

## SKU0001 Lightweight Carbon Fiber Robot Claws and Wrist Center Kit B9 Robot Motorized Claw Assembly Manual V1.00

I'm Robert Rossi B9-0694 fellow builder, thank you for your purchase of my B9 Builders Club Robot Claw Kit. This B9 Claw Kit can be assembled and built in 2 different ways. The claws can be motorized (Hitec Servo Motor) and non-motorized (positioned manually by hand). This document is the assembly manual for motorized operation of the claw. If you are looking for Non-Motorized manual please visit the B9 Builders club at [www.b9robotbuildersclub.com](http://www.b9robotbuildersclub.com) and download a copy.

### Document Resources for Lightweight Carbon Fiber Robot Claws and Wrist Center Kit:

**B9 Robot Claws Finishing & Painting Instruction Manual** (Complete this first before proceeding)

**B9 Robot Motorized Claw Assembly Manual** (This Manual)

**B9 Robot Non-Motorized Claw Assembly Manual**

### Things you should know about the kit before proceeding:

**SKU0001 - Lightweight Carbon Fiber Robot Claws and Wrist Center Kit \$299.00**

If you are motorizing your Claws, you need both of these kits below - they are **NOT** included in the SKU0001 Kit:

**QTY 1 [SKU0002 Servo Gear Kit](#) \$39.00 USD** can be purchased when you order just let me know if you are motorizing your claws

**QTY 2 [HS-5645MG Servos](#) \$39.00 USD EACH** You will need 2 servos per B9 Robot Build. Can be found at [www.servocity.com](http://www.servocity.com)

Why did I make these parts separate from the kit you ask?

#### **SKU0002 Servo Gear Kit**

I separated this Servo Gear kit in effort to reduce costs for the builders who are not motorizing their robot's claws. I recognized many of you will not be motorizing your robot claws. So, I wanted to keep the B9 Claw Kit priced low. This SKU0002 Servo Gear Kit contains 2 very expensive special gears. You need to buy this kit if you want to motorize your claws. The 2 gears in this kit interface the servos and the 4 drive gears included in the B9 Claw Kit. Only 1 kit is required per B9 Build. These special gears **ONLY fit Hitec Servos**. This kit separation arrangement keeps the kit costs relatively low and lets the builder decide if they want to implement the motorized version now or later. I recognize it does require you to order this kit separate from the 299.00 Claw Kit, but I think the members not motorizing their claws will be happy about the price break.

#### **HS-5645MG Servos**

I do not supply the servos for the robot claw kits as they are readily available just about anywhere. The B9 Claw Kit has been designed to use QTY 2 Hitec Servos. I'd suggest contacting [www.servocity.com](http://www.servocity.com) Part Number [35645S](#) HS-5645MG Servo they are about 39.99 per servo and you will need 2 for servos per B9 Claw Kit. The people at [www.servocity.com](http://www.servocity.com) are great there and customer service is awesome.

This kit fits nicely fits Craig Reinbrecht Wrist and Norman Sockwells Wrist. (B9 Robot Wrist are not included – Contact Craig or Norman)



Craig's Wrist



Norman's Wrist

**Before we get started:**

At the time of printing this manual the pictures that follow will be using a variety of Finished and Unfinished Robot Claws for demonstration purposes. When you go to install the B9 Robot Claws on your robot all the steps that were outlined in the “B9 Robot Claws Finishing & Painting Instruction Manual” should be completed **before** moving any farther with this manual. So download the B9 Robot Claws Finishing & Painting instructions now before proceeding. I mention this finishing & painting instruction manual throughout this assembly manual. Sorry if its overly repetitive.

**Important:**

I used a set of unfinished claws in this user manual to show you the builder exactly what parts we are showing for assembly. The way you finish your B9 Robot Claws is completely up to you. If you follow all the steps in the Finishing and Paint Instruction guide and you take your time with doing the proper prep work, you will have a set of claws you will be proud of. It takes a lot of work wet sanding, a lot of water, primer, paint and a ton of elbow grease! Follow the guide and the claw kit will turn out great. I want all the builders to have a great experience with this kit and I hope that will be the case. Hope you enjoy all my hard work. If you have any questions please send me an email to [davros.dalek@gmail.com](mailto:davros.dalek@gmail.com) I will be happy to answer any questions you may have about the B9 Robot Claw Kit. – Robert Rossi B9-0694

**A Giant THANK YOU - Todd, Greg and Craig.**

I'd like to take time and mention Gregorio Padin and Todd Mustachio without them this kit would not have been possible. We all worked so very hard to bring the builders club this B9 Claw Kit...and I am grateful for their expert building techniques. They are remarkable friends and I am grateful for both of them. I'd also like to thank Craig Reinbrecht who painstakingly reviewed the design and gave it his blessing for accuracy. Thank you to all of you!

**Familiarize yourself with all the parts of the build, test fit everything.  
Ensure the pieces all go together before and after painting.**



Metal Axle

Brass Drive Gear

Gear needs to spin freely.

**Do not** use set screws

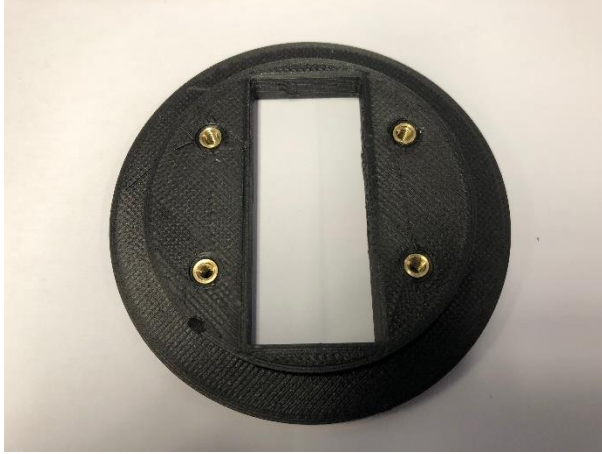
Temporarily insert the axles into the gears. You are test fitting these gears assuring they spin freely.

Please Note: The axles stay stationary in the design and the gear and the claw spin together on the stationary axle. It's necessary that the claw and gear spin freely enough so the servo can move them easily. If the assembly is too tight, the servo will be under too much load and not operate properly.

**Do not** use set screws the gear should turn freely on the axle for the motorized version of the robot claws. If your axle is too tight use sand paper to sand axle evenly. The brass gear should spin freely on the axle. You are test fitting these so you know they will fit properly after the claws have been painted. Test fitting all the pieces together is essential and required for the build to be properly executed.

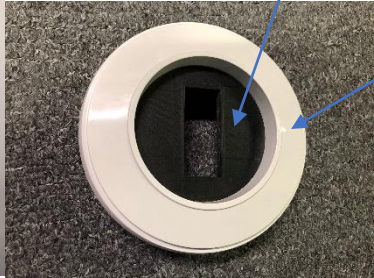
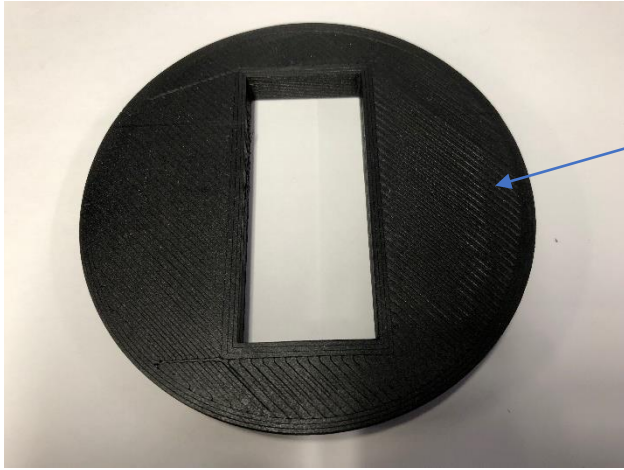
#### **Drying Time 1 Week - Painting Tip:**

The B9 Robot Claws Finishing & Painting Instruction Manual shows you how to prep the 3D printed parts for painting. I wanted bring attention to a lengthy time delay that should be observed. We are talking about drying time. After the final coat of primer is applied to the parts and they are super smooth ready to paint. **It is imperative that the parts are let allowed to dry for at least 1 week. Waiting this insane amount of time assures you that all the bondo glaze solvents (MEK) and primer solvents have totally evaporated and are indeed dried.** If you rush this drying phase there is a chance that the claw red automotive paint applied to the claws will eventually crackle and nobody wants to see that happen... You worked super hard prepping the parts, so don't rush the drying time. So the bottom line is take your time with this build.



Picture of Wrist Center Part  
Brass Inserts Shown

This side is needs to be finished well.  
As it is a highly visible part of the  
robot. Get it super smooth! So the  
paint job will look great.



Craig's  
Fiberglass  
Awesome  
Wrists

This is the side of the Wrist Center part that needs finishing & painting I'd recommend finishing both sides.

The Wrist Center Part must be finished and painted just like the claws themselves use same finishing and Painting Techniques as discussed in the finishing & Paint instruction manual. The face of the Wrist Center Part will be visible when it is in the wrist so it must be finished properly and painted just like you did the claws. Get it super smooth. Wet sanding, Bondo Glaze, Primer, etc. Take your time finishing this piece. It is the visual backdrop for your claws. It will be seen inside Craig's Wrists. Take your time with it as with all the parts for your robot.

**Prepping the Carbon Fiber Claws – Epoxy must be applied to BOTH opposing claws at the same time.**

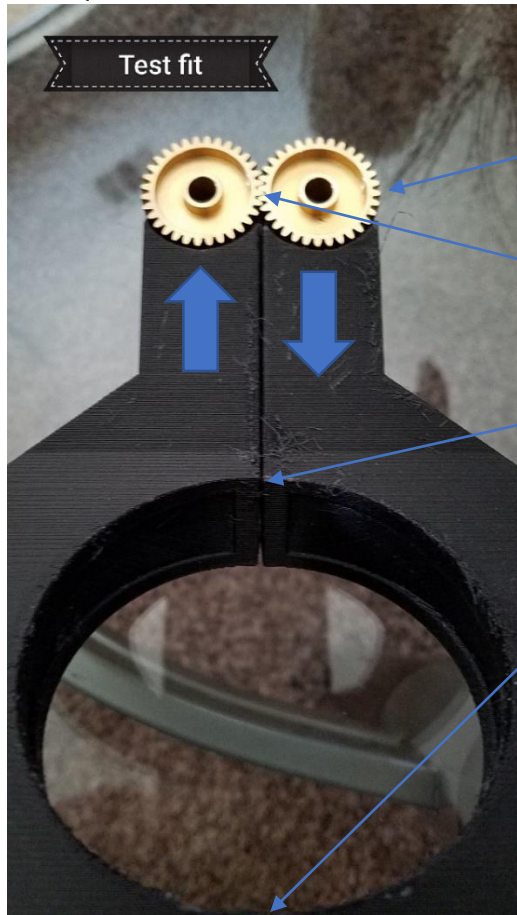
**USING EPOXY IS THE LAST STEP, DO NOT PERFORM THIS STEP UNTIL YOU HAVE FINISHED AND PAINTED YOUR CLAWS.**

Using Epoxy prematurely can and will be a miserable experience so make sure you have done all the other steps before proceeding.

**Alignment requires BOTH OPPOSING CLAWS TO BE EPOXIED AT THE SAME TIME!!! SO Prep Properly. Read before**

**proceeding.** Follow all steps in Finishing & Painting Guide. Only after your claws are wet sanded, glazed, primed, dried, and ultimately painted, will you attach the drive gears to your claws with Epoxy. I use [Loctite Brand 5 Minute Heavy Duty Epoxy](#) available anywhere on the web. Epoxy requires rough surfaces to bond good. Ensure this happens, you must rough up the surfaces with some very coarse sandpaper where the gear will sit, to give the epoxy a good chance of bonding with the black raw carbon fiber surface. Rough up bottom of face of gear where epoxy will bond (not teeth of gear). After roughing parts up, carefully coat BOTH areas where the bond takes place and press the gears so they will sit flush in both claws. Apply enough epoxy to get a good bond. **DO NOT GET EPOXY IN THE HOLES OF THE GEARS WHERE THE AXLES GO!** Wipe off any epoxy from the claws. **ALIGN BOTH OPPOSING CLAWS NOW!** – See pic below. **Critical Alignment step: You need to work quickly** - Now put both claws together while the epoxy is still wet and **work them against each other until you get proper alignment between the gears and the alignment of the closed claws.** The claws should be even with each other to give the perfect look of a closed claw...**WHILE the gears should be fully meshed.** If the gears are not meshed turn one or both of them to make them look like the picture below. If you don't get this right, you may as well let Dr. Smith pilot the Jupiter2 and we all know how that would turn out!

**WORK QUICKLY TO ALIGN GEARS WHILE EPOXY IS WET!!!!**



Epoxy is placed under the brass drive gears...Neatly & liberally spread epoxy under gear ensuring good bonding to roughed up surface. This area of claw needs to be rough down to the black carbon fiber to allow good bonding. You should remove any paint in this area. **ALIGN CLAWS BEFORE EPOXY SETS!!!**

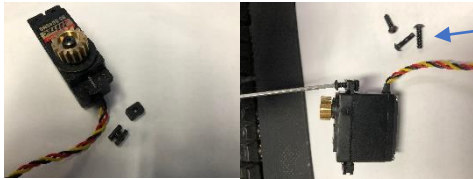
SEE HOW THE GEARS ARE MESHED WHILE THE CLAWS ARE ALIGNED. This will also align the tips of the claws. This is critical you don't want the epoxy to dry and not have these aligned properly. **So be really careful!**

**Push Claws** against each other and align them so gears mesh - **push a claw up and the other down** and repeat until they align as in picture. The gears will turn smearing the epoxy underneath gears. Push down on gears make sure they are flush at surface of claw.

**ONLY DO THIS STEP ON A FULLY PAINTED AND FINISHED SET OF CLAWS!!! Once aligned let the epoxy set overnight until fully cured.**

Unfinished Claws Shown – Gears should be epoxied into place on a finished and painted set of claws. It's hard to show the epoxy phase. You need to remove any paint under where the gear sits...you want to provide a very rough surface so the epoxy grips the raw carbon fiber. You don't want epoxy making a bond with paint, it should be bonded to the raw black carbon fiber. If you have done things properly, after the epoxy sets the axles will slide easily into place on the finished painted claw. The gears should be solidly bonded to the claws...and when the axles are inserted the whole claw and gears assembly should swing freely on the axles. Remember the axles stay stationary at all times and the claws move freely on the Axles.

Install Rubber Feet onto the HiTec Servo at this time.



These are the 6-32 Button Head Screws to attach Servo to Castle Servo Part – Test fit Servo if you want into the castle part.

Each Servo comes with little rubber feet which dampen vibration. These feet must be used. When I designed the Castle Servo Holder, the height dimension was taken into account within the design. So they must be used.

We refer to this piece as the Castle Servo Holder (not necessary to finish & paint as it will be hidden)



Please note single small black screw. Make sure small brass servo gear is properly seated. Then insert and tighten screw. (This screw comes with the servo) The little gear shown here is part of the SKU0002 Servo Gear Kit.

Each Servo has QTY 4 6-32 Screws (not shown) that mate with little brass insert in the Castle Mount part. Insert screws and tighten. The servo should be firmly mounted now in the Castle Piece. (Test Fit your servo)

Must use the little rubber feet that come with servo –Dampen and provide proper spacing!

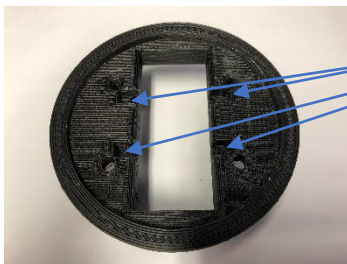
Test fit the servo by snapping the servo into place as shown in pic above (When the time comes for final assembly use a hex driver to tighten the button head screws to securely mount the Servo and Gear in place. The screws mate with the little brass inserts found on the Castle Servo Part. Do not attach servo at this time we are just test fitting parts)

Something you need to know about servo installation. You need to apply power to your servo and set it in the middle or neutral position. ELECTRONICALLY MOVE THE SERVO TO IT'S NETURAL Position (1500).

The Servo must be CENTERED Electronically BEFORE you assemble the claws.

This requires you to apply power to the servo to electronically set it then put it into the Castle Servo Holder.

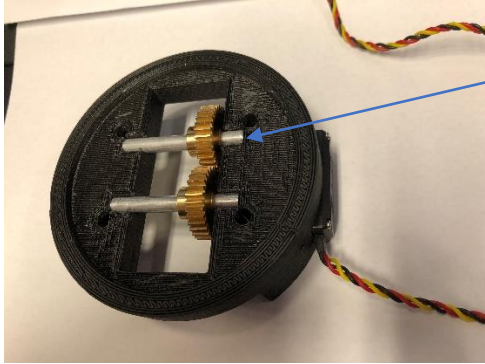
We want the servo to be centered so when power is first applied that the servo does not force the claws open or closed. This step is critical if you apply an electronic signal and the servo is not in the correct position the claws and gears can be damaged. So please be certain you know where your servo is mechanically and electronically before it is installed into the Castle Servo Holder.



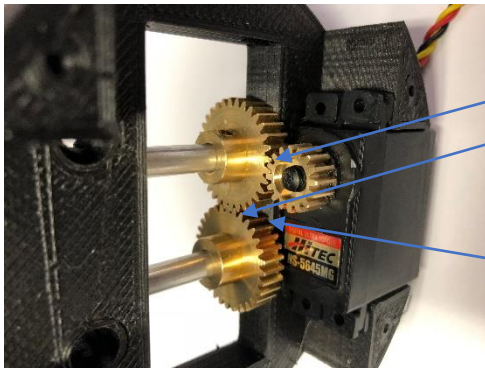
These are the Axle slots that hold the Axles. They are a very tight fit, you will need a flat blade screw driver to press down on the Axels when fitting them.

Axle Side of Castle

## TEST FIT AXLES AND GEARS TO ENSURE GOOD FIT



Push the axles down with a flat blade screwdriver. They need to be pushed all the way down so the brass claw gears touch the servo gear. If the wrist center is not level when placed on top of this piece push the axles down farther. See if there is any residual 3D support material at the bottom of the axle slots that might be blocking the axle from seating properly.



The spacing on the gears should look like this. I am showing this pic so you can see without the claws being present for clarity to give you an idea of how they mesh.

Please note if this spacing is off. There may be support material left in the axle slots. Remove 3D support material so spacing is right.

Figure X (gears shown)

Test fit the axles into the castle piece. They should fit very tightly. The axles are friction fit into the castle piece. They get sandwiched between the Wrist Center part and the castle servo holder. The axles are pinched between these parts so the axles cannot move. They are held stationary and the claws and gears swing from them. Don't be afraid to push on them firmly to get them to drop into the bottom axle groove found on the castle piece. The axles when sandwiched do not move. The sandwiching pinches them and they should lock in place by pressure of the wrist center piece held by the 4 8-32 screws. Please note these screws should not be used to pull the top of the wrist center down to meet the Castle piece. We talk about this later in this manual so when you get to that step be sure to make sure the parts are already sandwiched together nicely.



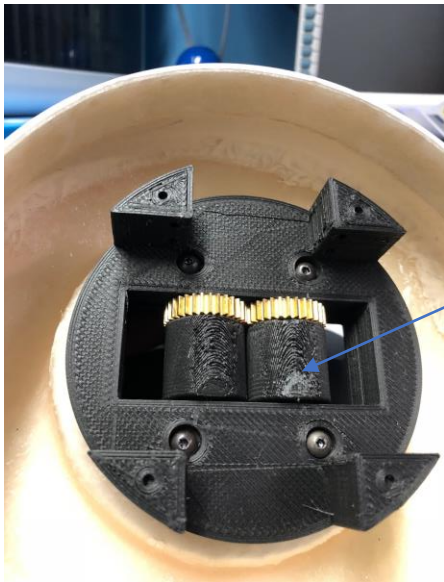
Craig's Fiberglass Wrist goes here. It is sandwiched between the Wrist Center Part and the Castle Servo Holder Part

The Castle Servo Holder and the Wrist Center Part fit together sandwiching together to hold the claws and also hold Craig's Wrist. The Pic above is shown without Craig's Wrist for clarity. When it comes time, you will actually put this assembly in Craig's Wrist. I wanted to show it here so you could see what the goal is and how the parts are seated mechanically.





The Claw Kit sits in Craig's wrist nicely allow it to rotate.  
Please note: The claws used in this picture were raw right off the 3D printer  
They have not been sanded or prepped properly.

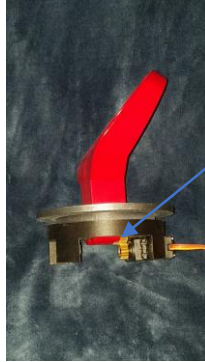


Make sure this area is clean of support material or the claws may bind when in operation.

To build the assembly shown above follow these steps.  
I have it shown here without the servo so you can see a bit better.  
I also wanted to show that this particular area on the claws must be clean...no support material can be left here or the claws could potentially bind when opening or closing...so its important to follow the finishing & painting instructions and to do a good job the first time round.

You might wish you had a third arm for this cause its awkward to put together after all the parts are finished and painted...maybe call someone to help hold all the pieces while you assemble it in Craig's wrist. It's imperative that you test fitted all the pieces before getting to these next assembly steps. If the parts don't mate properly go back and redo your prep work and adjust till they do.

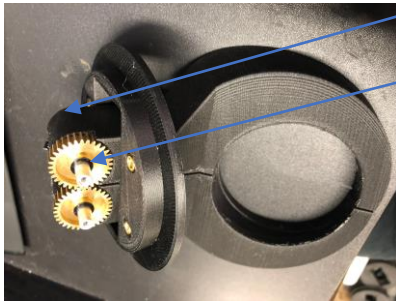
I have taken photos with the brass drive gears inserted into a non- painted claws just to show you how everything goes together with the parts you have received in the kit.



These are epoxied in the finished claws

Nylon washers on axles you can't see in pic

You have to assemble the claws in the following order.  
The gears must be epoxied into the finished **painted** claws.  
Inserted through the Wrist Center part as shown.



Insert Nylon washers on both sides of Axles 4 total per claw. 2 nylon washer go on brass drive gears the other 2 go behind on the back side of the claw

Slide the axles through the brass drive gears.

Slide the Nylon washers on each side of the axles as shown in the picture.

(The nylon washers keep a very small space between the claws and the castle servo holder to provide a lower friction surface)



Insert the whole assembly through Craigs Wrist.  
When holding the claws in your hand, make sure the Claws are straight in the wrist.



Brass Insert Side of Castle Servo Holder. [UPDATE PICTURE](#)

Secure that Castle Servo Holder at this time.

Lift the Castle Servo Holder to mate with the axles and axle slots. This gets abit awkward holding all the parts at once. You might want to get a friend to help you get everything lined up properly.

**MAKE SURE THE CASTLE SERVO PART HAS PROPER ORIENTATION SO THAT THE BRASS INSERTS ARE ON THE SIDE WHERE THE BRASS DRIVE GEARS.** Insert the Axles into the perspective axle slots on the castle servo holder part. The Brass Claw Drive gears need to align with the servo drive gear. Only one side of the castle piece has the brass inserts.

Ensure the axles are well seated. Don't be afraid to put a bit of pressure on the axles...(apply pressure to area right over slot, as you don't want to bend the axles) The axles should kinda pop into place. – it's really important to make sure they are all the way to the bottom of the axle slots.

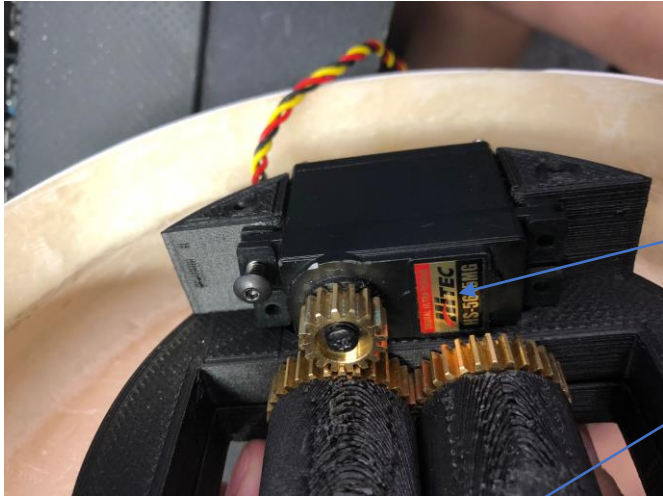


Look here and around the inner box to ensure you have the axles seated properly. There must be a low gap all the way around the inner opening box of the claws. This will tell you if all the axles are seated properly. Look carefully to make sure yours are indeed seated evenly!

**WARNING WILL ROBINSON!!!**

**DO NOT USE THE 8-32 SCREWS TO PULL THE PIECES TOGETHER! THEY NEED TO BE SANDWICHED FIRST! WE DON'T WANT TO RISK PULLING THE BRASS INSERTS OUT OF THE CARBON FIBER WRIST CENTER PART! SO ENSURE THE AXLES ARE SEATED PROPERLY BEFORE YOU TIGHTEN THIS ASSEMBLY.**

Check to see that the claws are closed and straight, then use the 8-32 Button head Cap screws to secure the whole assembly.



Before you install the Servos

**Read This!!!**

\*\*\*Special Procedure when it comes time to install the servo.

You must Power ON the servo and let it home to the neutral position BEFORE installing it into your claw.

After it has been powered on and allowed to home then Insert the Servo, and mount it using all QTY 4 6-32 .5" Button Cap Screws. The screws mate with the little brass inserts found on the Castle Servo Holder Part.

\*\*\*Danger Will Robinson!!!

The FIRST time you apply power to the servo make sure it's NOT mounted to the Castle Piece. After you know it's homed or zeroed, you can then mount it to the Castle Servo part. Never apply power to any servo if the homed position is in question.

You actually need to apply power to the servo before installing it into the Castle Servo Holder. Your software needs to tell the servo to go to the neutral position 1500ms. When a servo powers for the first time, the position is unknown. The builder needs to tell the servo to center from the control electronics BEFORE it is mounted in the claw. If you just mount it, without powering it up...the claw could start moving the first time its powered on. Damage can occur to the servo.

It is the builder's responsibility to set the software walls – That limit the motion of the claw (Open or Close). The servo has the ability to push past the mechanical limits of the claw. The builder needs to take account of these mechanical limits and see to it that the servo is programmed not to exceed the mechanical limits imposed by the design.

This should complete your B9 Robot Claw assembly. Check out the gallery pics below to see a finished claw.

\*Please note: Avoid moving the gears manually when the servo does not have power. Most servos do not like being moved when power is off. You take a risk at stripping the metal gear transmission inside the servo itself. It is very important that the builders know the electronic position of the servo. If you skipped the step of electronically calibrating the servo in the last steps outlined in this manual, damage may result. So make sure you know what your servos will do the first time they are powered on.

\*\* Disclaimer – Software Walls – Software Walls are used to limit the motion of the servo. In this case how much the servo can open or close. The way the claws have been designed software walls are mandatory in the motorized version of the robot claw kits. The servo used has the ability to travel past the full open point and the full closed point. The builder must design into their software or servo controller a set of software walls that works their claw sets.

I hope you enjoy this kit as much as I had making it. If you have any questions please email me at [davros.dalek@gmail.com](mailto:davros.dalek@gmail.com) I will try to answer your email as quickly as possible. I really hope you enjoy the kit. –Bob Rossi B9-0694

Gallery of pics (Todd Mustachio's AWSOME WORK on the B9 Carbon Fiber Claw Kit)



