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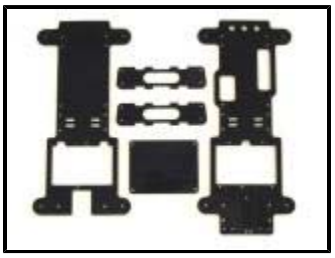
Lynx Hexapod 1 Inventory Sheet.
Updated 08/11/2003 Rev. 1



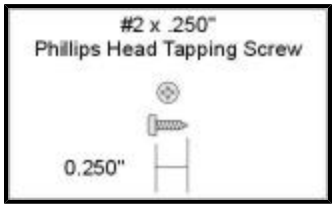
1) Lexan Parts (qty = 5)

2) Lexan Parts (qty = 21)

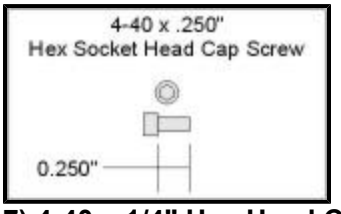
3) Hitec HS-422 Servo (qty = 3)

4) 1/4" Mini Power Switch (qty = 1)

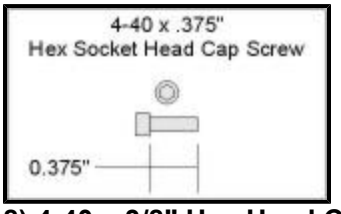
5) Rubber Feet (qty = 6)



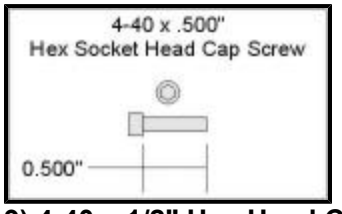
6) #2 x 1/4" Tapping Screw (qty = 6)



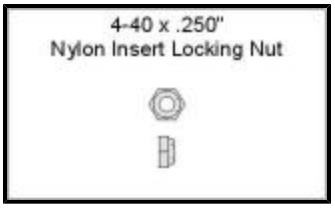
7) 4-40 x 1/4" Hex Head Cap Screw (qty = 12)



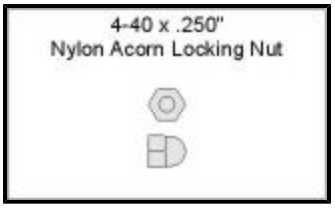
8) 4-40 x 3/8" Hex Head Cap Screw (qty = 36)



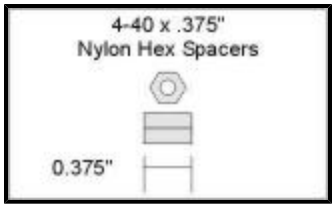
9) 4-40 x 1/2" Hex Head Cap Screw (qty = 10)



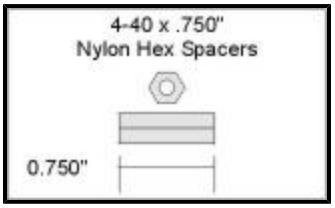
10) 1/4" Lock Nut (qty = 14)



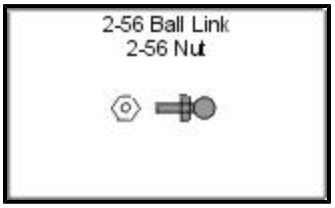
11) 1/4" Nylon Acorn Lock Nut (qty = 8)



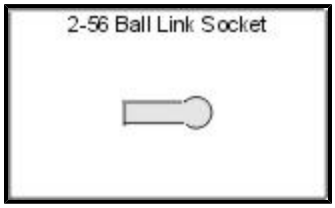
12) 1/4" x .375" F/F Hex Spacers (qty = 6)



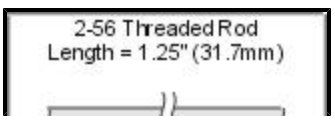
13) 1/4" x .75" F/F Hex Spacers (qty = 12)

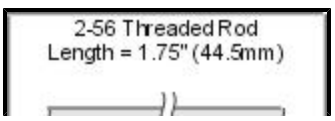


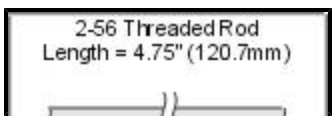
14) 2-56 Ball Link / Nut (qty = 12)



15) 2-56 Ball Link Socket (qty = 12)







16) 1.25" Threaded Rod (qty = 2)

17) 1.75" Threaded Rod (qty = 2)

18) 4.75" Threaded Rod (qty = 2)

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Tools Required to assemble the Lynx Arm.

Updated 06-23-2003 Rev. 1

1) 3/32" Hex Driver

2) Phillips Screw Driver

3) 5/64" Drill

4) Pliers

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Polycarbonate Information Page.

Updated 09/09/2003 Rev. 2

Please read this Safety First.

Why Polycarbonate?
We are moving all of our robots to use Polycarbonate. Why, because it is very strong. The image to the right is of me trying really hard to bend one of the H2 bottom panels. It really hurt holding this long enough for the camera to snap the image. When I let go it returned to it's normal flat shape, no worse for the wear. Now Polycarbonate is not indestructible, but it is very tough. A 1/8" thick x 1/4" wide strip can be broken, but it takes several back and forth bends before it finally breaks.

Will it Break? No!

Laser-cut Lexan properties
The cut edge has a black residue which can easily be cleaned with a damp rag or paper towel. It is normal and can't be helped. When the residue is cleaned off, the edge will still be darker than the material. The dark edge is going to be present no matter what color the Lexan is. Most people like the way the cut edge looks, but there are some who would prefer not to have the dark edge. Technically, it would be possible to try to polish the edges, but beware it would be a very labor intensive project, and not worth the trouble in my opinion.

Figure 1.

Lexan protective covering
The Lexan pieces have a protective covering that needs to be removed before assembly. When the laser cuts, the covering melts into the cut edge which can make removal difficult. If you gently scrape the cut edge with a metal edge, such as a flat blade screw driver, the covering can easily be separated with a thumb nail.

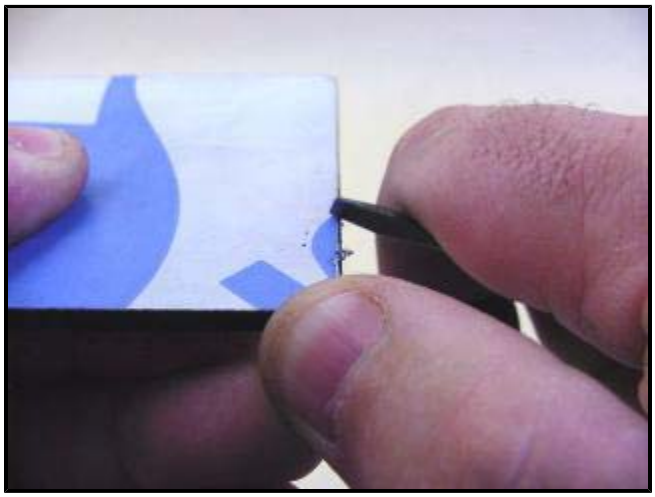

Figure 2.

Peal and Separate
Once it is started the covering easily peels off of the pieces. Note, you only want to scrape the edge. If done properly the pieces will not be damaged at all.

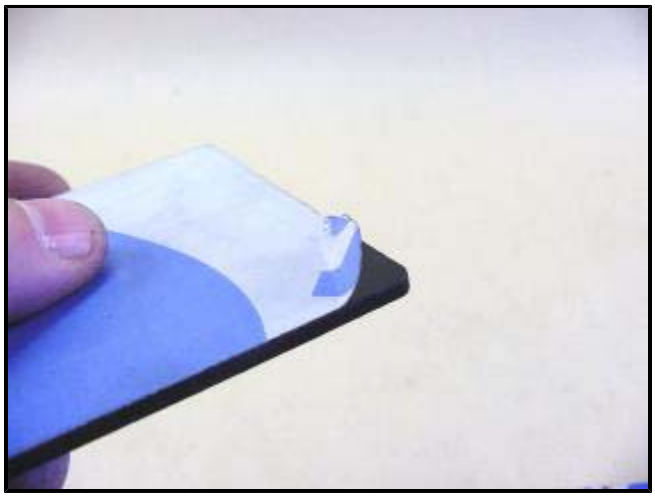
Figure 3.

Stubborn Coverings
From time to time the coverings can be more difficult to remove. If you have trouble you can gently scrape the cut edge as explained above, then put a piece of Duct Tape over it, then rip it up. This really works pretty well.

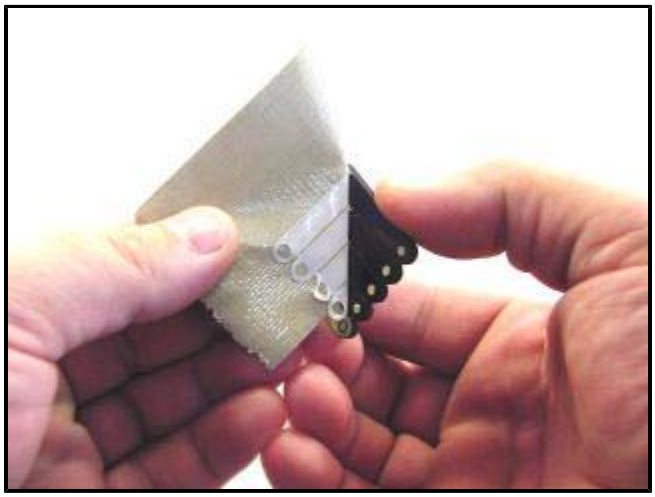
Figure 4.

The Finish
Lexan has a mirror smooth surface, but is easily scratched. As the material is cleaned or dusted off it will get tiny surface scratches. This is normal wear and tear for Lexan. It isn't really that noticeable, but under the right circumstances it can be very visible.

However the problem can be avoided by lightly sanding the parts with a random orbit sander with extra fine sand paper. This is easy to do, but also easy to mess up if not done carefully. The key is to use a non slip mat to hold the pieces in place while sanding, and to make light even passes with the sander. It can't be done by hand, and it has to be a random orbit sander to work properly. The result is a durable charcoal gray appearance that can't be scratched, because it has been pre-scratched in every direction.

Lexan can also be painted, but use paint specifically designed for use with Polycarbonate. Your local hobby shop can help with this. There has also been some new developments in the paint industry specifically for plastics. Check out Krylon Fusion.

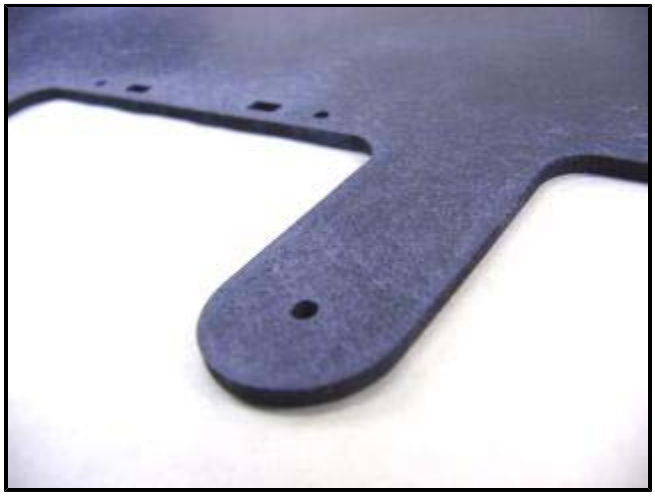
Figure 5.

Finishing the holes
The holes in the panels just need a bit of a push and they just fall out. I am using a 3/32" ball end hex driver here. It works quite well and it's required to build the kits anyway.

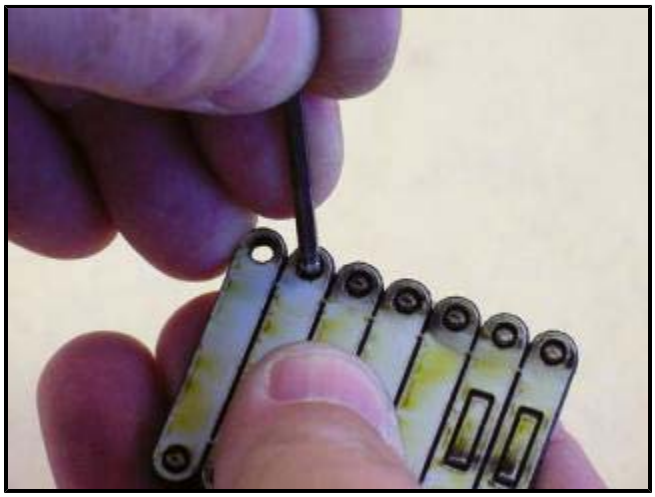
Figure 6.

Separating the parts
Some of the kits have parts nested to simplify packaging and reduce errors. Larger parts can be snapped apart. The smaller parts can be easily separated with a hobby knife. Be careful! Use a large wood backer and work slowly.

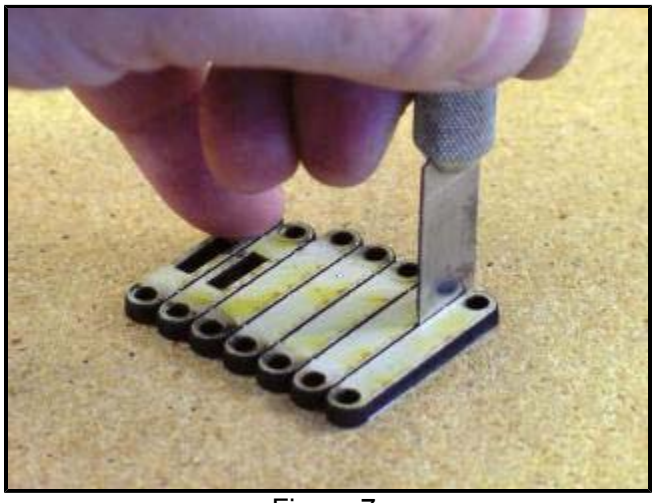
Figure 7.

Separating the optional openings
Some of the kits have optional openings that need to be cut out before assembly. Carefully press a flat Exacto knife into the opening where the part is attached to the main panel.

Caution! Do not attempt to snap these optional openings apart.

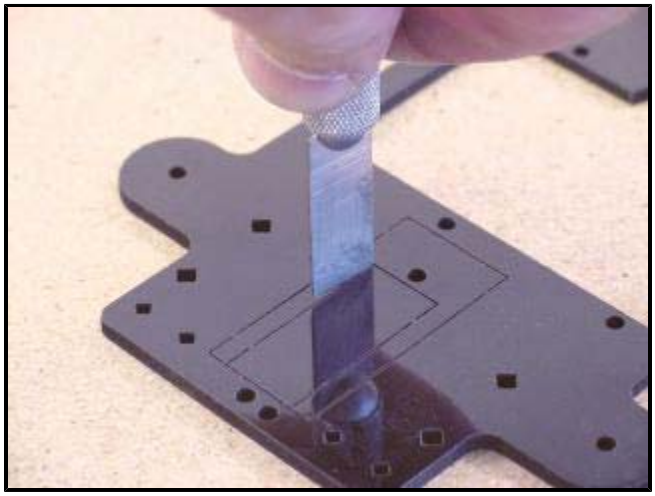
Figure 8.

Caution!
Lexan is the same material used in bullet proof glass. It is very strong, but has one important weakness. In the presence of certain chemicals, it will "craze". This means it will crystallize, become brittle, and even shatter. One substance in particular to watch out for is 1, 1, 1 Trichloroethane. This is a solvent, present in

some motor cleaners and degreasers, which will crystallize polycarbonate on contact. Trichloroethane is a liquid CFC and has been removed from use, but may still be out there. Some products have switched to its cousin, 1, 1, Difluoroethane. While not as vigorously reactive as the previous chemical, it is still capable of crazing Lexan if allowed to come into contact for too long. Also avoid using Loctite or thread locks on the chassis assembly. They are not necessary and may cause damage to the Lexan.

Other Information

Lexan is a bit on the expensive side compared to foam PVC and acrylic, but the added strength makes it well worth the added cost. It can be drilled and cut easily using standard wood working tools. Use a low speed on the tool and low feed rates to prevent the plastic from melting to the tool. Have fun building your robots, and above all be careful!

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Lynx Hexapod 1 Assembly Instructions.

Updated 08/11/2003 Rev. 1

Print this out and get the kit.

Please read this Safety First.
Check your Inventory
Lexan panel Preparation
Required Tools

Note: Do not use Loctite or thread locks on the assembly. They are not necessary and may cause damage to the Lexan.

Image of Hexapod 1.

Step 1.
You should have a small bag of parts packaged with each of your servos. Locate the four small rubber bushings and install them onto the servo as illustrated in figure 1. These parts are polarized, meaning they can only be installed one way. If you have difficulty, try turning the part around. The other components in the servo parts bag are not needed. Do this for all three servos.

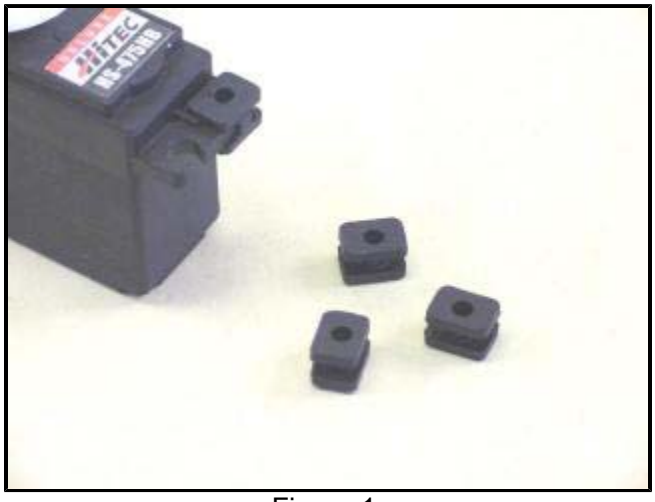
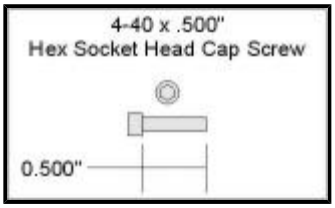


Figure 1.

Step 2.
Install the center "Lift" servo into the bottom chassis panel as shown. Use two of the .500" screws and two nylon insert locking nuts. Easy does it. These can be over tightened. Hint: Wrap the wire around the servo once and place a small piece of electrical tape over it to hold it in place. This will make the assembly easier when you join the top and bottom chassis panels together.

2 x 

2 x

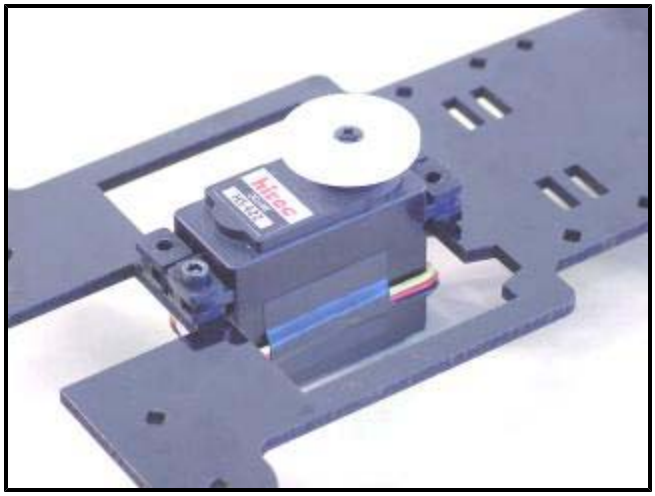
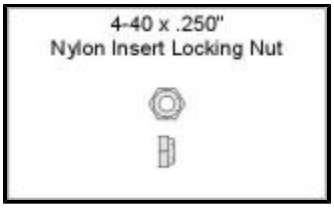
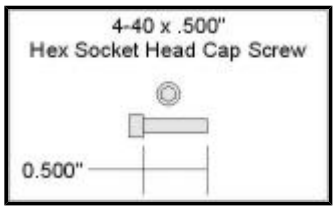


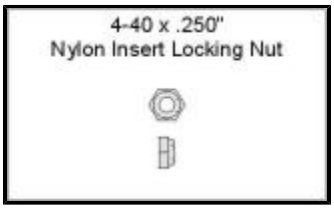
Figure 2.



Step 3.
Install the left and right "Stride" servos into the top chassis panel as shown. Use four of the .500" screws and four nylon insert lock nuts. Easy does it. These can be over tightened. Don't forget the tape on these servos as well.

4 x


4 x



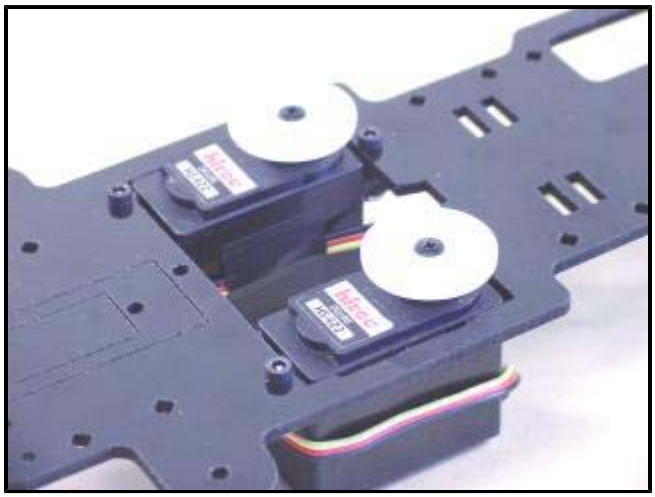
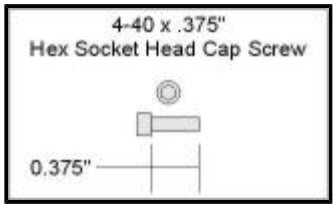
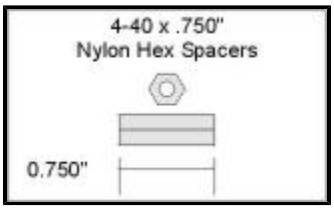


Figure 3.

Step 4.
Install the nylon hex spacers onto the bottom chassis panel as shown. Use eight of the .375" 4-40 screws and eight of the .750" nylon hex spacers. Tighten these down snugly.

8 x


8 x



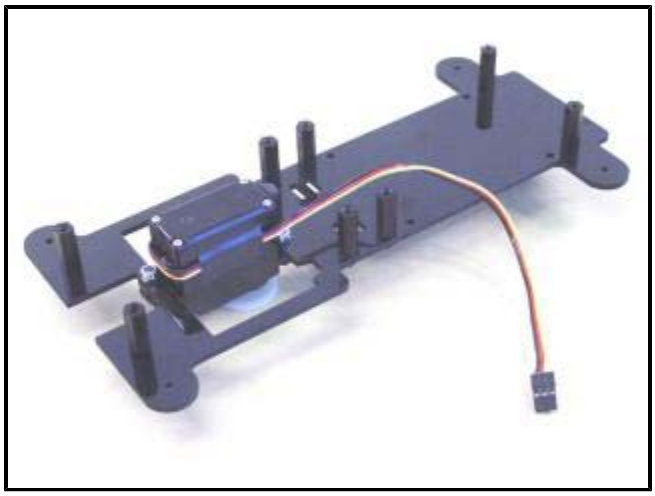


Figure 4.

Step 5.
Install the two center leg panels as shown. The longer edge goes to the bottom. Run the servo wires through the hole. If these don't fit right, then adjust the nylon spacers so the flat side is aligned with the center leg panels. They should fit perfectly.

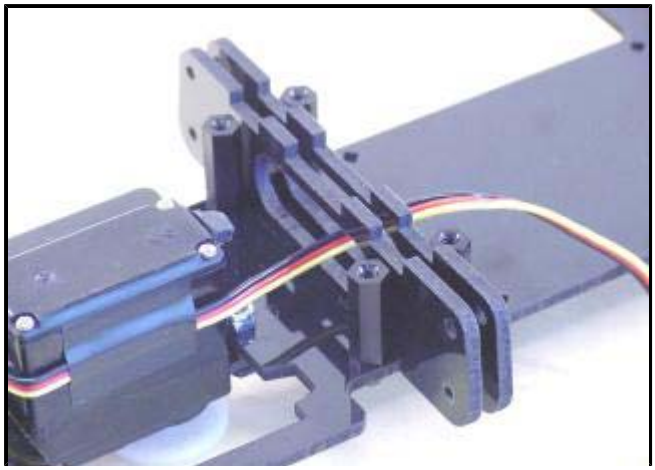
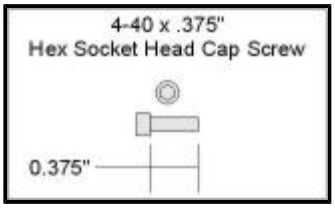


Figure 5.

Step 6.
Bring the top and bottom chassis panels together to complete the chassis assembly. Don't forget to route the servo wires through the holes. Then install the eight .375" 4-40 screws. Tighten these down snugly.

8 x



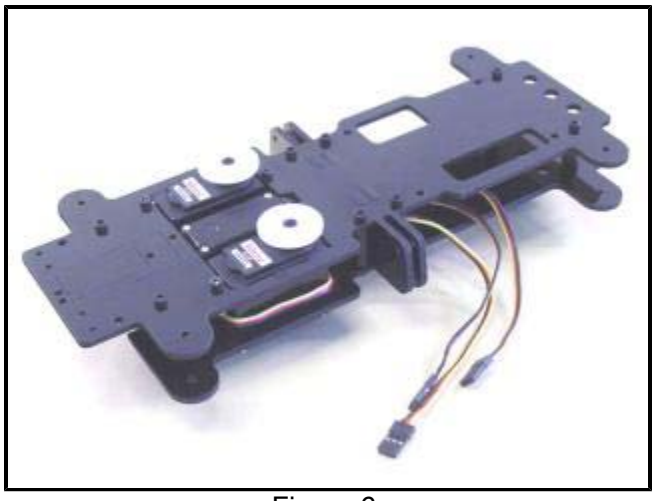


Figure 6.

Step 7.
Caution! This step needs to be done carefully. If the parts are assembled incorrectly it may not be possible to disassemble them without damage.

Make the front and rear legs as shown. These parts snap together. It is a tight fit, but should be relatively easy. Start by lining up the parts and firmly rocking the "C" shaped part while pushing them together. If you find it difficult you can smooth the inside of the leading edge of the "C" part with some fine sand paper. This will smooth the rounded edge allowing it to slide on the leg easier. The part labeled "T" goes on the top and the part marked "B" goes on the bottom. Look at figure 9 and 10 for a better view.

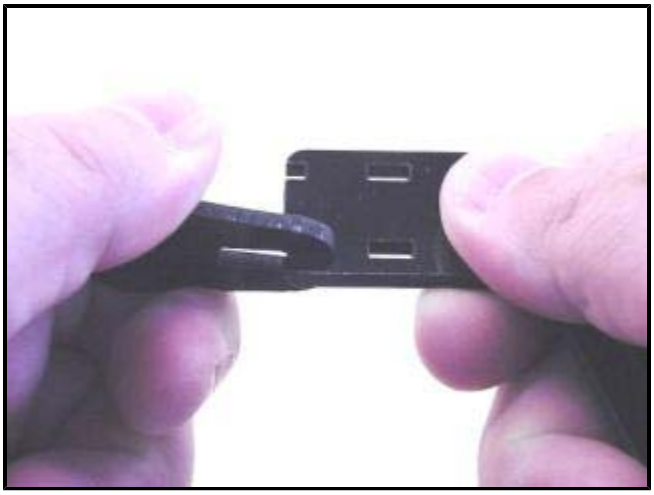


Figure 7.

Step 8.
Next, install the top part onto the leg. When you are done you should have two legs that look like figure 9, and two legs that look like figure 10.

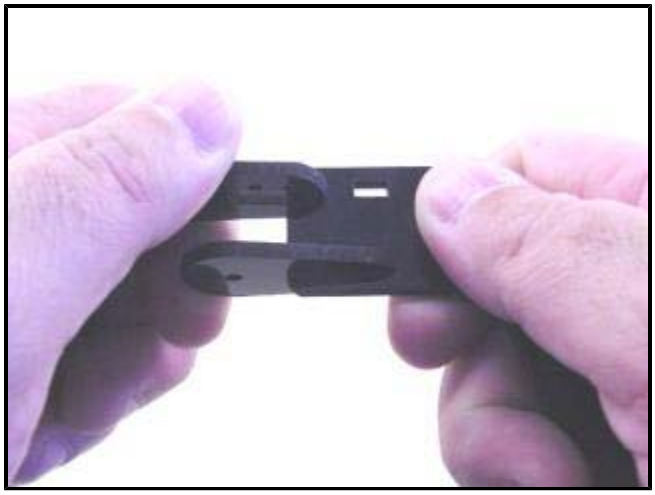


Figure 8.

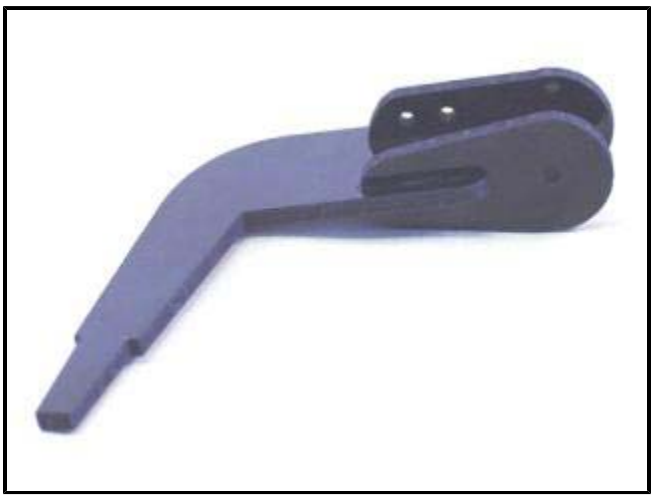


Figure 9.

Figure 10.

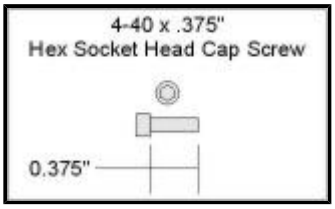
Step 9.
Install the rubber feet onto the legs. They just press on.

4 x

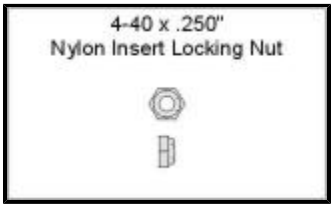
Figure 11.

Step 10.
Install the two front legs as shown. Use two .375" 4-40 screws and nylon insert lock nuts for each leg. These should not be tightened too much. The leg should be able to move with ease.

4 x



4 x



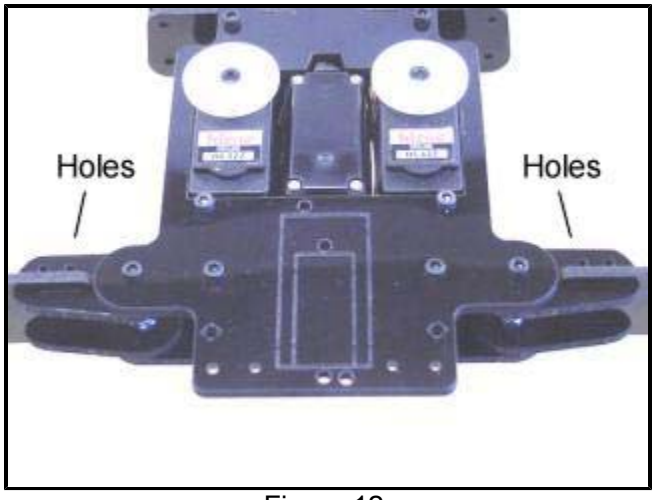
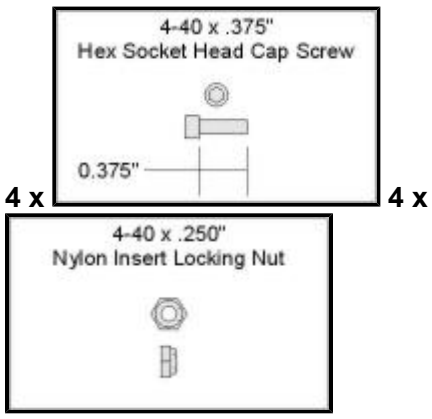


Figure 12.

Step 11.
Install the two back legs as shown. Use two .375" 4-40 screws and nylon insert lock nuts for each leg. These

should not be tightened too much. The leg should be able to move with ease.



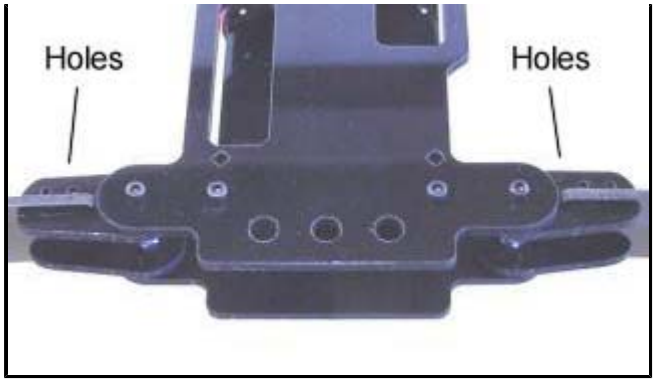
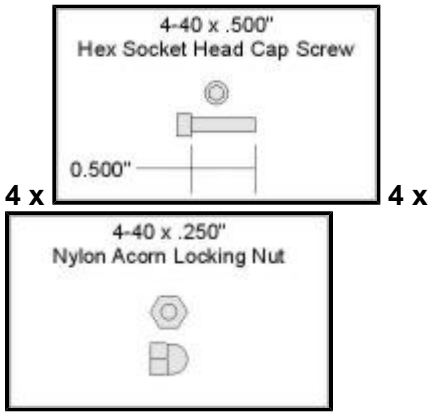


Figure 13.

Step 12.
Install the upper and lower middle leg levers as shown. Use two .500" 4-40 screws and nylon acorn lock nuts for each side. Do this for both sides. These should not be tightened too much. They should be able to move with ease.



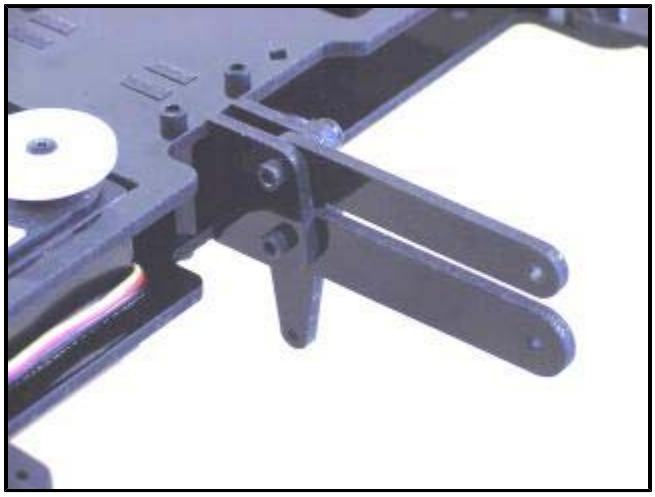
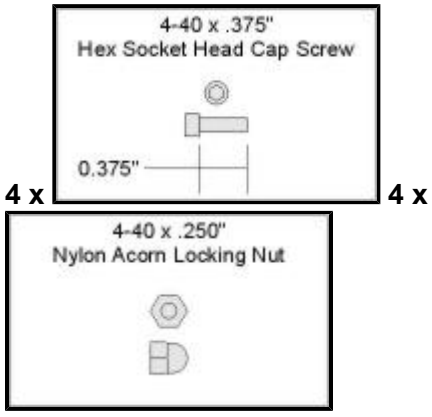


Figure 14.

Step 13.
Install the two middle legs as shown. Use two .375" 4-40 screws and nylon acorn lock nuts for each leg. Do this for both sides. These should not be tightened too much. The leg should be able to move with ease.



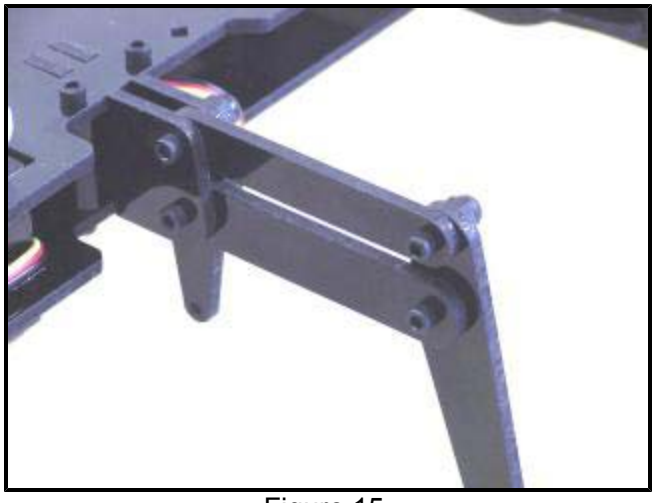


Figure 15.

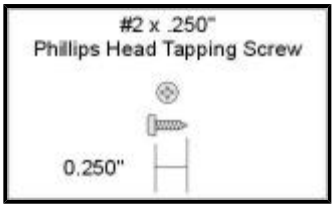
Step 14.
Install the two rubber feet onto the middle legs. The just press on.

2 x

Figure 16.

Step 15.
Install the two stride servo horn brackets as shown. Use four of the .250" #2 tapping screws

4 x



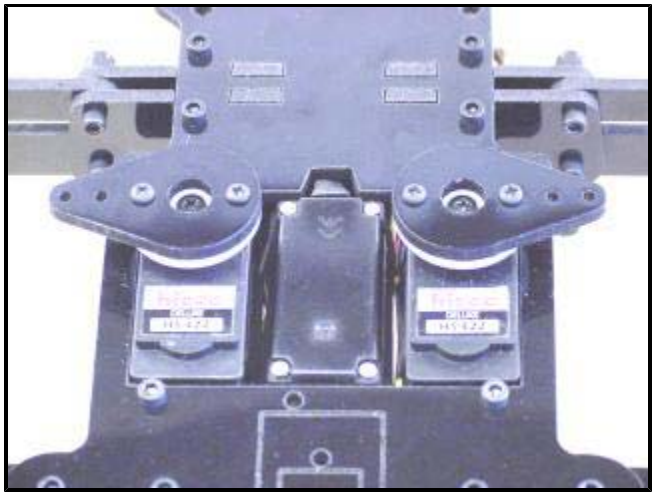
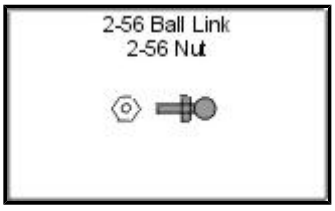


Figure 17.

Step 16.
Install the 2-56 threaded ball links as illustrated. Install the ball links to the outside of the front legs. The ball links install from the bottom on the servo horn brackets. Do this for both sides. These should be tightened with care. They can be broken if over-tightened.

6 x



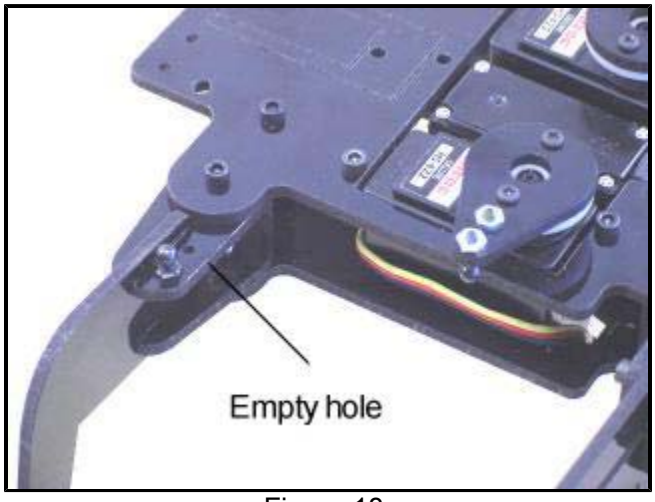
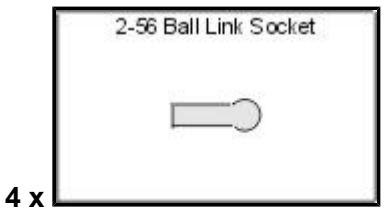


Figure 18.

Step 17.
Make two links for the front legs. Use the two 1.75" (44.5mm) threaded rods and four of the ball link sockets. The overall length should be 2.45" (62mm) when assembled. It is more important that both sides are the same, rather than being a specific length.

Finally snap them onto the ball links. Do this for both sides.



4 x **2 x**

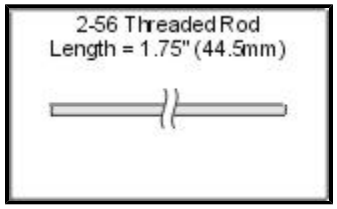
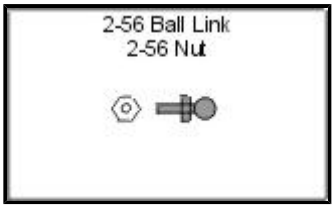


Figure 19.

Step 18.
Install two of the 2-56 threaded ball link as illustrated. Orient the ball links to the inside of the rear legs. Do this to both sides. These should be tightened with care. They can be broken if over-tightened.



2 x

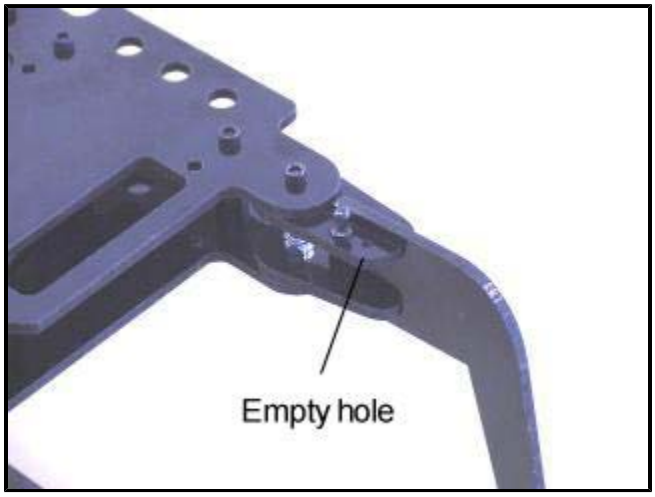
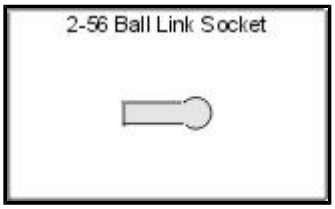
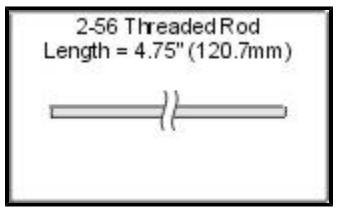


Figure 20.

Step 19.
Make two links for the back legs. Use the 4.75" (120.7mm) threaded rods and four of the ball link sockets. The overall length should be 5.50" (139.7mm) when assembled. It is more important that both sides are the same, rather than being a specific length. Finally snap them onto the ball links. Do this for both sides.



4 x **2 x**



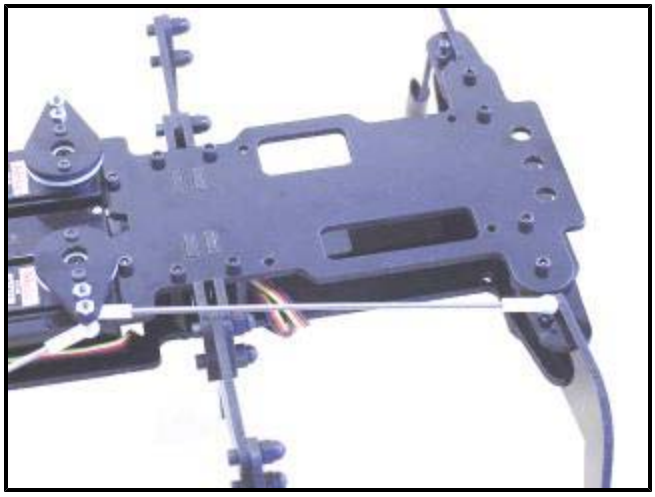
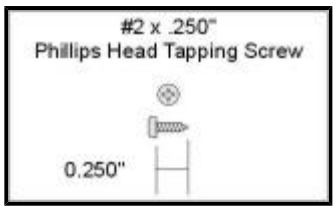


Figure 21.

Step 20.
Install the lift servo horn bracket as shown. Use two of the .250" #2 tapping screws



2 x

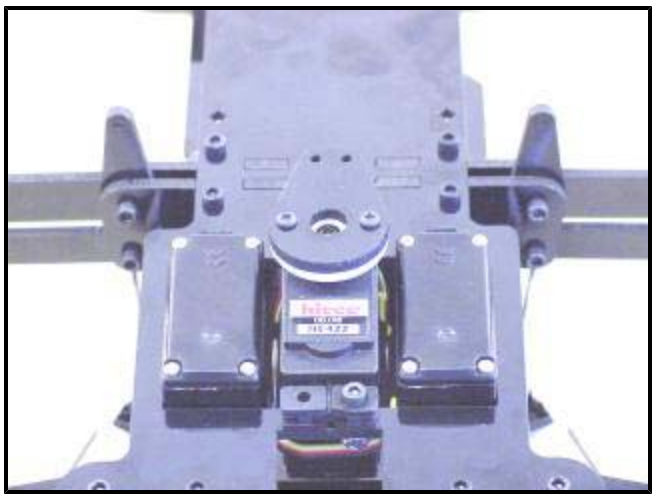
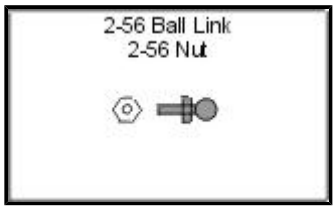


Figure 22.

Step 21.
Install the 2-56 threaded ball links as illustrated. Install the ball links from the front of the robot on the center legs. The ball links install from the bottom on the servo horn brackets. Do this for both sides. These should be tightened with care. They can be broken if over-tightened.



4 x

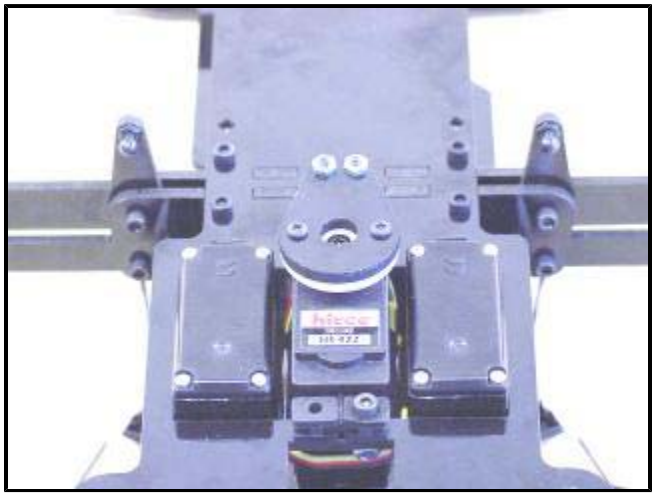
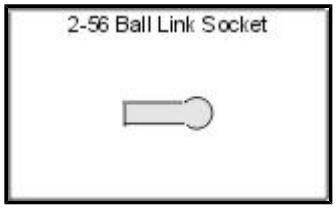
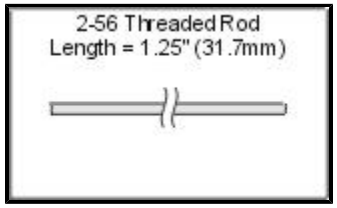


Figure 23.

Step 22.
Make two links for the center legs. Use the 1.25" (31.7mm) threaded rods and two ball link sockets. The overall length should be 1.90" (49.0mm) when assembled. The legs should both touch the ground if the links are adjusted properly. Finally snap them onto the ball links. Do this for both sides.



4 x **2 x**



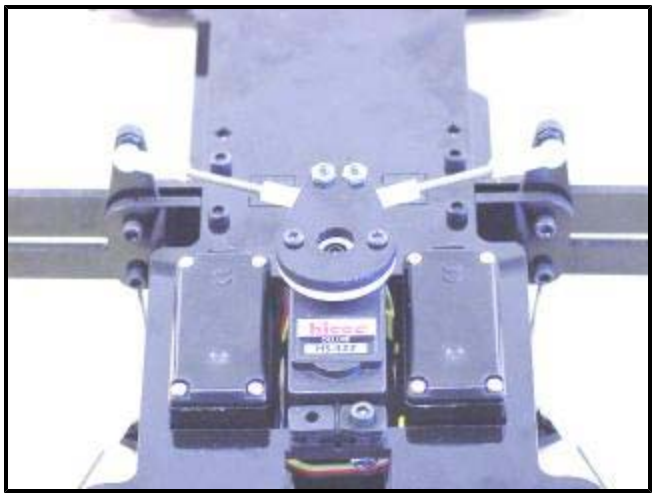
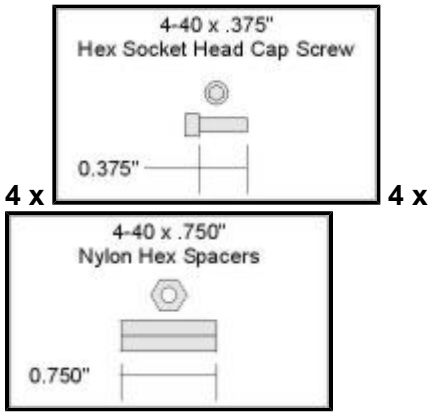


Figure 24.

Step 23.
Install the four .750" nylon hex standoffs as shown. Use four of the .375" 4-40 screws. These will hold the battery tray.



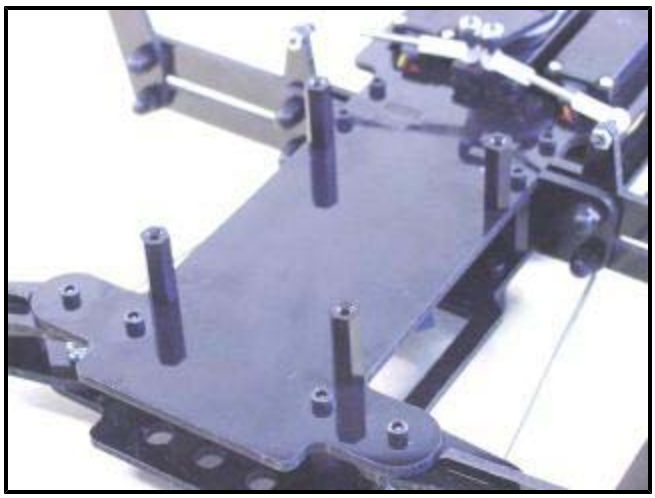
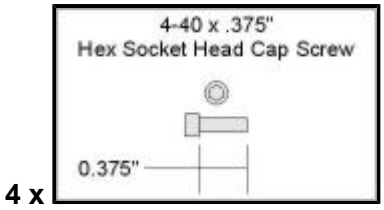


Figure 25.

Step 24.
Install the battery tray using four of the .375" 4-40 screws.



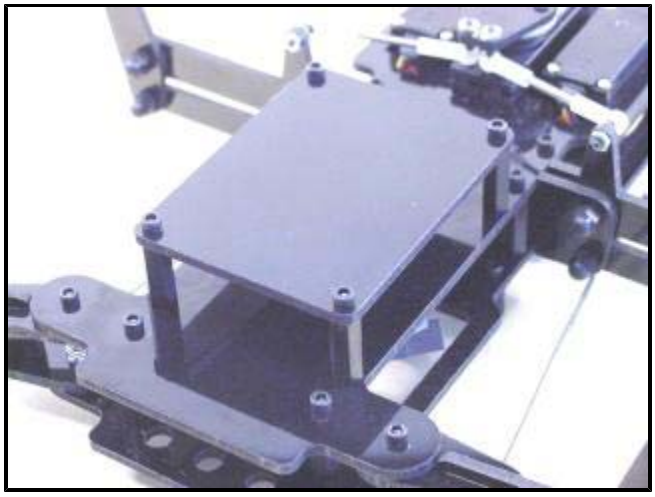


Figure 26.

Completion!
This completes the basic assembly of robot chassis. There are options from this point which are covered in separate assembly guides. The chassis weighs about 13 oz. at this stage.


Figure 27.

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Lynx H1 PC board Installation Instructions.

Updated 08/11/2003 Rev. 1

Print this out and get the kit.

Please read this Safety First.
Lexan panel Preparation
Required Tools

Note: Do not use Loctite or thread locks on the assembly. They are not necessary and may cause damage to the Lexan.

Image of Hexapod 1.

Note:
The Nest Step can be mounted to the top of the robot, or inside the robot. When mounting the Next Step on top of the chassis it is easier to access the I/O bus, jumper settings, and IC socket. This is helpful if you are new to building robots, or if you want to a lot of experimentation with the electronics. After it is working the way you want the Next Step can be moved inside the chassis for a more streamline appearance. With the PC board mounted on top you can use the inside of the chassis to hold additional items such as a video transmitter. There is no right or wrong way to set it up, do it the way you want.

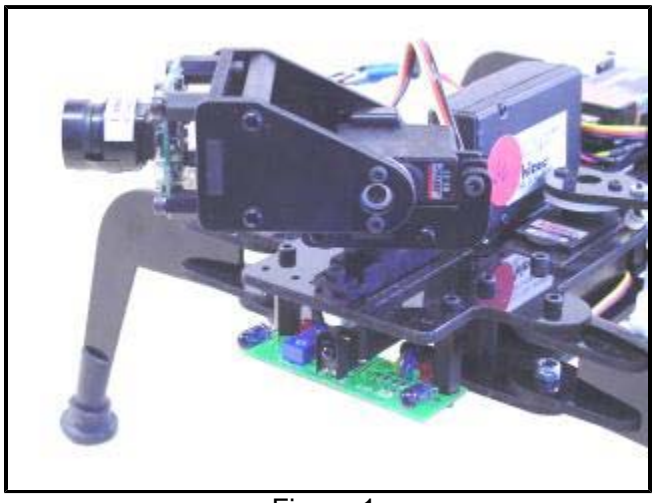
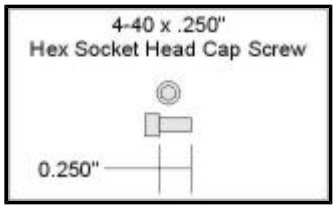


Figure 1.

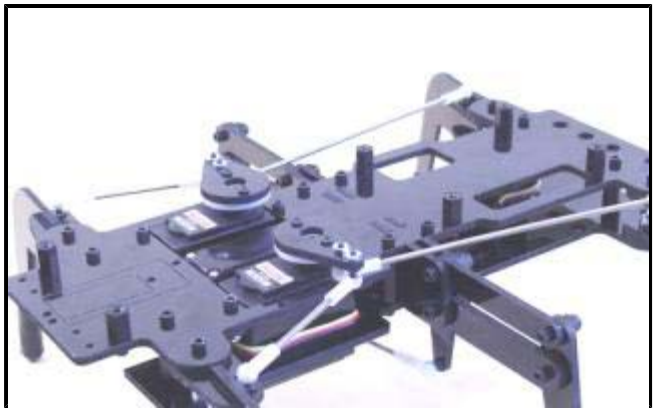
There are several options for this chassis. There are two optional openings on the front that will accept either an HS-81 micro servo, or an HS-422 standard size servo. An ultrasonic sensor can be attached to the standard size servo with the ultrasonic sensor housing. A pan and tilt can be added to the front in the HS-81 opening. The IRPD can even be used at the same time, as illustrated in figure 1. There are also mounting holes for bumper switches as well.

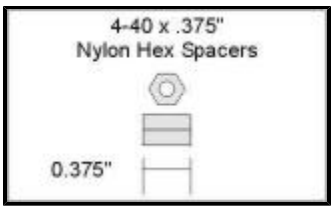
Step 1.
Install the .375" hex spacers for the Next Step and IRPD as shown. Use six of the .250" 4-40 screws for this.

6 x

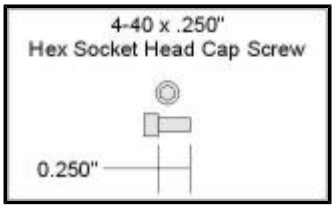


6 x

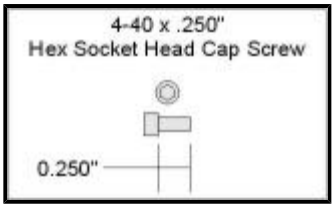




Step 2.
Install the IRPD using two of the .250" 4-40 screws.

2 x


Step 3.
Install the Next Step using four of the .250" 4-40 screws.

4 x


Note: The servos plug in as follows:

I/O 0 = Left servo
I/O 1 = Right servo
I/O 2 = Middle servo

The IRPD will be plugged into either I/O 8-10, or I/O 13-15 depending on the program that is being downloaded. Check the "connections" within the text of the program to be sure.

Step 4.
Wire the power switch as per the diagram in figure 5. Pushing the toggle to the right applies power only to the Next Step. This allows programming without the robot walking around. Pushing the toggle to the left applies power to the Next Step and the servos. This is for normal operation.


Figure 2.

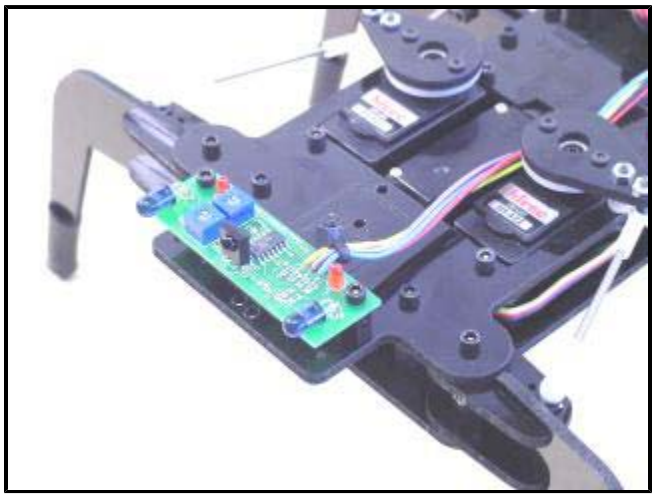


Figure 3.

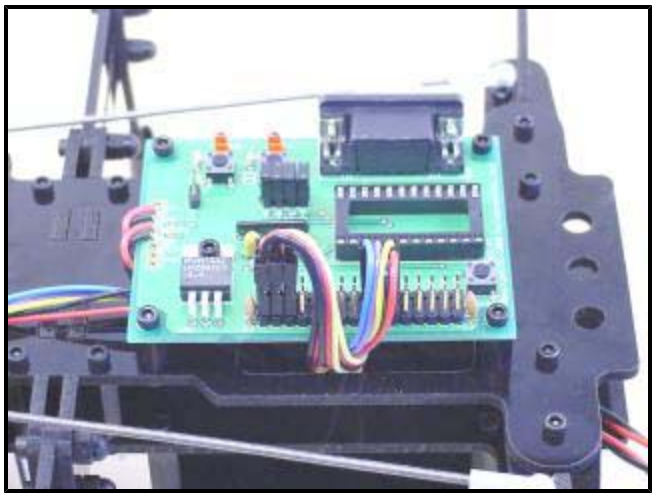


Figure 4.

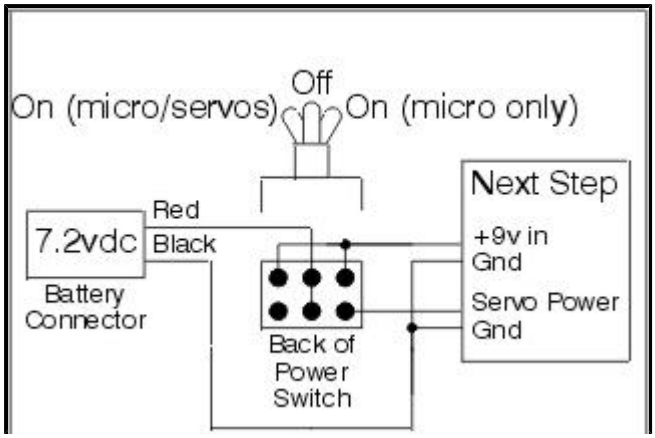


Figure 5.

Step 5.
Install the power switch as shown. I mount it so pushing the toggle forward causes the robot to operate normally, and pushing the toggle back turns on the electronics, but not the servos.

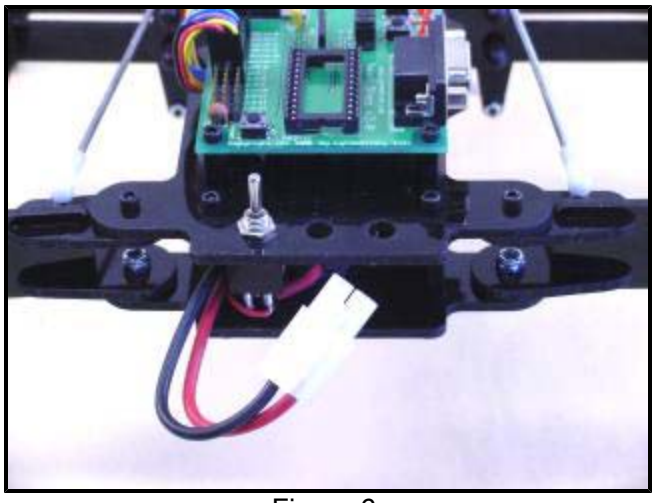


Figure 6.

Step 6.
Install the Atom, BS2 or OOPic-C as illustrated.

The robot is now ready for programming and experimentation. We have many programs for this robot. They can be found on the software / projects section of the web site. Consult the documentation that comes with your favorite stamp based microcontroller for programming information.

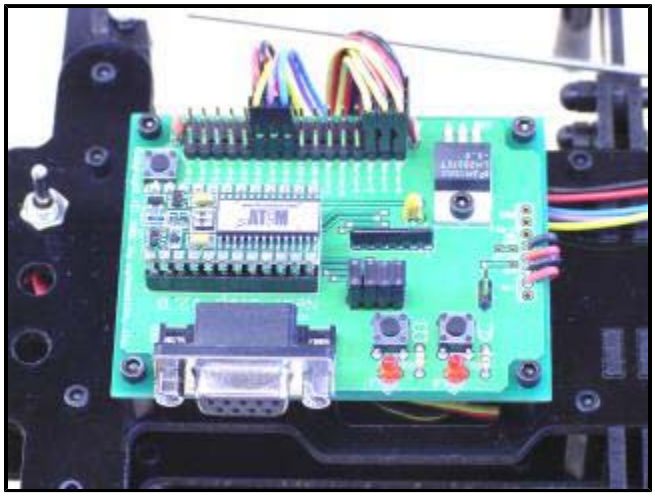


Figure 7.

Option 1.
Figure 6 illustrates the IRPD sensor installed on the front of the robot.

IR Proximity Detector Sensor / Part no. IRPD-01 / $29.95

Figure 6.

Option 2.
Figure 7 illustrates the ultrasonic sensor installed on top of a standard size servo with our ultrasonic sensor housing.

Ultrasonic Range Sensor / Part no. URS-01 / $35.95
Single Ultrasonic Sensor Housing / Part no. URSH-03 / $4.95

Figure 7.

Option 3.
Figure 8 illustrates the pan and tilt installed in the front. This is the Remote Piloted version of this kit.

Pan and Tilt Kit (B) / Part no. BPT-KT (coming soon)

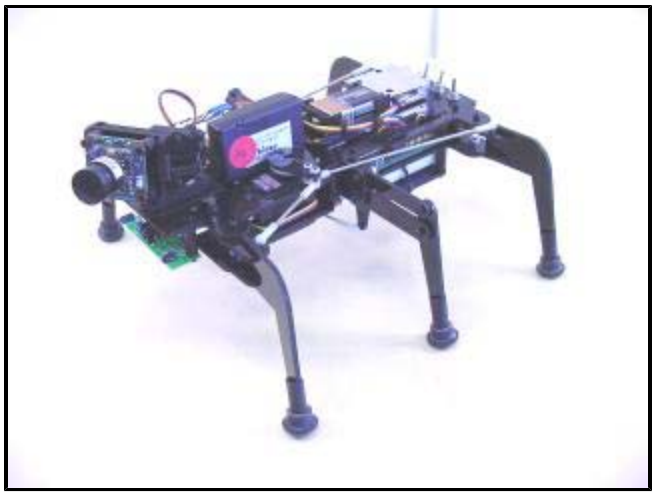


Figure 8.

Option 4.
Figure 9 illustrates the bumper kit installed onto the front of the robot.

Bumper Switch Assembly Kit / Part no. BMP-01 / $10.00 pair

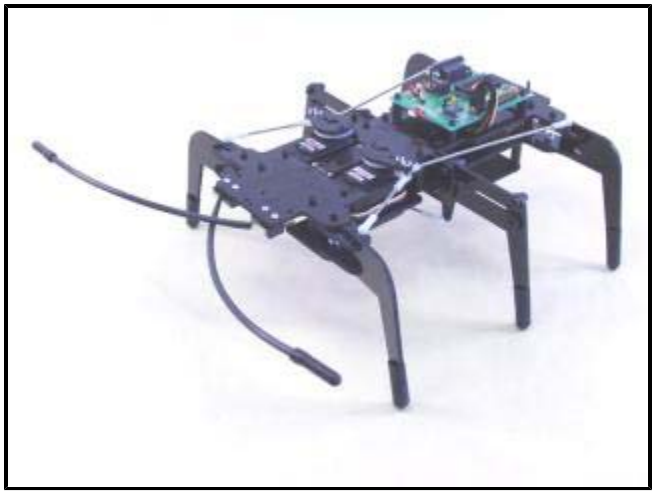


Figure 9.

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