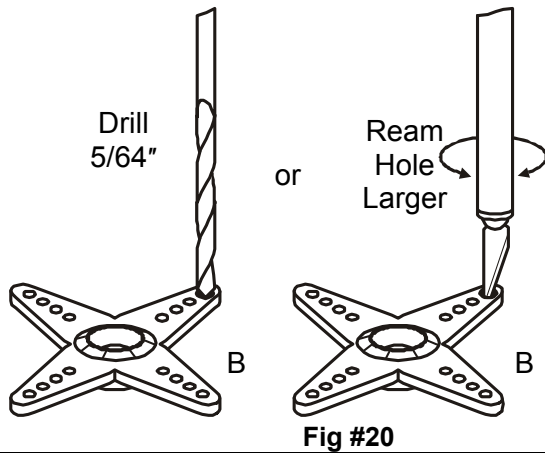
Fig #19

Step #11: Drill Servo Horn

Item	Qty	Description
(11)	(1)	servo horn

- Use **Fig #20** as a guide. The servo horn needs to have one of the outside holes enlarged. If you do not have a 5/64" drill bit you can enlarge the hole with a hobby knife. When using a knife, carve from each side to keep the hole even.
- Test the hole size by inserting the actuator rod through the hole.
- Compare your work to **Fig #21** then proceed to **Step #12**.

Note: The pictures in the remaining steps show only one servo horn arm for clarity.

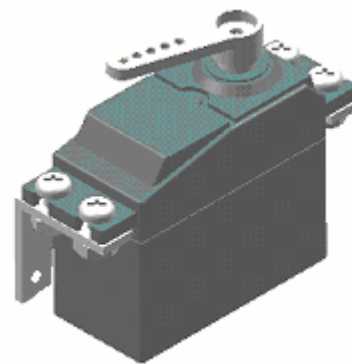
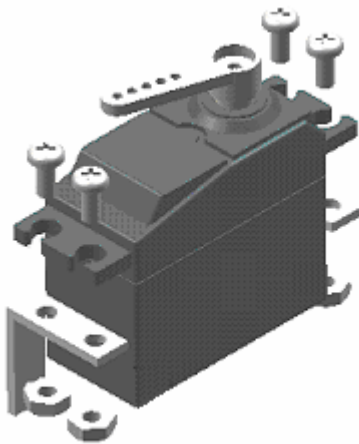


Step #12: Servo Brackets

Item	Qty	Description
16	(2)	servo brackets
17	(4)	4-40 x 3/8" pan head screw
8	(4)	4-40 hex nut
11	(1)	Parallax Standard Servo

- Attach servo brackets to servo with 4-40 screws and nuts. Make sure the metal brackets are placed below the plastic servo tabs as shown in **Fig #22**.
- The final assembly should match **Fig #23**. Double check your work, then proceed to **Step #13**.

Note: Only one arm of the servo horn is shown for clarity.



Step #13: Bend Actuator Rod

Item	Qty	Description
12	(1)	actuator rod

- Using the needle nose pliers, bend actuator rod at mid-point. Then bend as shown in **Fig #24**.

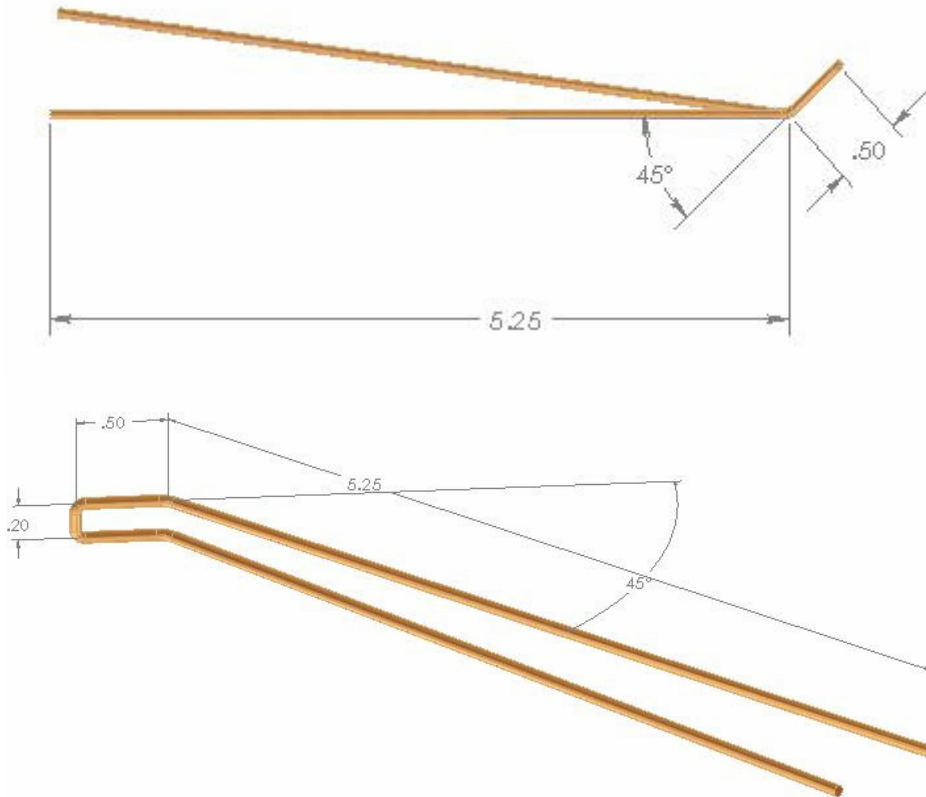


Fig #24

Step #14: Install Actuator Rod

<u>Item</u>	<u>Qty</u>	<u>Description</u>
12	(1)	actuator rod
11	(1)	Parallax Standard Servo

- Thread bent rod through servo horn as shown in **Fig #25**.

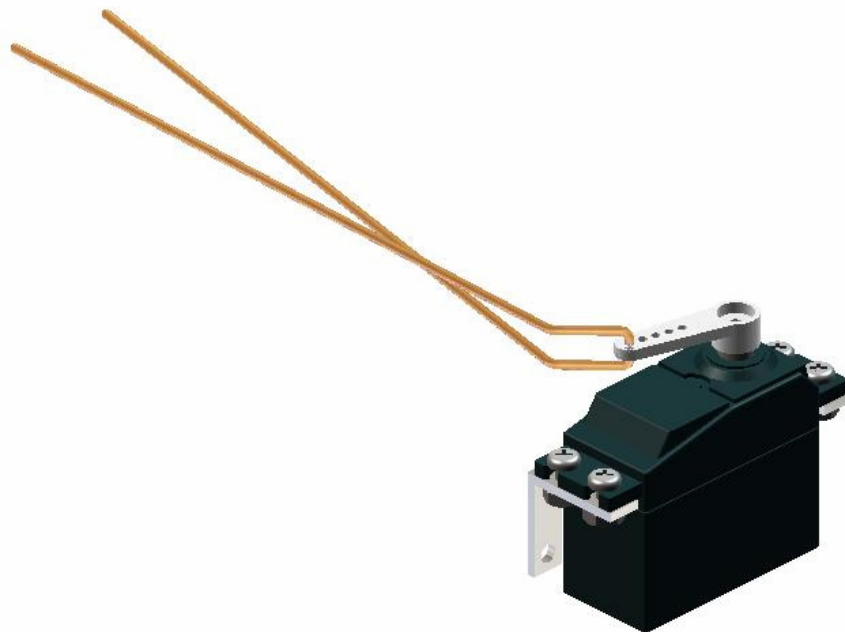


Fig #25

Step #15: Install Spring

<u>Item</u>	<u>Qty</u>	<u>Description</u>
9	(1)	spring

- Squeeze spring between the Gripper and the mounting bracket.
- Position the spring to fit over tabs as shown in **Fig #26** below.

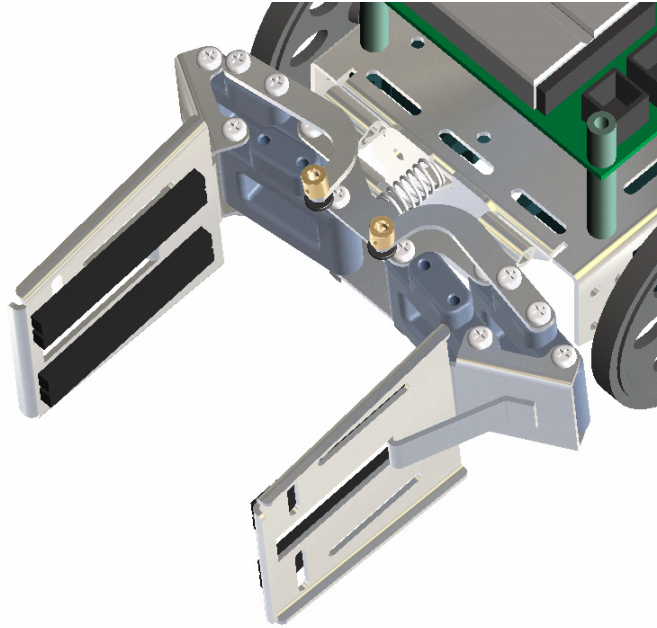


Fig #26

Step #16: Fasten Servo to Boe-Bot

Item	Qty	Description
19	(2)	#4 1.25" standoff
15	(2)	4-40 x 1/4" pan head screw
6	(2)	4-40 hex nut
18	(2)	lock nut

- Replace the Board of Education support standoffs (A) with the 1.25" standoffs in this kit.
- Insert the actuator rods into the control horns on the Gripper.
- Fasten the servo brackets to the servo as shown, using the hex nuts.
- Fasten the servo brackets to the **top** slots in the Boe-Bot chassis using the lock nuts. You may need to temporarily remove the battery pack during this step. Make sure to position the servo shaft on the right as shown in **Fig #27**.
- When finished, carefully compare your Boe-Bot to **Fig #28** to make sure everything is correct.

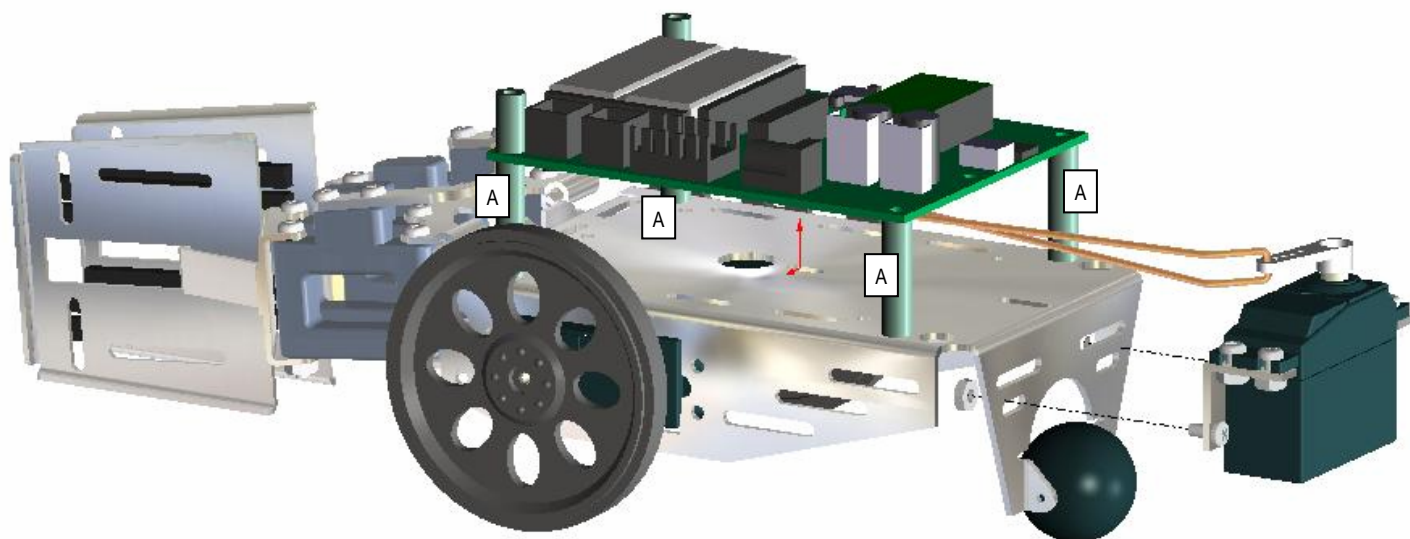


Fig #27

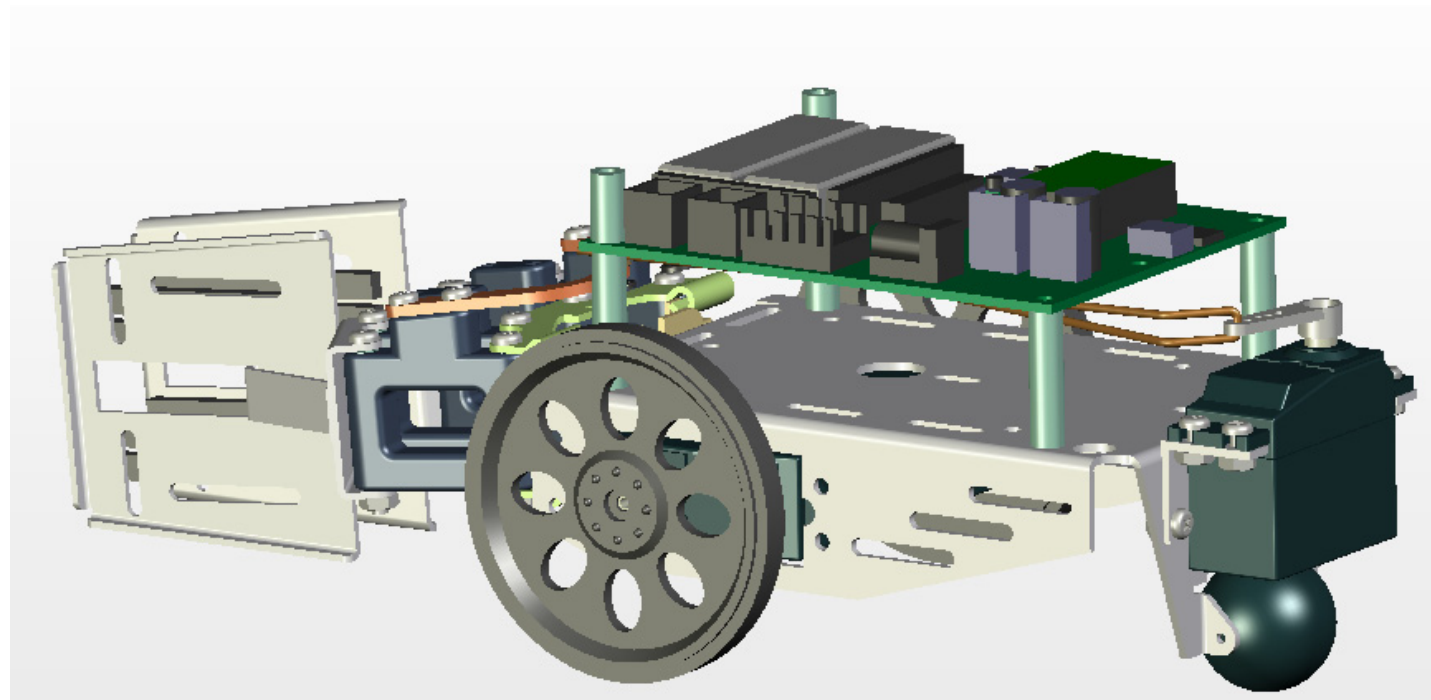


Fig #28

Step #17: Plug in Servo

- Plug the servo into servo port 14 as shown in **Fig #29**.
- **IMPORTANT:** The black wire should be closest to the breadboard.

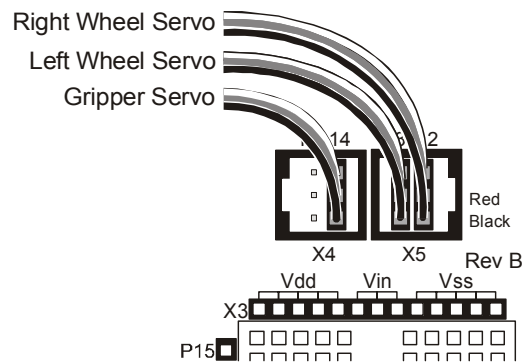


Fig #29

Step #18: Fasten Actuator Rod

<u>Item</u>	<u>Qty</u>	<u>Description</u>
13	(2)	Screws for E/Z connector

- Install the screws set aside from **Step #7**.
- Lock the actuator rods in place using the screws (see arrow in **Fig #30**).
- Insert the rods about ¼ inch into the E/Z connector for now.
- Gently tighten screws on E/Z connector.

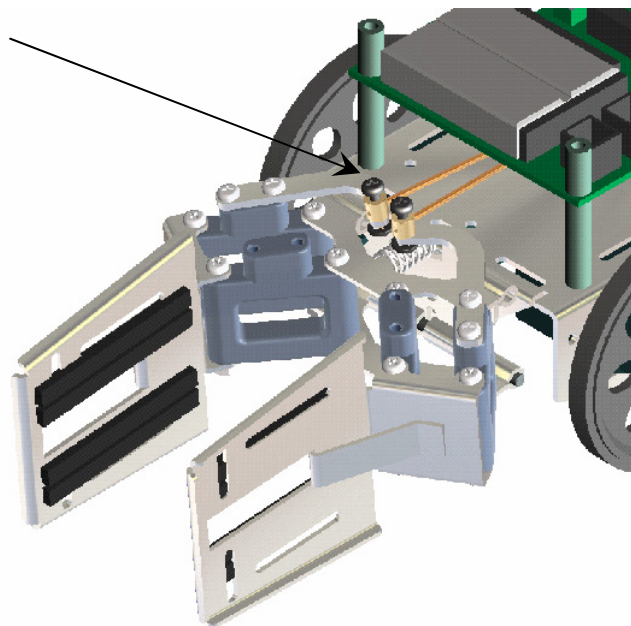


Fig #30

Step #19: Adjust Servo Horn Position

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

counter VAR    word

FOR counter = 1 TO 100
  PULSOUT 14, 500
  PAUSE 20
NEXT
```

- Remove the screw from the servo horn and pull the servo horn off the servo.
- Type in the PBASIC program in the left column.
- Turn the switch to Position 2 and download the program.
- The splined servo shaft will move to the Gripper open position.
- Now replace the servo horn as shown in **Fig #31** below. The arm is facing towards the front of the robot. Align the servo horn 90 degrees to the servo body.
- Replace screw and tighten.

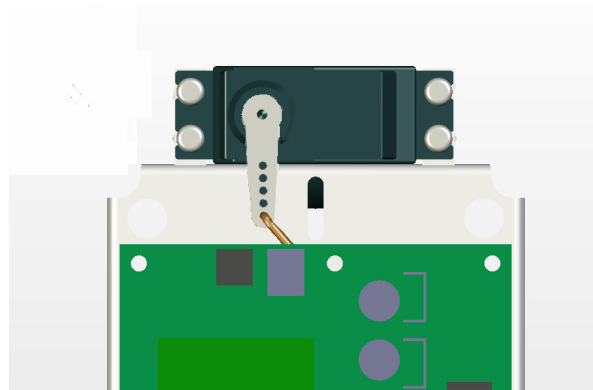


Fig #31

Step #20: Final Gripper Adjustment

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

counter VAR    word

FOR counter = 1 TO 100
  PULSOUT 14, 1000
  PAUSE 20
NEXT
```

- Edit the PBASIC program to match the listing below.
- Turn the switch to Position 2 and download the program.
- The servo shaft will move to the Gripper closed position
- Adjust the rods in the E/Z connector so the Gripper is fully closed and slightly raised off the surface.

Your Gripper is now ready to lift:

- Objects up to 2 in. (5 cm) wide
- Up to 4 oz (113 grams) without counterweight
- Up to 14 ounces (397 grams) with counterweight (not included)
- Please note that these measurements are approximate; individual Gripper performance may vary with battery charge, servo performance, and actuator rod adjustment.