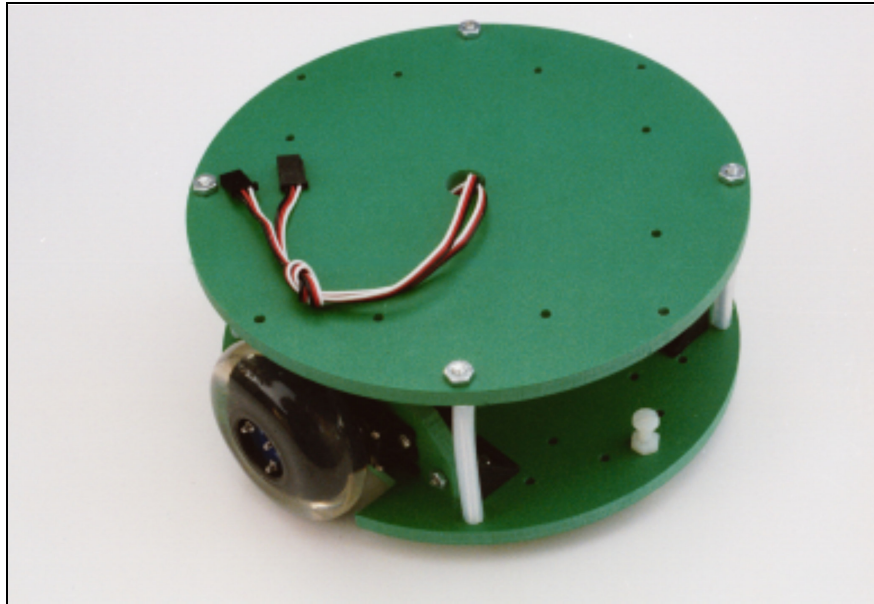


Budget Robotics Scooterbot Assembly Instructions



The Budget Robotics Scooterbot kit is a low-cost 7" diameter servo-driven robot base, ready for expansion. Assembly is simple, and takes less than 15 minutes.

The Scooterbot comes with two "decks" for mounting the servo motors, batteries, sensors, microcontroller, and other components. Additional decks can be added if desired (we recommend no more than three decks total, to reduce the possibility of the robot tipping over).

The Scooterbot uses the popular differential steering motor arrangement, where the robot is propelled by two motors and wheels on opposite sides of the base. Two skids, placed in the front and rear of the Scooterbot, provide balance. With this arrangement, the Scooterbot is able to move forward and back, turn left and right, and spin in place. The skids are smooth nylon, so they present little drag on whatever surface the robot is rolling over.

The two drive motors are standard R/C airplane servos. Normally, such servos are limited to 180° rotation only, but the motors included with the Scooterbot have been modified to permit continuous rotation. As with all R/C servos, the Scooterbot motors must be driven using the appropriate control circuit. This control circuit is not included with the basic Scooterbot kit.

If you need a control circuit, the OOPic R, from Savage Innovations, (www.oopic.com) is a good all-purpose solution. The board has connections for attaching up to 16 R/C servos. Another option is the Parallax Board of Education BASIC Stamp 2 programming development board (www.parallax.com), available with either serial or USB computer ports.

Parts List

The Scooterbot kit contains the following parts:

Quantity	Description
1	7" diameter base (bottom deck). The base has "wheel well" cutouts for the drive wheels. The base is pre-drilled for the servo motor mounting brackets, skids, and optional sensors.
1	7" diameter 2nd deck. The 2nd deck is attached to the base using risers. Holes in this deck match mounting holes in the bottom deck.
2	Pre-modified R/C servo motors.
2	2 1/2" diameter wheels, with hubs to attach to the servo motors.
2	Servo mounts.
4	90° corner brackets, for attaching the servo mounts to the base.
16	4-40 x 1/2" machine screws and nuts, for attaching the servo mounts to the base.
4	Risers consisting of: (4) standoffs, (8) machine screws
2	Skids consisting of: (2) machine screws, (4) hex nuts, and (2) cap nuts.

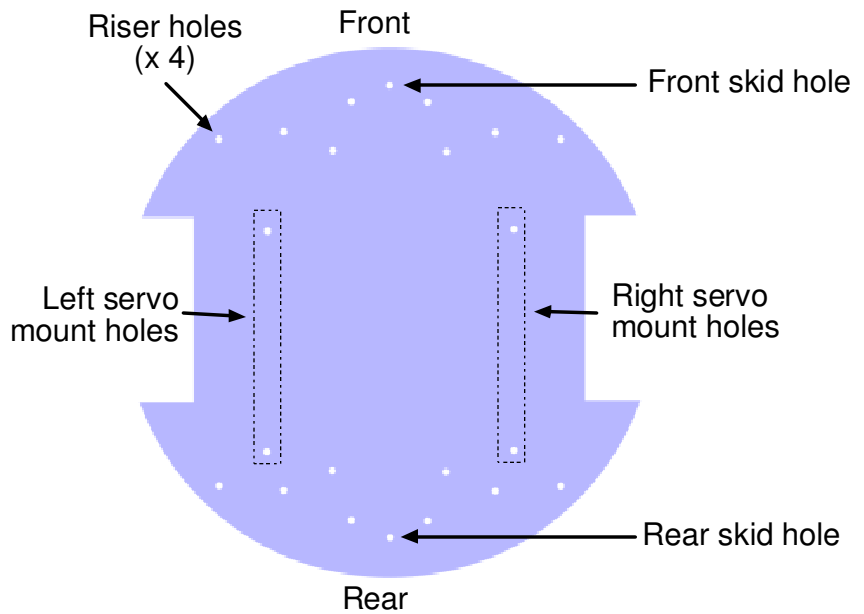
Assembly Steps

Step 0

Before assembly you may wish to use 150 grit sandpaper to smooth the edges of the base. Isopropyl (rubbing) alcohol can be used to clean the plastic, as needed.

Orient the base so that the left and right servo mounting holes are aligned as shown. Note that the holes for each servo are not symmetrically placed on the base. This is to accommodate the offset of the servo drive shaft.

(That said, there is really no "front" or "rear" of the Scooterbot; either end can be used as the front or rear.)



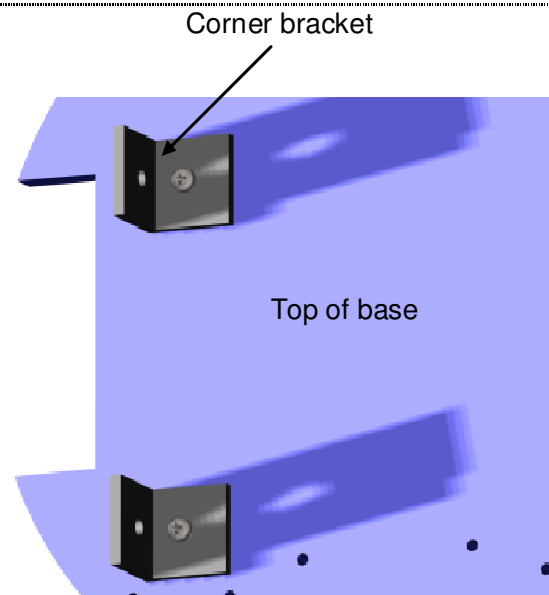
Step 1

Mount the left servo corner brackets over the servo mounting holes as shown. Use 4-40 x 1/2" screws and nuts to fasten the brackets in place.

Repeat the same for the right servo.

The nut should be placed on the bottom side of the base. The "upright" portion of each bracket should face the wheel well cutout.

Finger-tighten only at this point.



Step 2

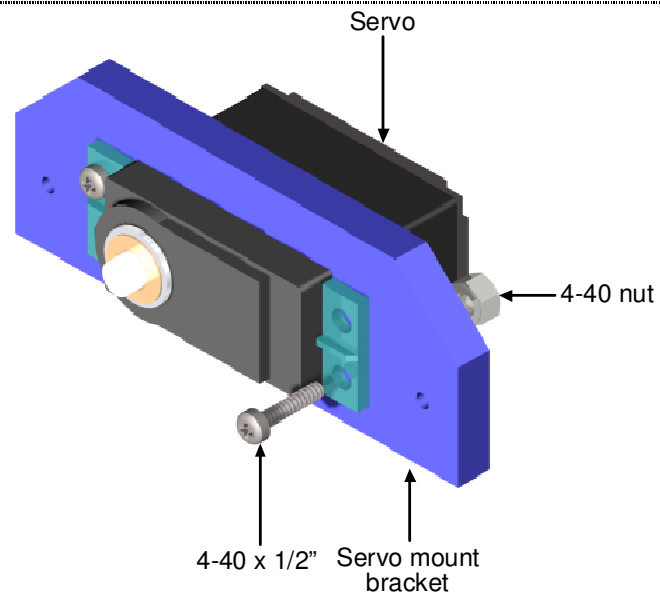
Mount one of the servos into a servo mounting bracket by sliding it back-end first through the bracket.

The fit may be tight, depending on the make and model of the servo. Do not force the servo into the bracket, or the bracket may be damaged.

If you are using servos than other those that come in the Scooterbot kit, you may need to lightly file the inside pocket of the servo mounting bracket to enlarge it to accommodate your servo. *Don't make the pocket any larger than it needs to be.*

Secure the servo to the mount with two 4-40 x 1/2" screws and hex nuts. (There is usually no need to use fasteners on all four corners of the servo; two screws are sufficient.)

Repeat for the opposite servo and mounting bracket. *Be sure to mount the servo in mirror-image to the one shown!* Refer to the photo for Step 7 to see how the motors should be inserted into the mounts.



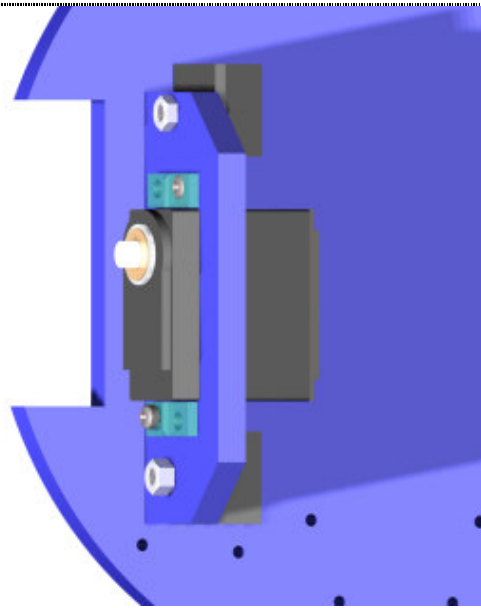
Step 3

Attach the left servo and servo mount to the base using two 4-40 x 1/2" screws and nuts. The nuts should be secured to the side of the mount facing the wheel well cutout.

Note that when properly attached, the servo shaft will be centered in the wheel well cutout.

Repeat the same procedure for the right servo and servo mount.

After the servo mounts have been attached, align the mounts so they are parallel with the wheel well cutout, and tighten all screws.



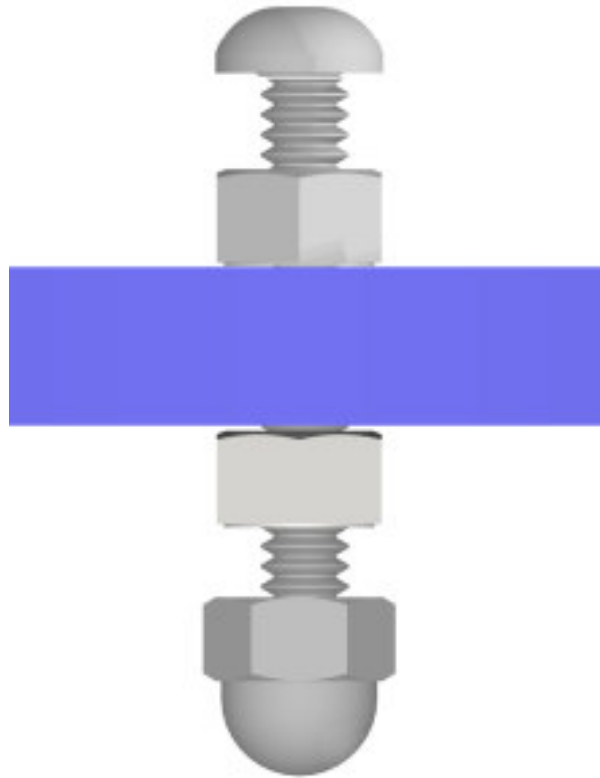
Step 4

Attach the front and rear skids as shown. For each skid:

1. Thread a hex nut onto the machine screw, and place through hole on one end of the base. (The hole is intentionally undersized. Use a screwdriver to "tap" the plastic with screw threads.)
2. Secure another hex nut to the end of the screw. (Omit this nut if you need to lower the height of the skid.)
3. Thread the cap nut onto the end of the screw.

Repeat the above steps for the other skid.

If you wish to use the Scooterbot over thick carpet, consider exchanging the skids with 1 1/4" swivel casters (available at Lowe's and many other hardware store). Flip the base over and attach the casters servo side down with machine screws or double-sided foam tape.

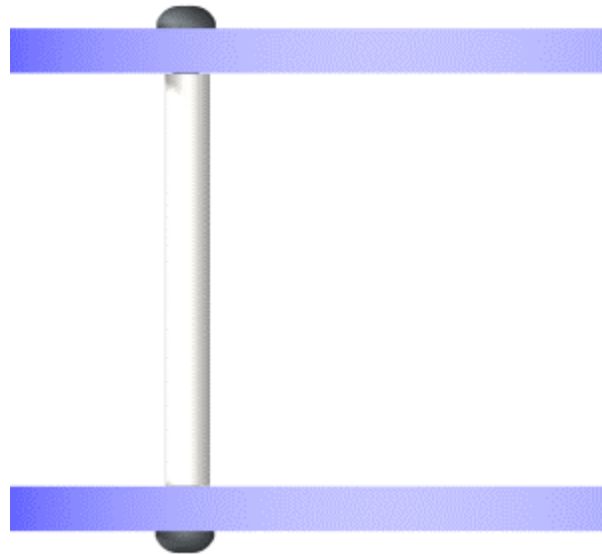


Step 5

Assemble and install the four risers as follows:

1. Insert a machine screw through one of the four holes in the bottom deck designated for the risers.
2. Thread a standoff onto the screw. The smaller end fits into the hole. Finger tighten.
3. Repeat for the other three risers.

Optional jack screws (small standoffs) and washers are included as needed.



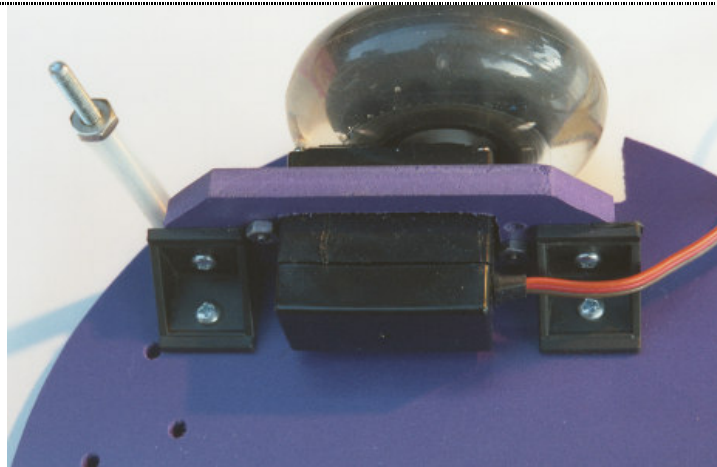
Step 6

Construct the two wheels according to the instructions provided with the wheel set.

Mount one wheel to each servo. The wheel is secured with a small self-tapping screw.

Note that the servo shaft is splined, and this spline matches the wheel hub. Be sure to press the wheel onto the shaft firmly while tightening the screw.

Do not over-tighten the wheel mounting screw, or it may break off!



Step 7

At this point your Scooterbot should look like this. Note that with the supplied servos, the wires face the same direction: toward the "front" of the base.

Servo wiring key:

Brown: ground

Red: +vdc (4.8 to 6.0v)

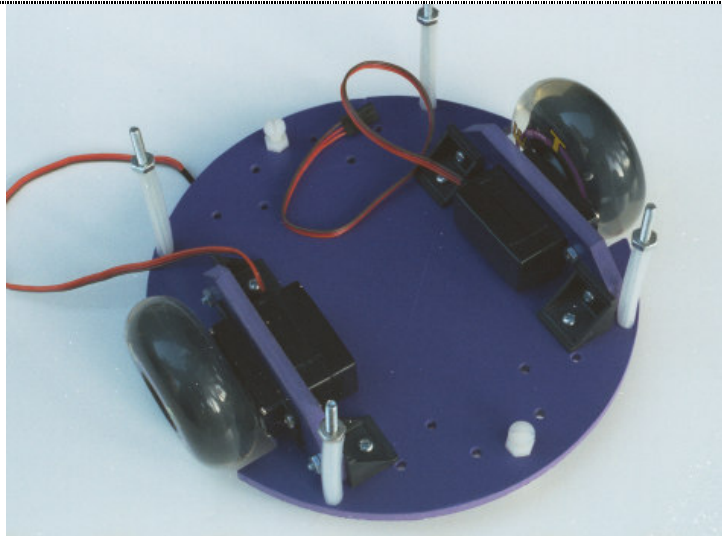
Orange: Signal

or

Black: ground

Red: +vdc (4.8 to 6.0v)

White: Signal

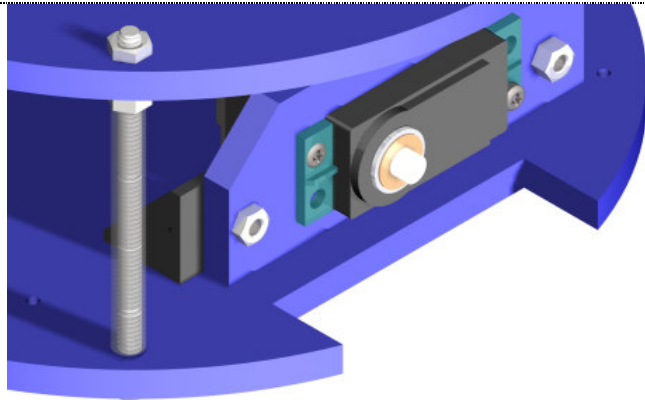


Step 8

(Note: Servos shown without wheels for clarity.)

Attach the 2nd deck by locating the matching four holes to the risers (if the holes don't appear to be quite aligned, rotate the top deck 1/4 turn).

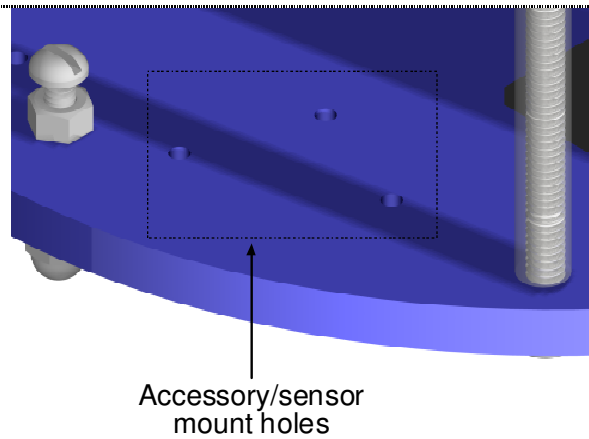
Secure the top deck by threading four 6-32 hex nuts onto each riser.



Step 9

The front and back of the bottom deck is drilled for optional accessories, sensors, or other attachments you may like to add.

You may drill additional holes as needed. A standard wood bit may be used to drill holes.



Front and Rear Skid Adjustment

With the wheels attached to the servos, adjust the height of both front and rear skids as described in Step 4. You may experiment with the proper height, but a good starting point is to allow a *slight* "teeter" front and back when you press down on the skids. You may also remove the bottom hex nut of each skid if you need extra clearance distance between the cap nut and the ground.

If the skids are adjusted too low (the skids protrude down too far), the wheels may suffer from impaired traction because they don't completely touch the ground -- or they may not touch the ground at all!

Conversely, if the skids are adjusted too high, the robot will rock back and forward excessively when reversing directions.

Servo Centering Adjustment

The Scooterbot uses standard R/C model airplane servo motors that have been modified to allow for continuous rotation. This modification entails removing a "stop" on the bottom of the drive gear, and disengaging the drive gear from the feedback potentiometer inside the servo.

Before the servo was shipped to you, the potentiometer was positioned *near* its physical center position. This allows you to make fine-tuning adjustments to the servo center to best suit the control circuitry you are using.

Ordinarily, software running on your servo control circuit or microcontroller is used to set the "center" of the servo. This signal is nominally a repeating pulse of 1.5 milliseconds in duration. When centered, the servo stops all motion. Applying a pulse greater than 1.5 milliseconds causes the servo to rotate in one direction; a pulse of less than 1.5 milliseconds causes the servo to rotate in the other direction. Note this pulse is repeated 20-50 times each second.

Should you wish to adjust the physical center of the servo you may do so by following these steps:

The servo has a small hole above the power/signal cable for adjusting the centering. Use a small ("0" or "00") Phillips screwdriver to turn the small potentiometer inside the servo, while providing it with pulses of 1.5 milliseconds. The servo does not need to be disassembled to set its center.

The Scooterbot is from:

Budget Robotics
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Oceanside, CA 92056
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orders@budgetrobotics.com

080706

Double O-Wheel Assembly

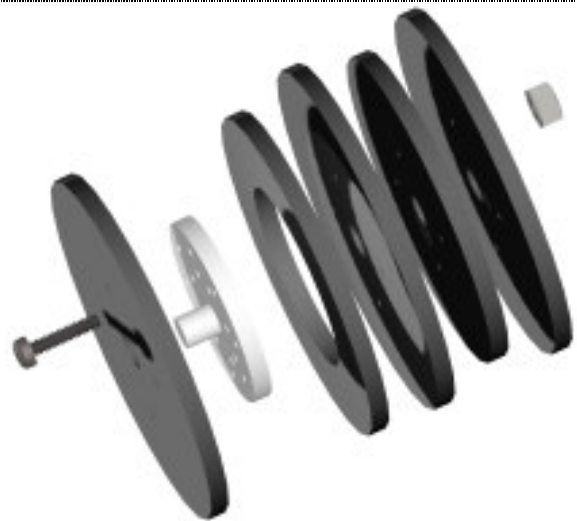
The Scooterbot comes with 2 1/2" wheels, designed to couple with the RC servos used in the kit. These wheels must be assembled prior to attaching onto the Scooterbot.

Each Double O-wheel consists of the following

- 1 Inner wheel hub (center hole is chamfered)
- 1 Outer wheel hub (the four screw holes are slightly enlarged)
- 1 Center wheel hub
- 1 Servo disc shoulder (donut shaped)
- 1 Spacer (slightly smaller than the other hubs)
- 1 Servo disc (round or "X" shaped)
- 4 Machine screws and recessed nuts
- 2 Rubber o-rings

Follow these steps to assemble the Double O-Wheels

1. Use 150 grit sandpaper to remove any burrs on the plastic pieces left over from the manufacturing process.
2. Insert two (2) machine screws through the Inner wheel hub.
3. Press Servo disc onto wheel hub, aligning screws into the drilled-out holes of the Servo disc. The spline of the Servo disc is inserted into the chamfered side of the Inner Wheel hub.
4. Press the Servo disc shoulder over the Servo disc.
5. Mount the Center wheel hub.
6. Mount the Spacer.
7. Mount the Outer wheel hub.
8. Secure the two machine screws using the recessed nuts. *Do not over tighten.*
9. Insert the other (2) machine screws, and fasten them using the recessed nuts.
10. Finish each wheel by placing (2) rubber o-rings into their grooves. Manipulate the rubber so that it is not twisted.



Note: During final assembly squeeze the plastic pieces together and bear down on the screwdriver to catch the threads of the recessed nuts.