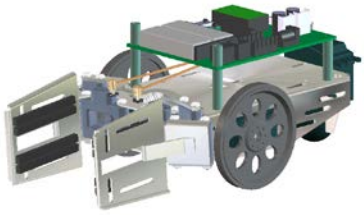
Web Site: www.parallax.com
Forums: forums.parallax.com
Sales: sales@parallax.com
Technical: support@parallax.com

Office: (916) 624-8333
Fax: (916) 624-8003
Sales: (888) 512-1024
Tech Support: (888) 997-8267

Gripper Kit (#28202) for Boe-Bot or ActivityBot Robots

The Gripper Kit

This kit allows your Parallax Boe-Bot (#28132 & #28832) or ActivityBot (#32500) robot to pick up objects. Note: robots are sold separately. This kit is not compatible with the Shield-Bot for Arduino (#130-35000 & #32335).



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” screw
8	(15)	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” screw
16	(2)	servo bracket
17	(4)	4-40 x 3/8" screw
18	(2)	4-40 lock-nut (not shown)
19	(4)	#4 x 1.25” standoff (not shown)

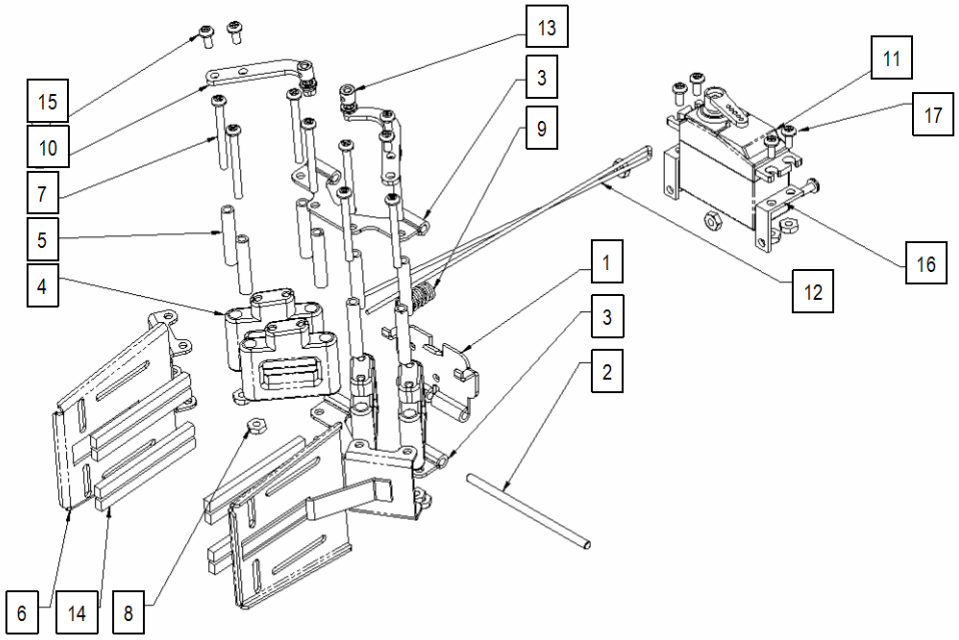


Fig #1

Recommended Tools

- 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

Item	Qty	Description
4	(2)	Gripper link
5	(2)	#4 x 1" spacer

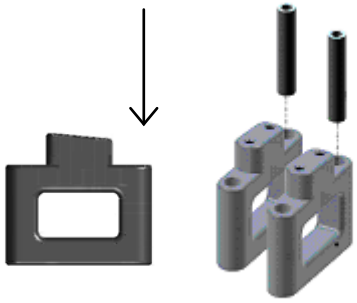


Fig #2

- The Gripper Links have an angled portion on top. Insert spacers into the large plastic holes near the lower side of the angled portion.
- Use **Fig #2** as a guide to install the spacers. When done, the pieces will appear as shown in **Fig #3**.

Fig #3

Step #2: Gripper Links

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

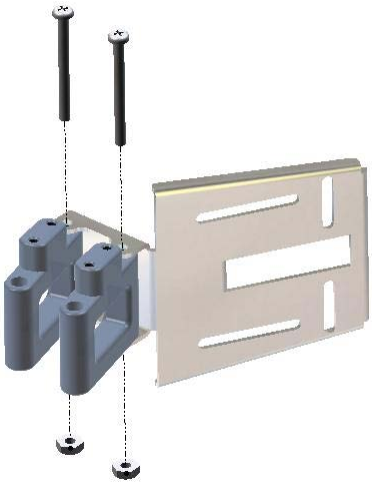


Fig #4

- Match the angled portions on top of the plastic links to 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**.

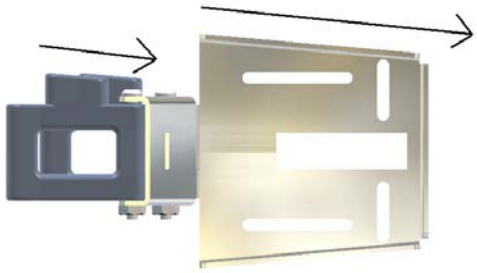


Fig #5

Step #3: Foam Tape

Item	Qty	Description
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.

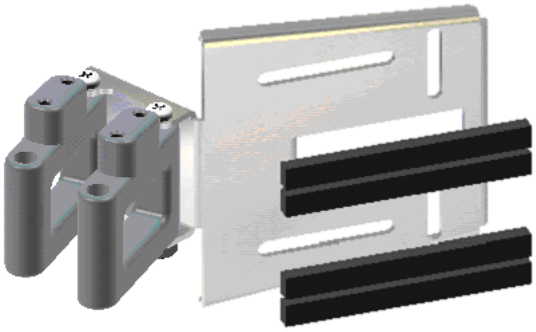


Fig #6

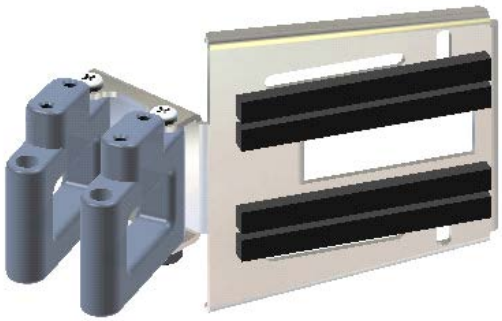


Fig #7

Step #4: Second Gripper Sub-assembly

Item	Qty	Description
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**.

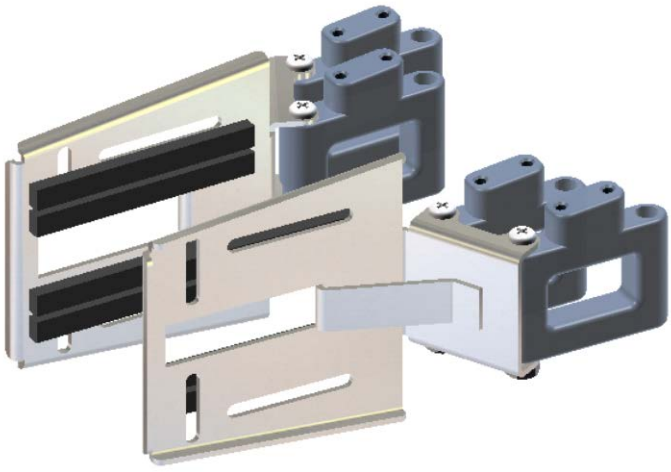


Fig #8

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

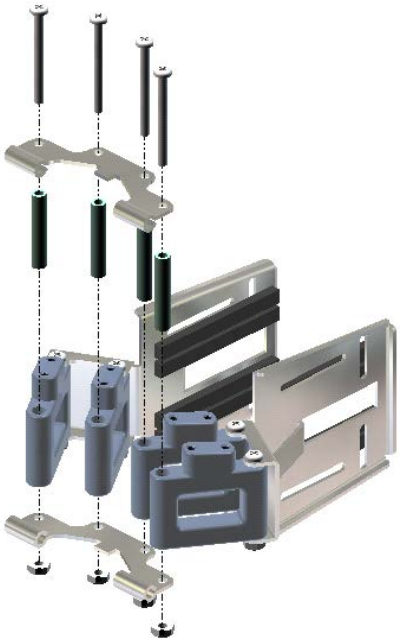


Fig #9

- Position the upper and lower linkage plates above and below the Gripper links as shown in **Fig #9**. The top linkage plate's hinge tabs should curl down, and the bottom linkage plate's tabs curl up.
- Insert a spacer into each Gripper link, and secure the link between the top and bottom linkage plates with 1.25" screws and nuts **Fig #9**.
- When all four plastic links are installed, tighten securely.
- Double check your work against **Fig #10**. Note again that the hinge tabs on the bottom linkage plate curl up, while hinge tabs on top plate curl down.

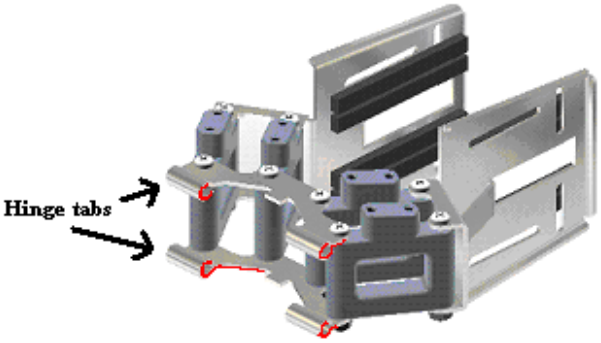


Fig #10

Step #6: Control Arms

Item	Qty	Description
10	(2)	control arm
15	(4)	4-40 x ¼" pan head screw

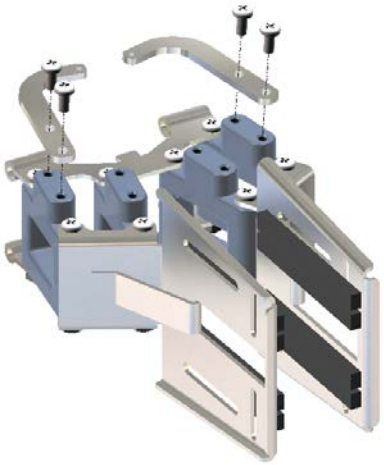


Fig #11

- Attach control arms with 4-40 x ¼" screws as shown in **Fig #11**.
- Final assembly must match **Fig #12**. Double check your work, then proceed to **Step #7**.

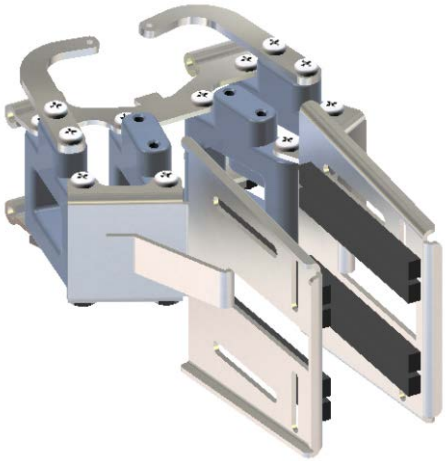


Fig #12

Step #7: E-Z Connectors

Item	Qty	Description
13	(2)	Brass 0.072 E-Z Connector set

- Insert a brass E/Z Connector into the end of each control arm and secure with washers. Pliers may be needed to seat the black snap-washers. Save the set-screws for a later step.
- Check your work; your final assembly should match **Fig #13**.

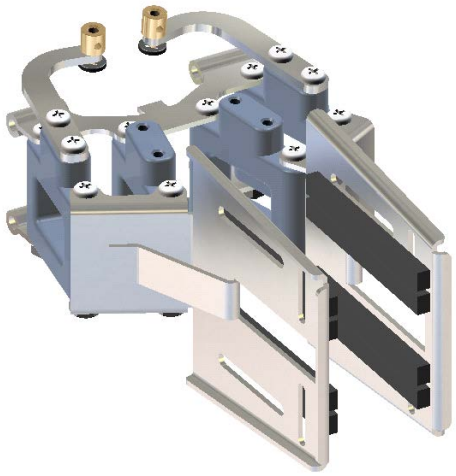


Fig #13

Step #8: Install Gripper Hinge Plate

Item	Qty	Description
1	(1)	hinge mount
15	(3)	4-40 x ¼" pan head screw
8	(3)	4-40 hex nut

Note: Remounting the wheels (and, if using the ActivityBot, the wheel encoders) "axle-forward" moves the axle closer to the front of the chassis. This helps prevent your robot from tipping forward when it picks up objects.

- Remove the wheels and un-mount the servos, keeping the screws and nuts. Turn the servos over and re-position them so their axles are closer to the front of the chassis.
- If using the ActivityBot, unscrew and detach each encoder sensor from its bracket. Turn around each bracket and re-attach each encoder sensor so the lenses are repositioned over the servo axles, see **Fig #16A** on the next page.
- Re-mount the servos with original screws and nuts.
- Attach the hinge mount to the front of the chassis with 4-40 x ¼" screws and nuts as shown in **Fig #14** and **Fig #15.**
- Double check your work against **Fig #16A/B.**

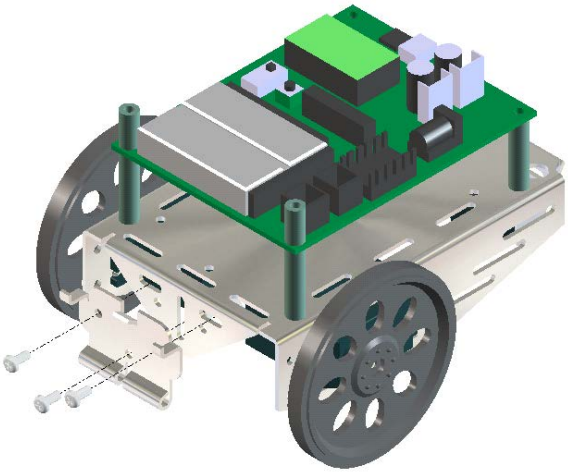


Fig #14 – Top View

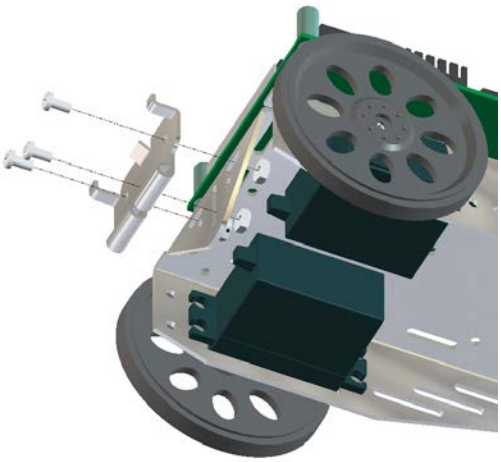


Fig #15 – Bottom View

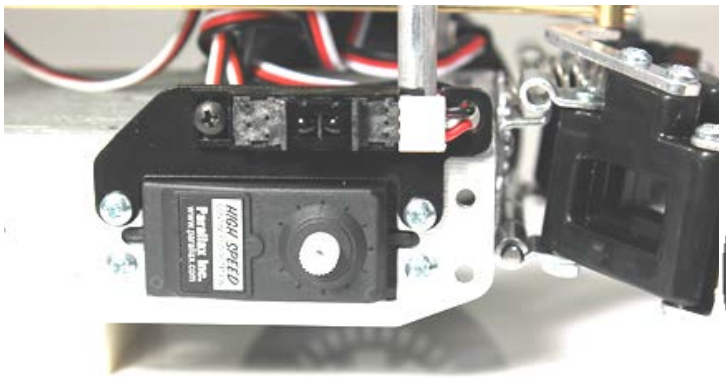


Fig #16A – ActivityBot, Axle and Encoder Forward

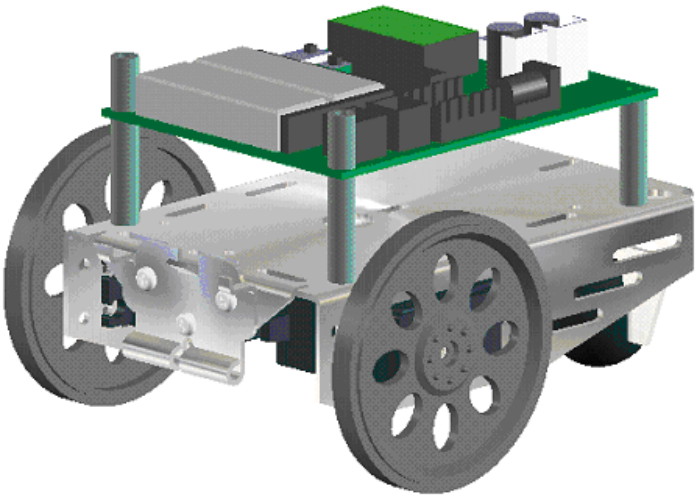


Fig #16B - Boe-Bot, Axles Forward

Step #9: Position Gripper on Robot

Item	Qty	Description
	(1)	Gripper assembly
	(1)	Boe-Bot or ActivityBot robot, assembled

- 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.

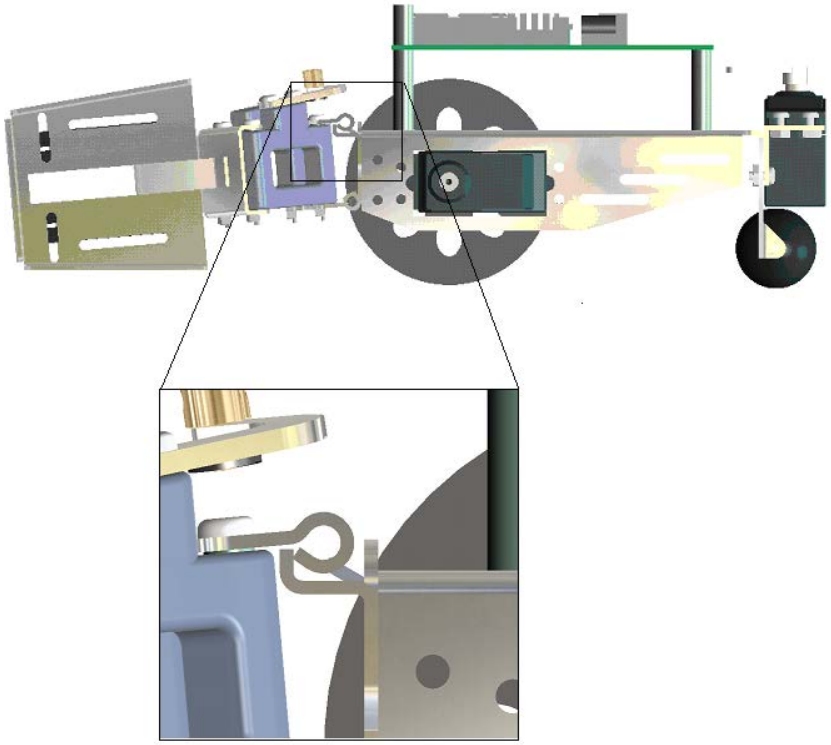


Fig #17

Step #10: Insert Dowel Pin

Item	Qty	Description
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.

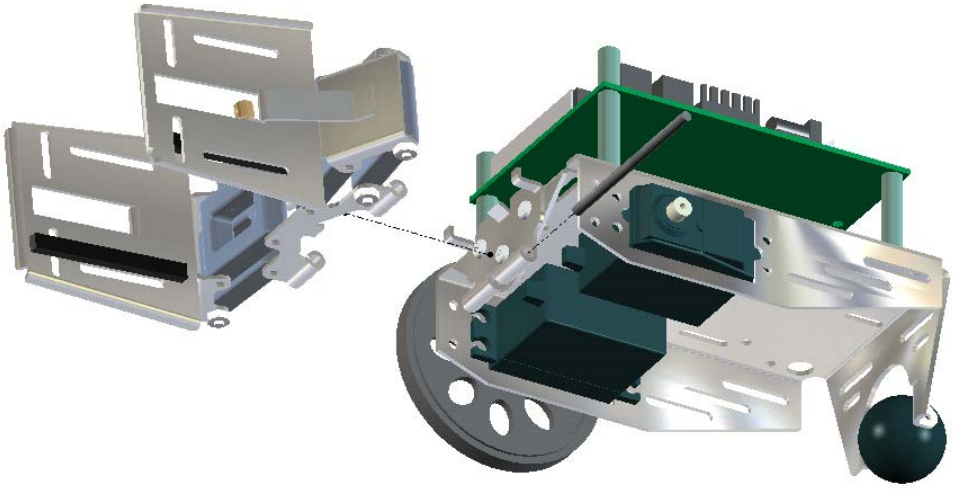


Fig #18

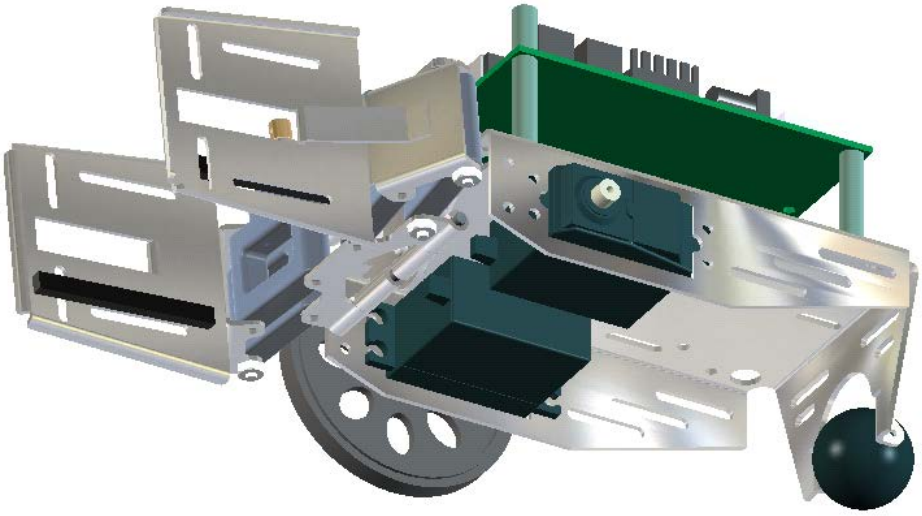


Fig #19

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. Using a 5/64" drill bit, Phillips-tip screwdriver, or hobby knife, gently enlarge the hole slightly. 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.

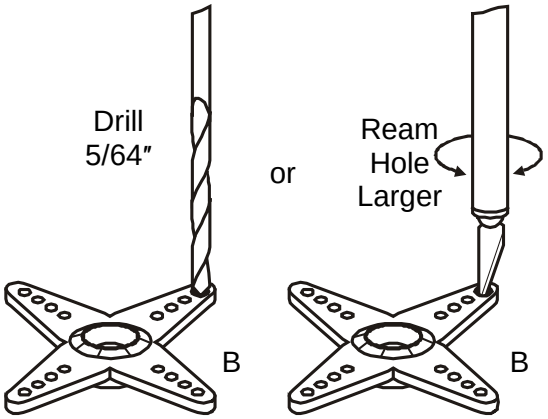


Fig #20

Fig #21

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.

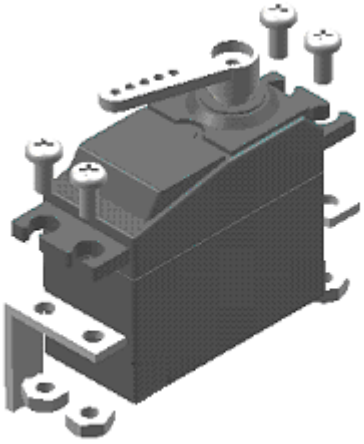


Fig #22

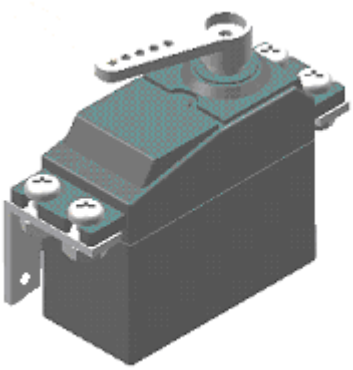


Fig #23

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**.

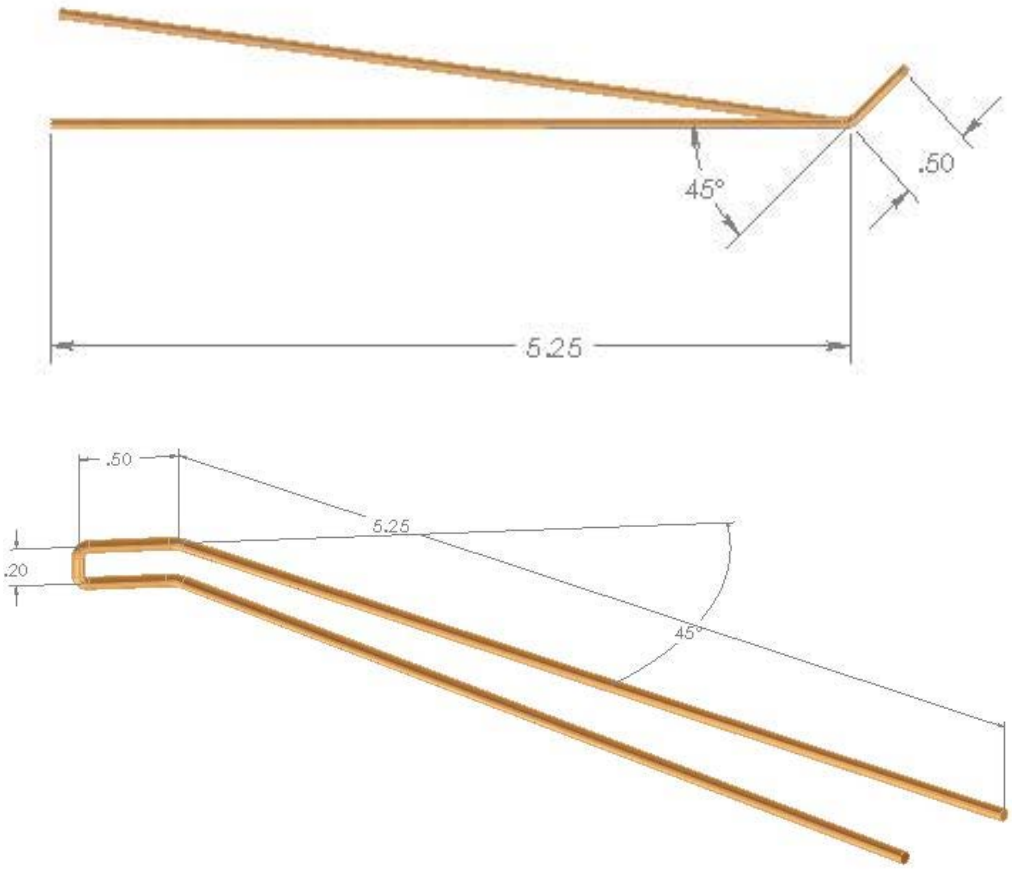


Fig #24

Step #14: Install Actuator Rod

Item	Qty	Description
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

Item	Qty	Description
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.

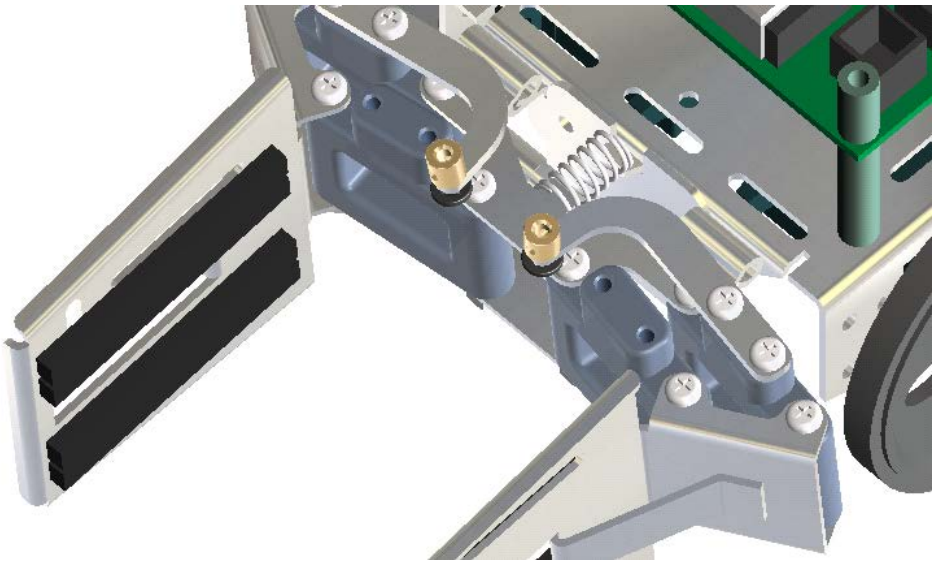


Fig #26

Step #16: Fasten Servo to Chassis

Item	Qty	Description
19	(2)	#4 1.25” standoff
15	(2)	4-40 x ¼" pan head screw
6	(2)	4-40 hex nut
18	(2)	lock nut

- Remove the battery pack.
- 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 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**.
- Re-install the battery pack, and replace the development board support standoffs (A) with the 1.25” standoffs in this kit.
- When finished, carefully compare your robot to **Fig #28** to make sure everything is correct.

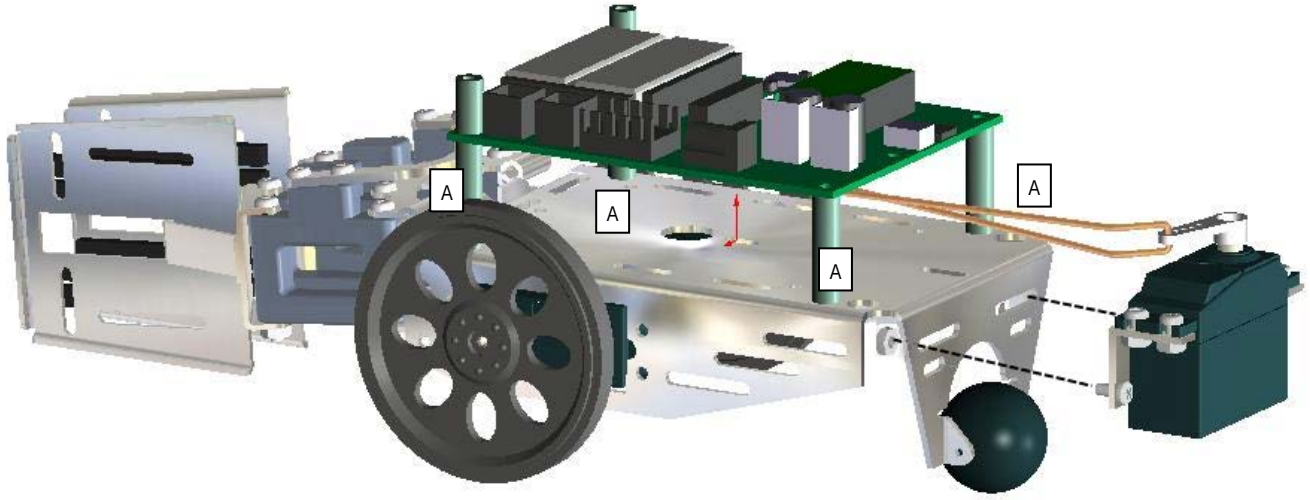


Fig #27

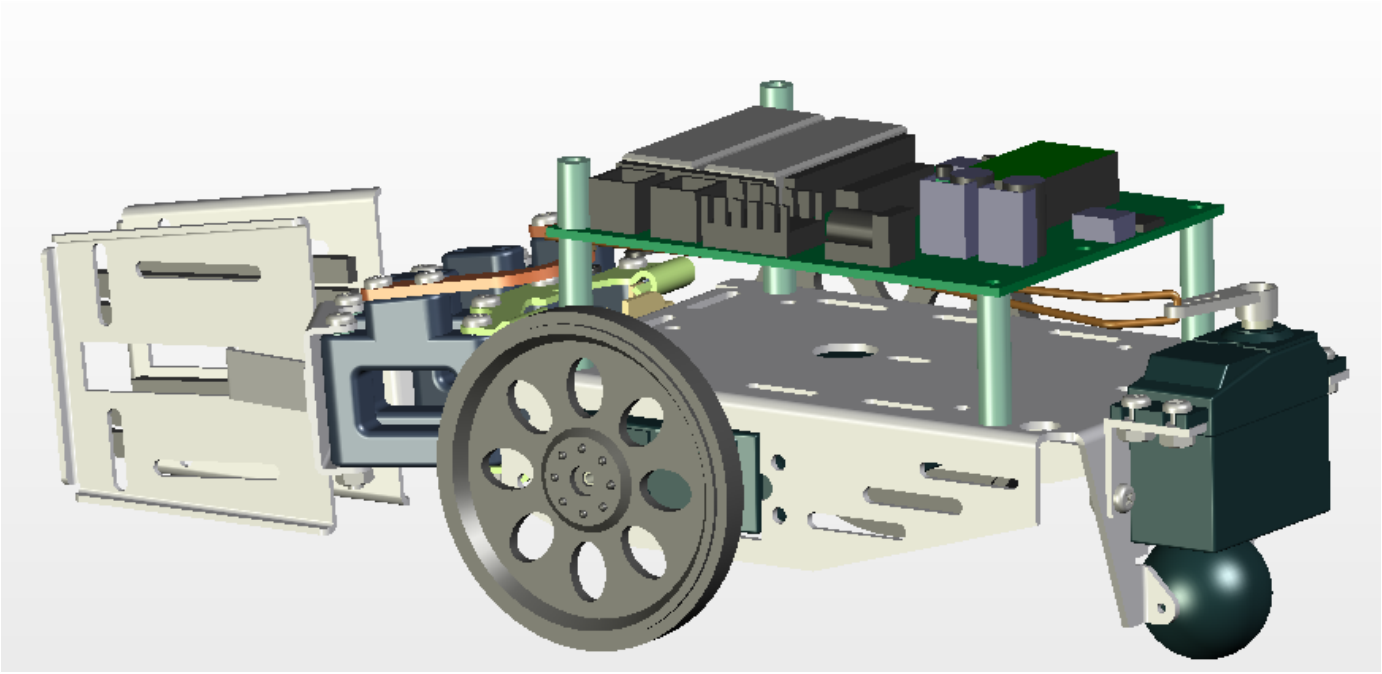


Fig #28

Step #17: Plug in Servo

- **Boe-Bot:** Make sure your servo port power jumper is set to 5V.
- Plug the gripper servo in to the P14 port, making sure the black wire is closest to the breadboard.

- **ActivityBot:** Set the servo port power jumper for P16/P17 to 5V.
- Plug the gripper servo into the P16 port, making sure the black wire is closest to the breadboard.

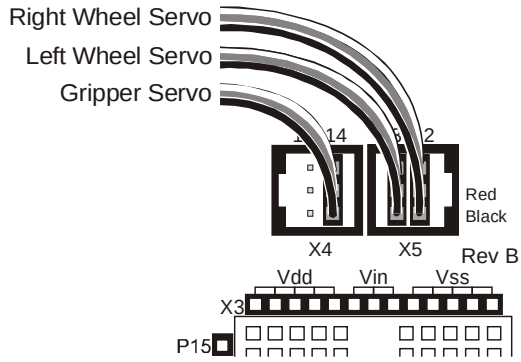


Fig #29A – for Boe-Bot

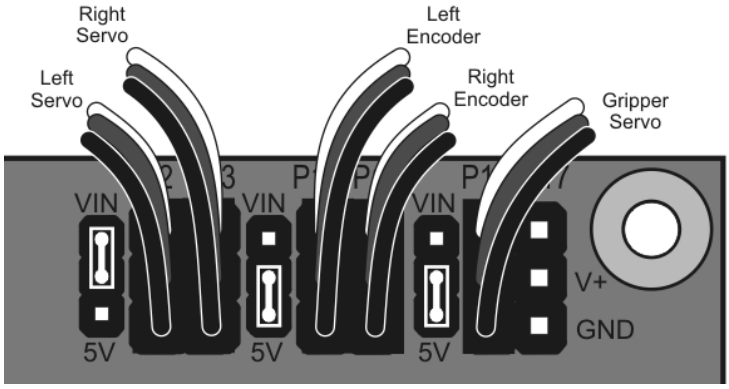


Fig #29B – for ActivityBot

Step #18: Fasten Actuator Rod

Item	Qty	Description
13	(2)	Set-screws for E/Z connector

- Locate the set-screws set aside from **Step #7.**
- Insert the ends of the actuator rod about 1/4 inch into the E/Z holes in the sides of the brass E/Z connectors
- Lock the actuator rods in place using the set-screws (see arrow in **Fig #30)**.

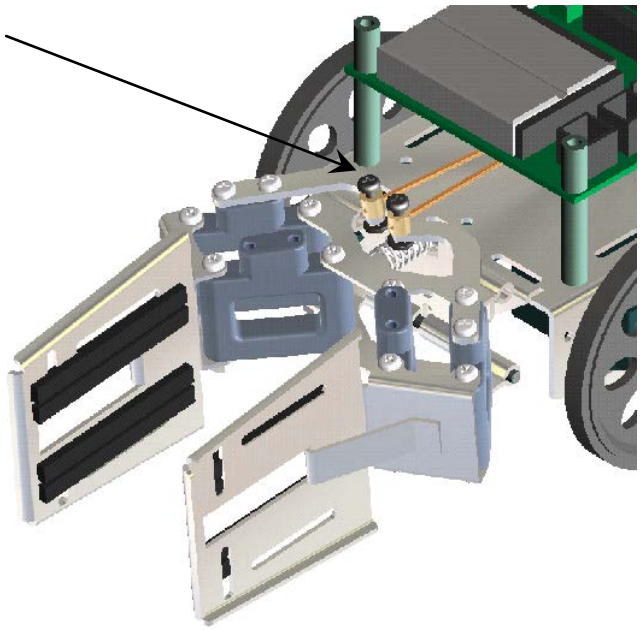


Fig #30

Step #19: Adjust Servo Horn Position

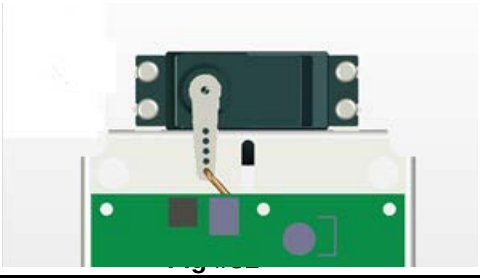
```
' For Boe-Bot robot
' {$STAMP BS2}
' {$PBASIC 2.5}

DO
  PULSOUT 14, 250
  PAUSE 20
LOOP
```

```
// For ActivityBot robot
#include "simpletools.h"
#include "abdrive.h"
#include "servo.h"

int main()
{ while(1)
  {
   servo_angle(16, 0);
  }
}
```

- Remove the screw from the servo horn and pull the servo horn off the servo.
- Type in the program for your robot (Boe-Bot or ActivityBot), at left.
- Turn the switch to Position 2 and run the program. The splined servo shaft will rotate to the clockwise end of the servo's range.
- Now replace the servo horn as shown in **Fig #31** below. Align the servo horn 90 degrees to the servo body, pointing towards the chassis.
- Replace the servo screw and gently tighten.



Step #20: Final Gripper Adjustment

```
' For Boe-Bot robot
' {$STAMP BS2}
' {$PBASIC 2.5}

DO
  PULSOUT 14, 1250
  PAUSE 20
LOOP
```

```
// For ActivityBot robot
#include "simpletools.h"
#include "abdrive.h"
#include "servo.h"

int main()
{ while(1)
  {
   servo_angle(16, 1800);
  }
}
```

- Edit your program to match the listing at left for your robot.
- Turn the switch to Position 2 and download the program.
- The servo shaft will move the Gripper to the closed position.
- Loosen the set screws in the E/Z connectors and adjust the rods so the Gripper is fully closed and slightly raised off the surface.
- Re-tighten the set screws securely

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.

Revision History: Version 4.0 adds support for ActivityBot robot.