SES Arm Assembly Guide.

Updated 02/25/2008.

Safety first! Wear eye protection and never touch a powered robot!

Note: Loctite or thread locks can be used on the construction of the aluminum components. However, don't use them with Lexan, as they are not necessary and may cause damage.

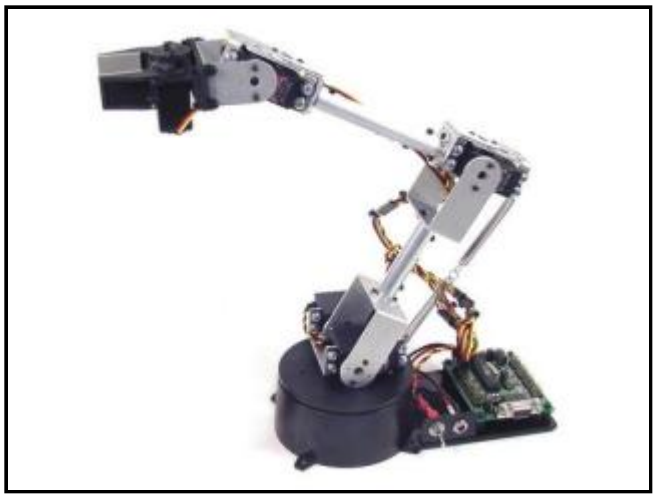
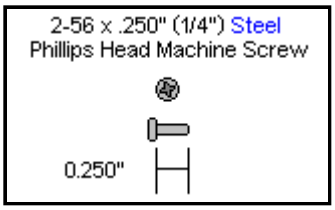


Image of complete arm.

Step 1.
Attach two of the tubing connector hubs to the "L" connector brackets, using four 2-56 x .250 screws and 2-56 nuts.

4 x



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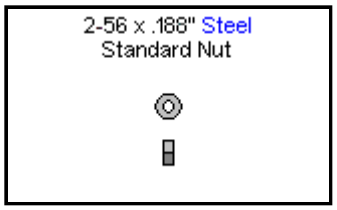
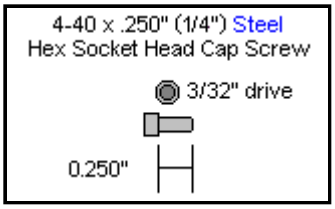


Figure 1.

Step 2.
Connect the hubs to the 3.375" tube using two 4-40 x .250" screws.

2 x



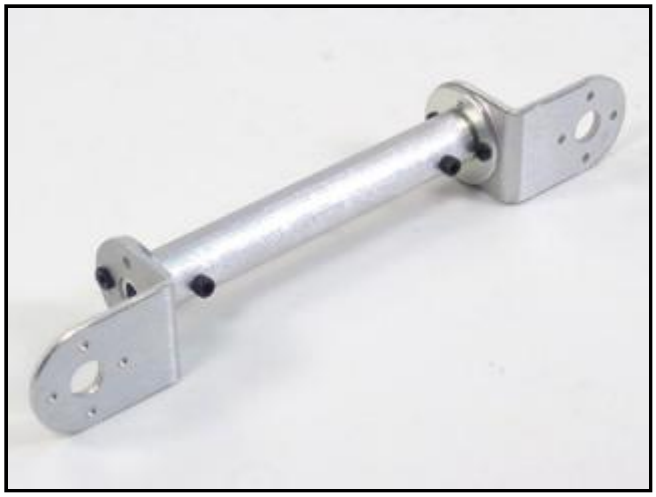


Figure 2.

Step 3.
Add two Multi-Purpose servo brackets, using four 2-56 x .250" screws and 2-56 nuts.

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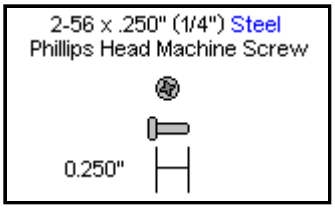

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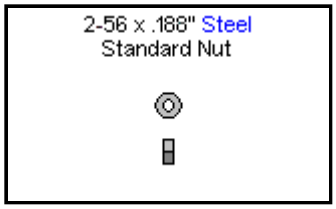

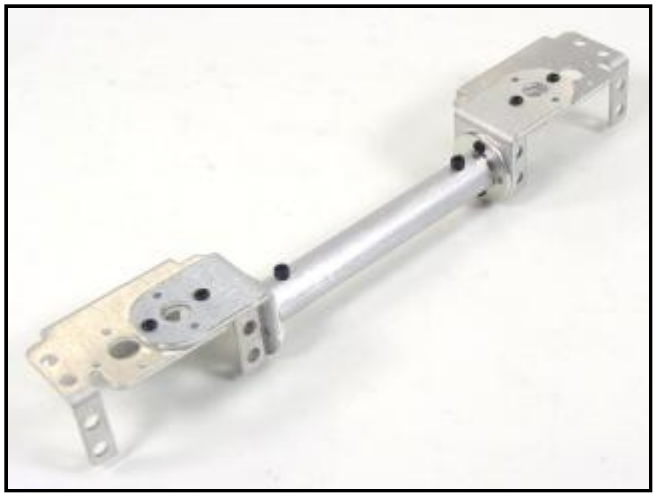

Figure 3.

Step 4.
Attach two of the tubing connector hubs to the Long "C" connector brackets, using four 2-56 x .250 screws and 2-56 nuts.

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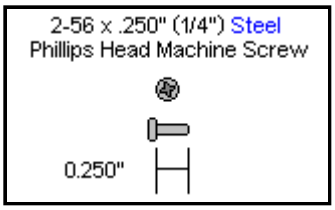

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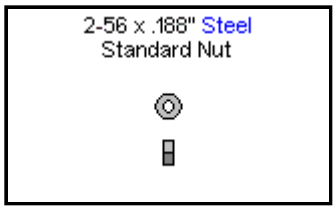
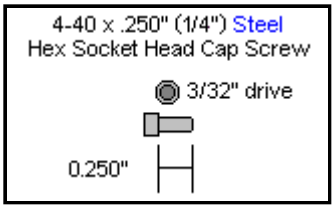


Figure 4.

Step 5.
Connect the hubs to the 2.250" tube using two 4-40 x .250" screws.

2 x



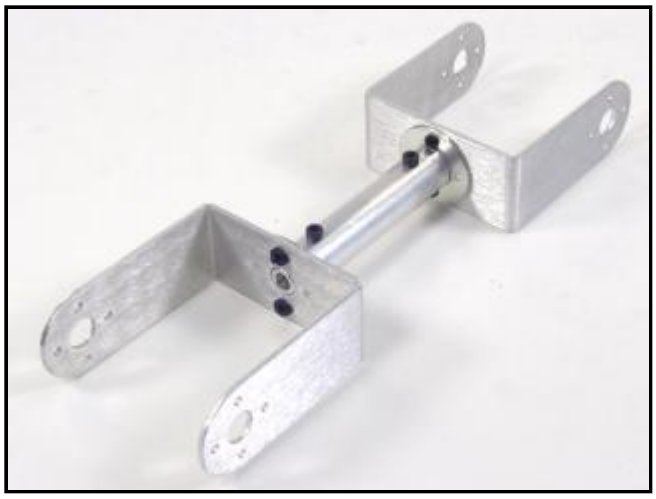


Figure 5.

Step 6.
Attach the Little Gripper connector to the Short "C" bracket using two 2-56 x .250" screws and 2-56 nuts.

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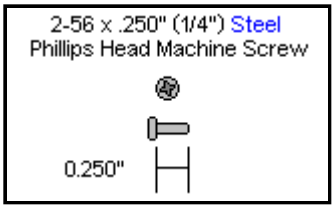

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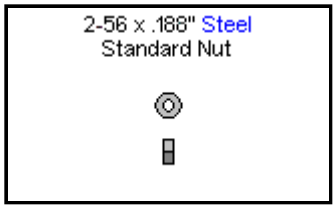


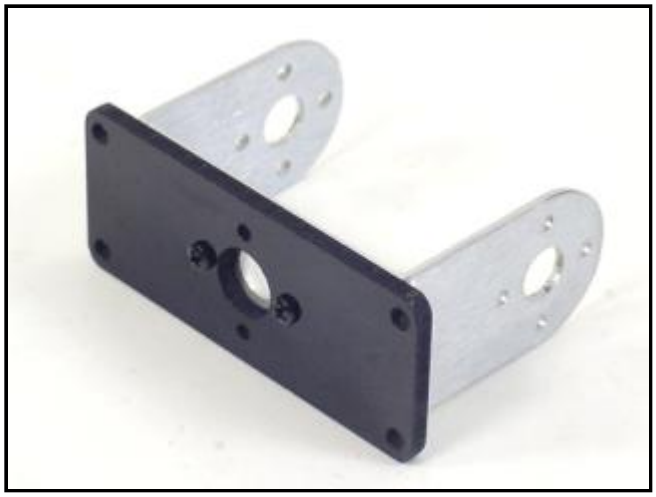


Figure 6.

Step 7.
Attach one of the Long "C" brackets to one of the Multi-Purpose brackets as shown. See the diagram below for detailed information.

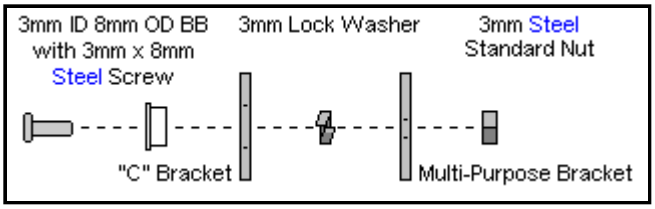


Figure 7-1.

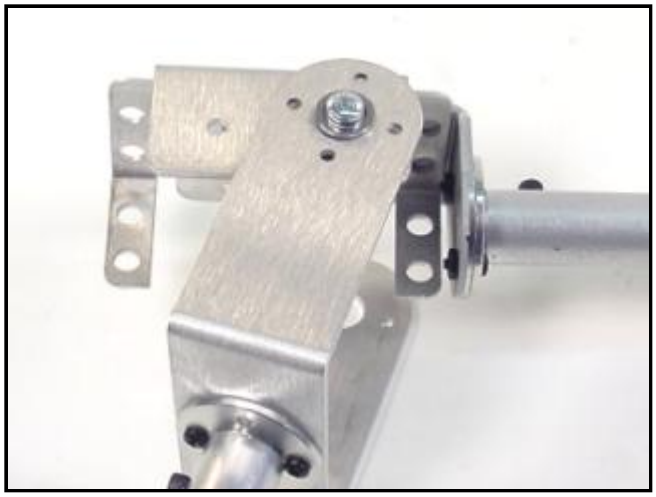


Figure 7-2.

Step 8.
Attach the Short "C" bracket to the other Multi-purpose bracket as shown. **Note! If you are *NOT* going to use the gripper upgrade, refer to Figure 7-1 for connection information.** If you are going to use the gripper upgrade, please follow figure 8-1 to allow for easy gripper rotate installation.

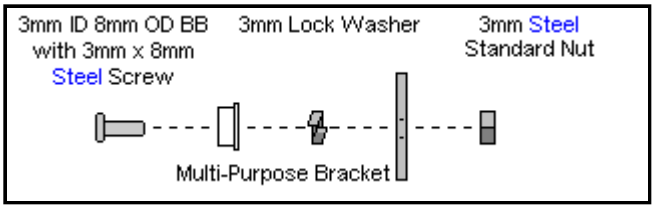


Figure 8-1.

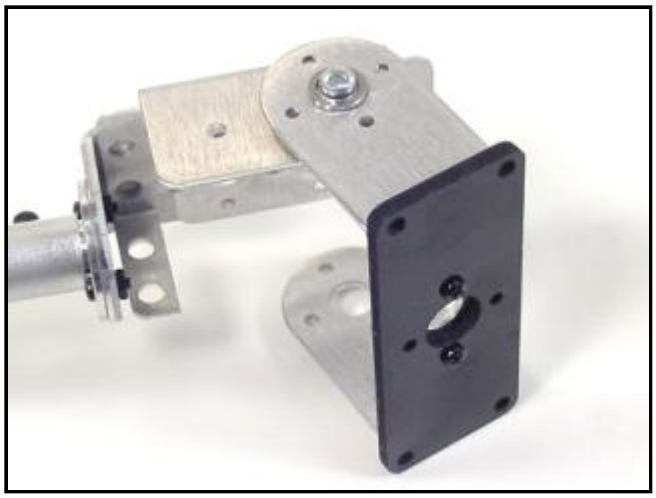
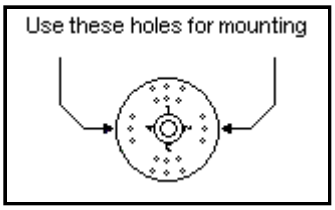


Figure 8-2.

Step 9.
The shoulder uses two HS-645 servos in its joint. Use four #2 x .250" tapping screws to attach the servos as shown. The connections on Servo B are temporary at this point.



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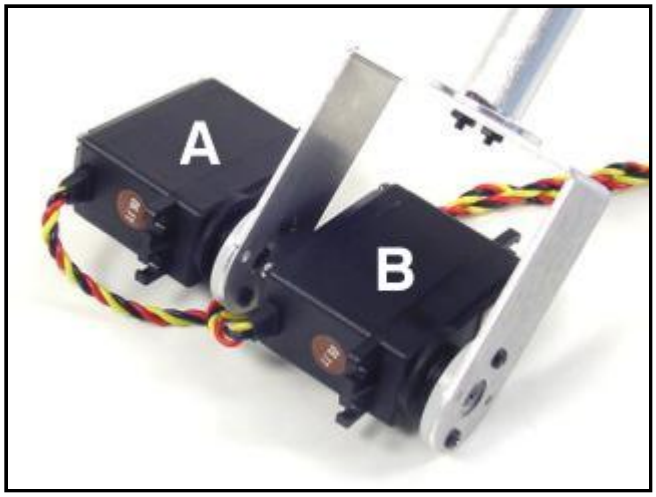


Figure 9.

Step 10.
Connect the shoulder servos to a Y-adapter as shown. Make sure to align the connectors properly, so that yellow goes to yellow, and black goes to black.

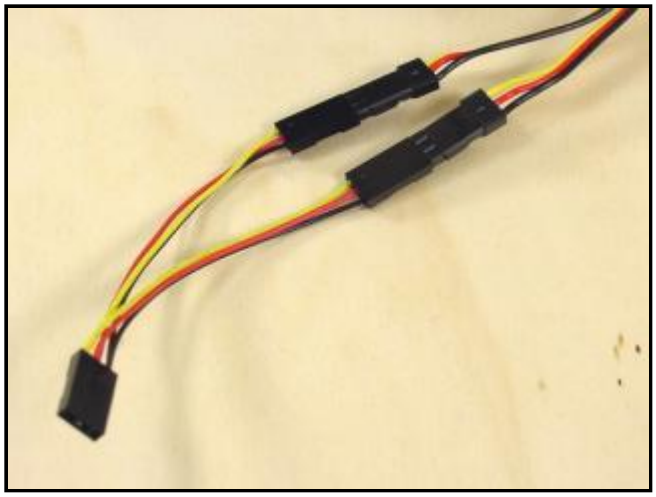
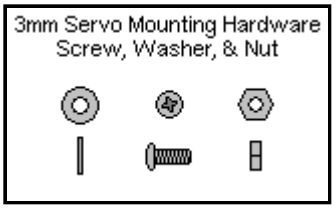


Figure 10.

Step 11.
Install an HS-645 servo into the elbow joint, and an HS-475 servo into the wrist joint. Use the #2 x .250" tapping screws to attach the brackets to the servo horns. For all servo installations, you have the option to use the 3mm hardware or the nylon rivet fasteners. The 3mm hardware will make a more rigid assembly, but the nylon rivet fasteners are faster. You can use whichever method suits you.

8 x



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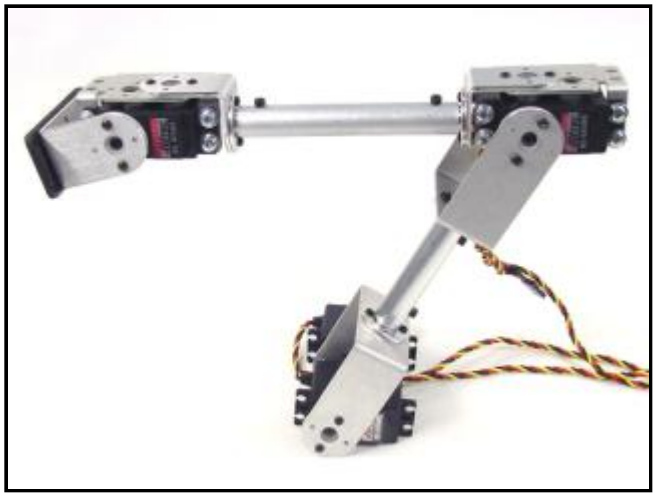


Figure 11.

Step 12.
Attach the Little Grip to the lexan as shown, using three 4-40 x .375" button head screws and acorn locking nuts. Only three screws are used (shown in the image) as the body of the gripper servo is in the way for the fourth. Make sure the HS-422 servo is aligned to mid-position, and the gripper is halfway open. Now the servo and gripper will be aligned correctly. Remove the servo screw and horn. Slide the servo into the gripper from the bottom. You may need to wiggle it a bit to get it seated properly. Use the servo screw to attach the servo. Tighten this down, but then unscrew it half a turn. Too much friction can bind the servo.

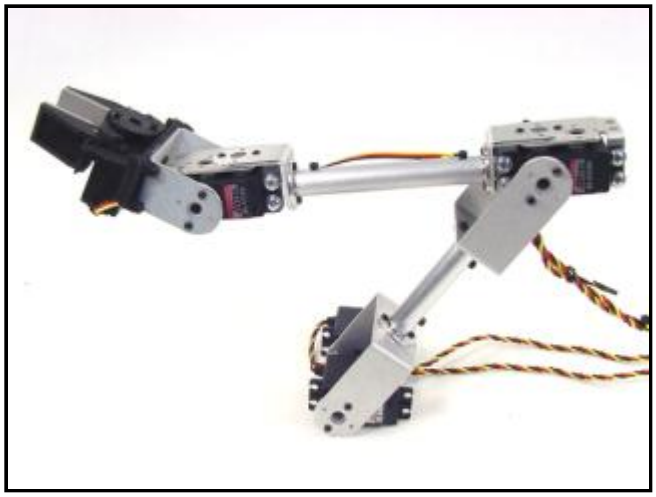
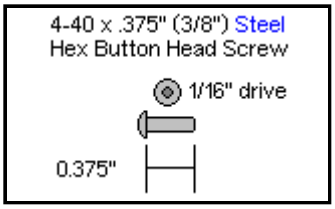


Figure 12.

3 x



3 x

Step 13.
Attach the arm to the ASB-13 on the base. Install the Y-adapter into channel 1 on the SSC-32. Use wire ties to wrap the shoulder servo wires as shown. **Note: Do not apply power to the servo controller until instructed to!**

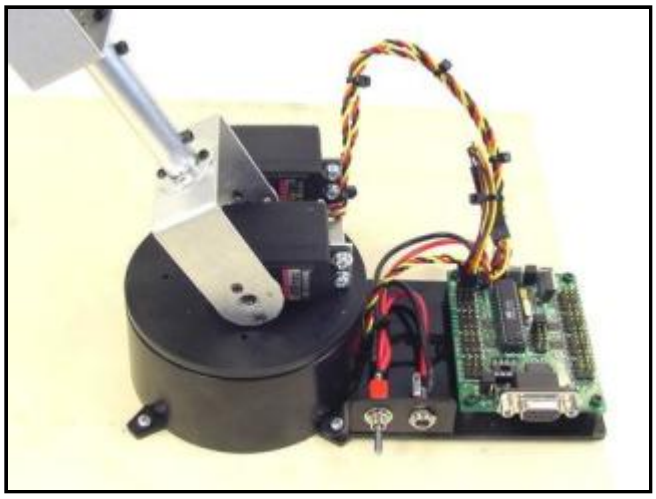
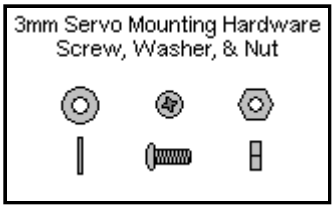


Figure 13.

8 x



Step 14.
Add a 12" and a 6" extender cable in series to the gripper servo. Plug the gripper in to channel 4 on the SSC-32. Add a 12" extender cable to the wrist servo, and plug it into channel 3. Add a 6" extender to the elbow servo, and plug it into channel 2. Use wire ties to neaten the wires from the elbow, wrist, and gripper servos as shown. How the wires are routed isn't critical, just make sure the arm is able to move in all possible positions without the wires binding.

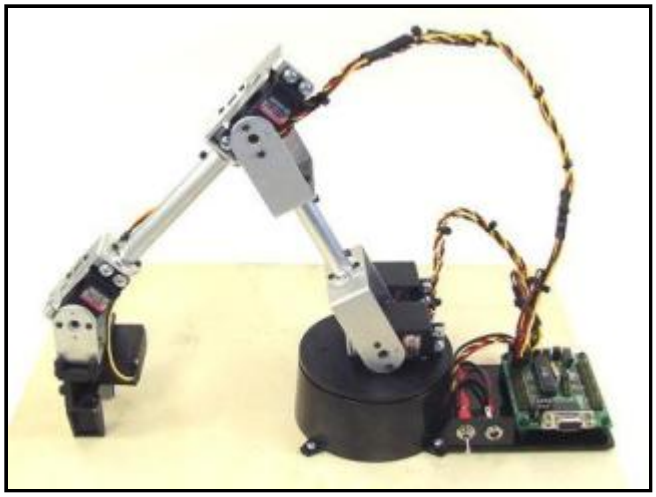


Figure 14.

Step 15.
The shoulder servos will receive the same command pulses via a "Y" servo cable adapter. The servos need to be mechanically aligned while maintaining centered position. Now that the shoulder servos are securely held in the base, we can align them. Remove the tapping screws in the outside servo's horn. Now center both servos. See the Servo Mid Position tutorial for more info. Now check to see if the mounting holes in the visible servo's horn match up with the holes in the bracket. If they do not line up, which is usually the case, drill two 3/32" holes in the servo's horn. Attach the "C" bracket to the servo horn using 2-56 x .250" screws and nuts. If necessary, you can remove the servo horn, rotate it, and reinstall it to have a clear place to drill.

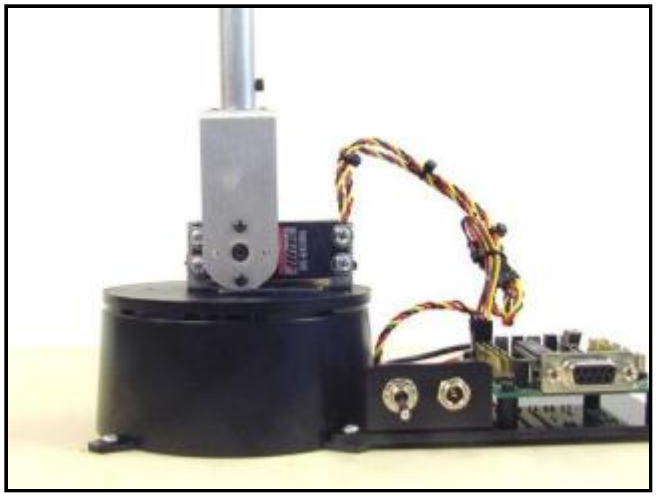
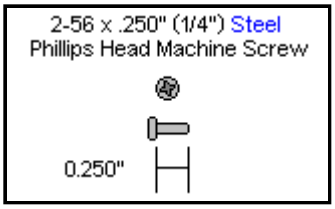


Figure 15.

2 x



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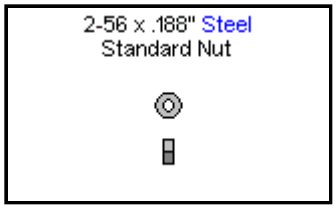

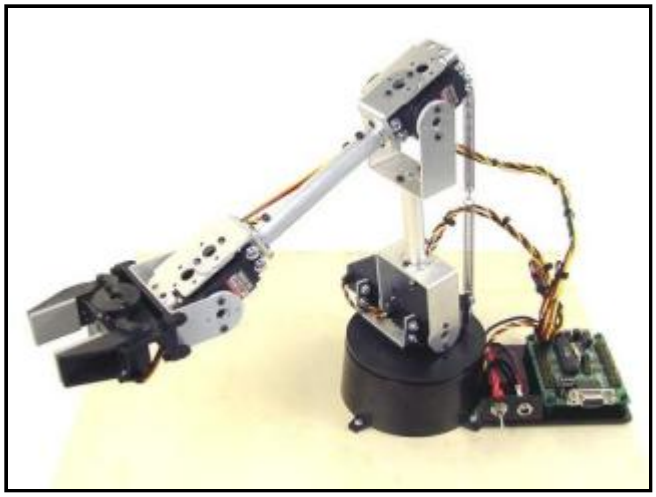
Figure 16.

Step 16.
This completes the mechanical assembly of the basic SES Arm. You can now move on to any of our arm tutorials, or continue this guide to add wrist rotation to the arm.

Step 17.
If you are going to use the RIOS L5 / L6 Arm control software, then you need to make one minor modification. Remove the servo horn screw from the elbow servo. Pull the servo horn off the servo, lift the arm two clicks (30°) at the elbow and reattach the servo horn and screw. Note, the Hitec spline has 24 grooves, so each groove is 15°.

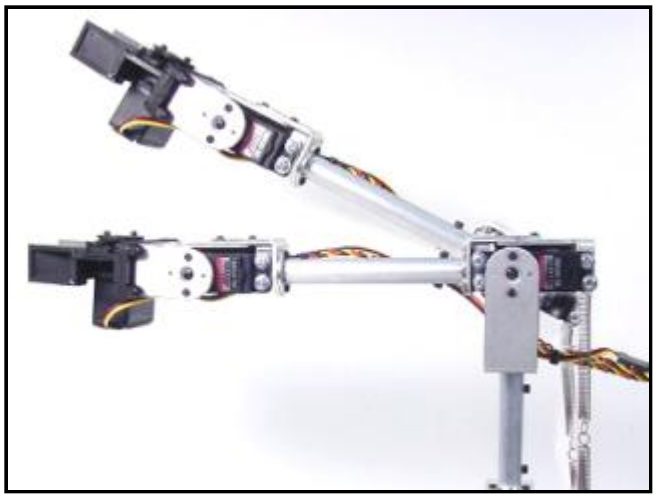
Figure 17.

Step 18.
Note: To maximize the lifting capability of the arm, attach the load-balancing springs as shown. Use the servo-attaching screws to hold the springs in place.

This step should be completed *after* the arm has been calibrated in RIOS!

Install RIOS (Robotic arm Interactive Operating System). **The serial number is located on the back of the CD sleeve.**

The RIOS user's manual (included with the program) will explain how to set up and use your robotic arm.

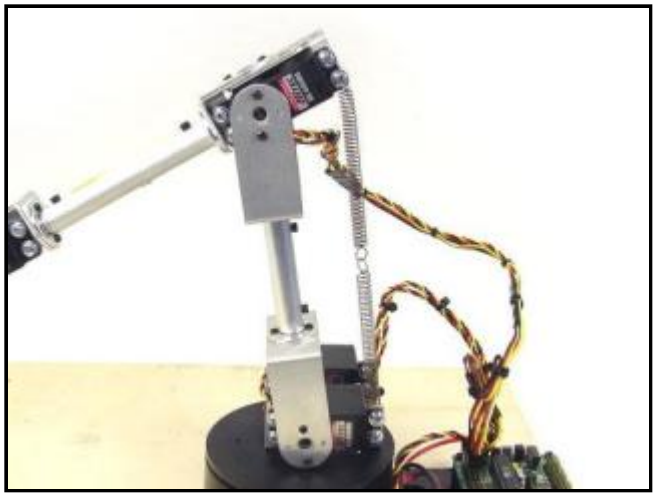

Figure 18.