

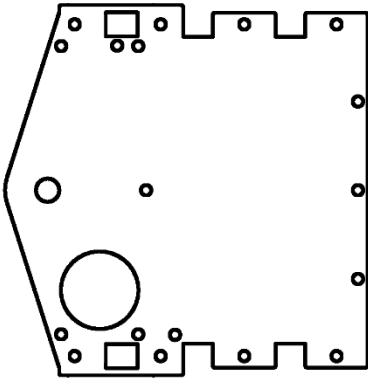
# *Jolt!* 3lb Combat Robot Kit

Instruction Manual v2.1

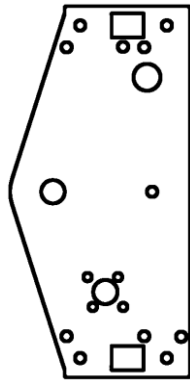
Digital version with hyperlinks available at:

<https://absolutechaosrobotics.files.wordpress.com/2023/11/jolt-kit-instruction-manual-v2.1.pdf>

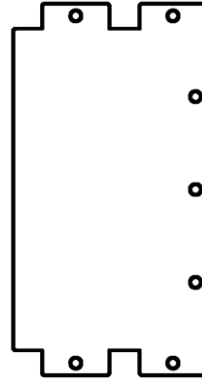
# Jolt! Kit –Contents



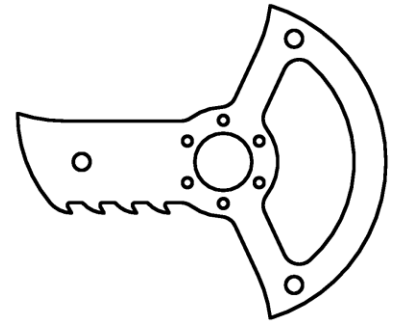
1x Bottom Frame Plate



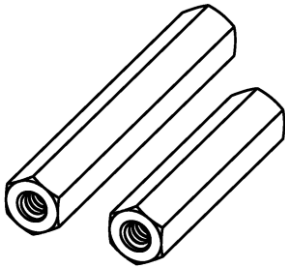
1x Top Frame Plate



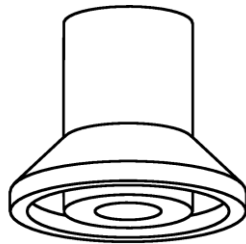
1x Lid Plate



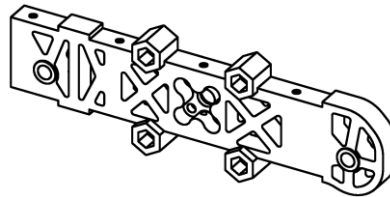
1x Weapon Blade



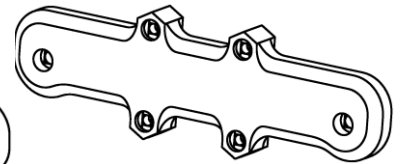
8x Guard Standoff  
4x Front Standoff



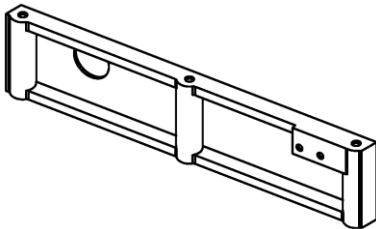
1x Front Spacer



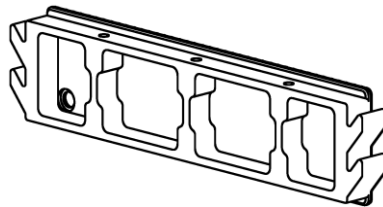
2x Side Wall



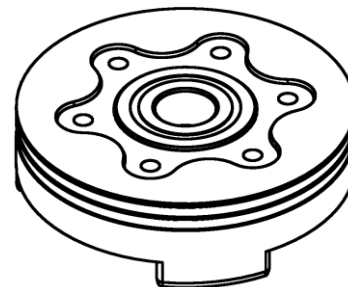
2x Wheel Guard



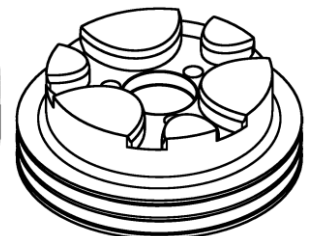
1x Front Wall



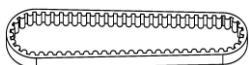
1x Back Wall



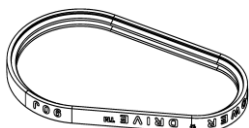
1x Disk Pulley



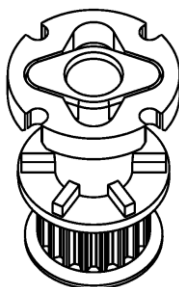
1x Motor Pulley



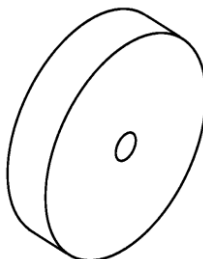
4x Drive Belt



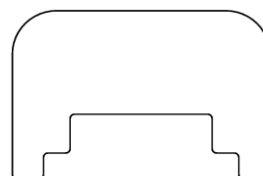
1x Weapon Belt



4x Chaos Hub



4x Foam

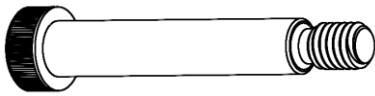


1x Chaos Hub Key

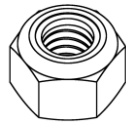


1x Blade Strike Guard

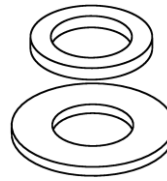
# Jolt! Kit –Contents



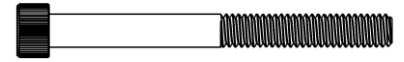
1x Shoulder Bolt



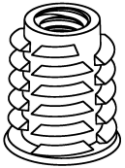
1x Lock Nut



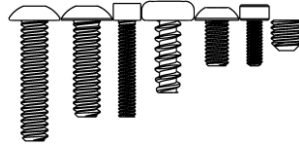
2x Small Spacer Washer  
1x Large Spacer Washer



4x Axle Screw



4x Axle Threaded  
Insert

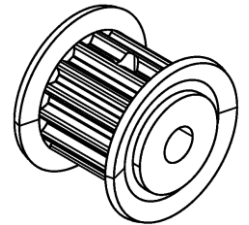


## Screws

6x 6-32—5/8"  
24x 6-32—1/2"  
2x 2-56—1/2"  
28x #6—3/8"  
8x M3—6mm  
3x M2—6mm  
4x set screw



1x Disk Bearing



2x Drive Pulley



1x Brushless Motor



1x Brushless ESC



2x Brushed Motor



1x Brushed ESC



1x LiPo Battery



1x Power Switch



2x XT-30 Connectors  
(Male/Female)



2x JST Connector Pair



3x 3.5mm Connectors  
(Female)



1x Power Light

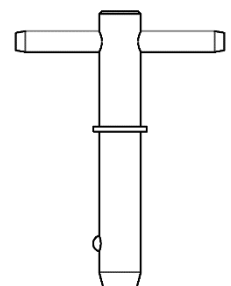


2x Wires



## Heat Shrink

Green  
Blue  
Yellow  
Clear



1x Safety Pin

## *Jolt!* Kit –Contents

### Complete Kit Extras



1x Hex Wrench Set



1x 1/2" Wrench



1x Radio Transmitter



1x Radio Receiver



1x LiPo Charger



1x LiPo Charging Bag



1x Charging Adapter

# Jolt! Kit - Basics

## Required Tools (not included)

- Wire strippers
- Soldering iron
- Solder
- Heat gun/lighter
- Thread locking compound (recommended, apply before installing each screw for wheels, motors, and standoffs, not for screwing into TPU frame parts)

## Safety

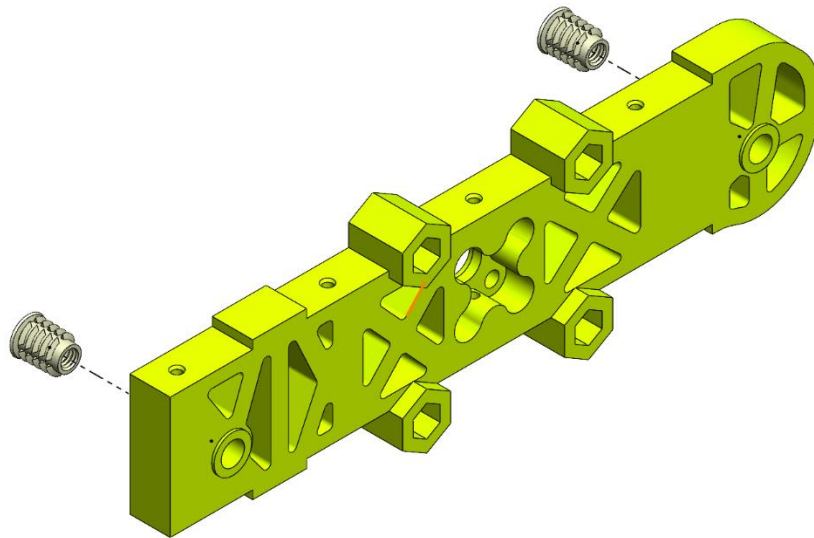
- LiPo safety
  - LiPo batteries can catch fire if damaged. Always charge and store your LiPo batteries in a LiPo safe bag. The bags are fire resistant and designed to mitigate the effects of a LiPo battery charging mishap.
  - If a LiPo pack is discharged below 3.3V per cell (9.9V for a 3S pack) they will not be safe to recharge. When your robot starts to slow down, it needs to be recharged!
  - If a pack is ever damaged or seems puffed up, do not try to charge it. Replace the pack and recycle the old one. Charging damaged or puffy batteries can result in a fire.
  - The included battery pack can be charged at a maximum current of 2x the battery capacity. (In amp hours. So a maximum current of 2.2A for an 1100mAh (0.85Ah) pack.) Charging at 1x capacity is better for the battery in the long term when a fast charge is not critical. Charge current is set on the charger, see the manual for details.
- Make sure a responsible adult is present when building and operating your robot.
- Have the robot's wheels off the ground when turning it on. If settings are wrong the robot may drive right at you.
- Always have the safety lock in place when turning the robot on if the brushless motor is connected, serious injury could occur.
- Do not test or operate this bot outside a suitable enclosed arena that has a minimum of 1/4" thick polycarbonate walls. Failure to do so may result in severe injury.
  - An example of a test box design may be found at <https://absolutechaosrobotics.wordpress.com/2020/06/19/new-test-box/>
- Remember to always turn the transmitter on *before* powering on the robot, and always turn the transmitter off *after* powering down the robot. This way any spurious transmissions picked up by the receiver will not cause the robot to twitch.

## Basic Skills

- Soldering
  - See <https://www.instructables.com/How-to-solder/> for a complete guide on basic soldering tools and techniques
  - See <https://learn.sparkfun.com/tutorials/working-with-wire/how-to-splice-wires> for a guide on soldering wires together
- Heat shrink tubing
  - See <https://www.wikihow.com/Use-Heat-Shrink-Tubing> for a guide on the technique of using heat shrink tubing

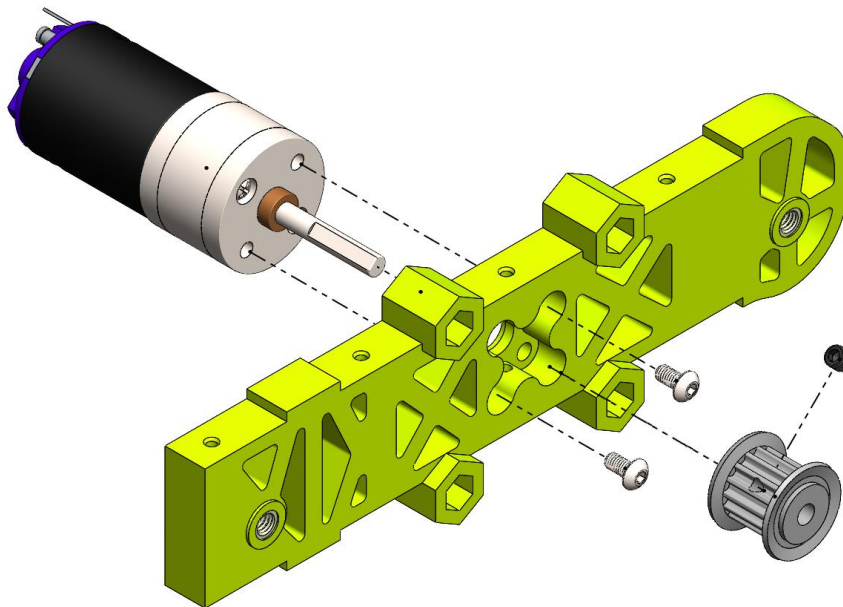
## Jolt! Kit – Frame Assembly

### 1. Assemble the drive axle mounts



- a. Insert two threaded inserts into one of the side walls as shown and screw in until the back of the insert is flush with the flat side of the side wall.

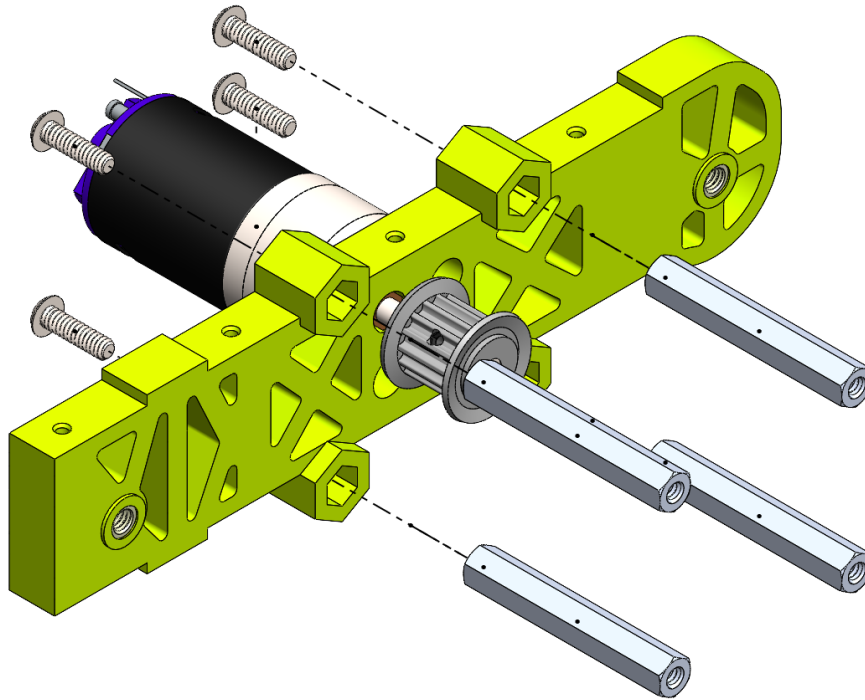
### 2. Assemble drive motor and pulley



- a. See the instructions under Electronics Assembly for preparing the motors before installing them in the frame.
- b. Insert one drive motor into the side wall as shown, and use two M3 – 6mm screws to secure it in place. Insert one of the drive pulleys onto the motor shaft, and secure with a grub screw tightened to the flat on the shaft.

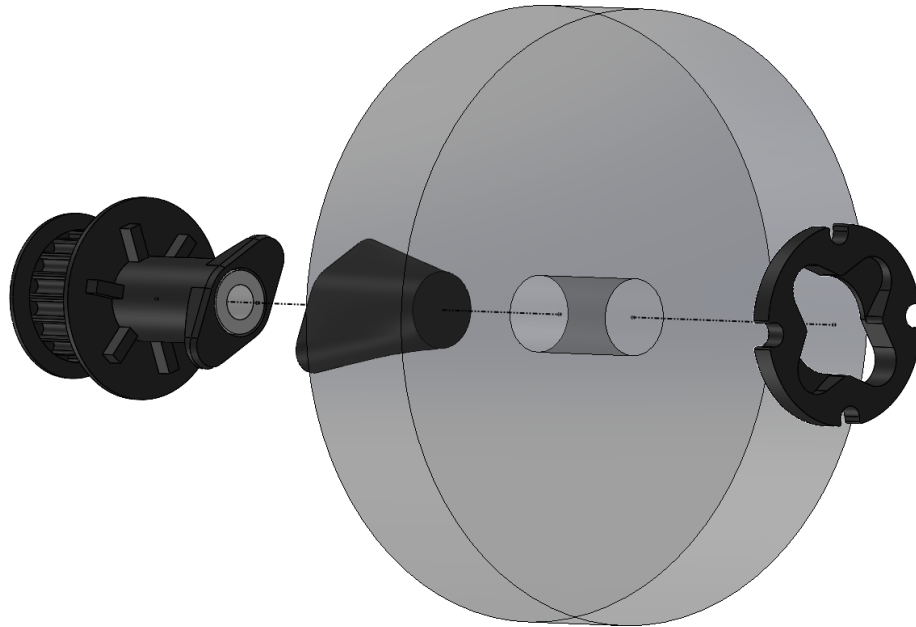
## Jolt! Kit – Frame Assembly

### 3. Assemble wheel guard standoffs



- a. Insert four of the wheel guard standoffs into the mounting holes in the side wall as shown, and secure with four 6-32 – ½” screws.

### 4. Assemble wheel hubs

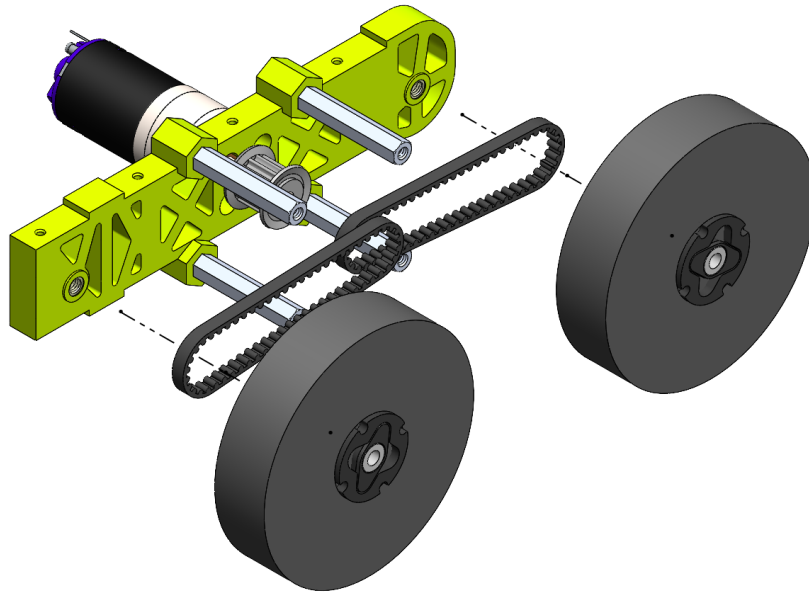


- a. Insert the hub insertion tool into the center of a foam wheel, then push it through the other side with a chaos hub to insert the hub. Secure the wheel with the locking washer, using the included chaos hub key to push in and turn the washer 90 degrees into the locked position.



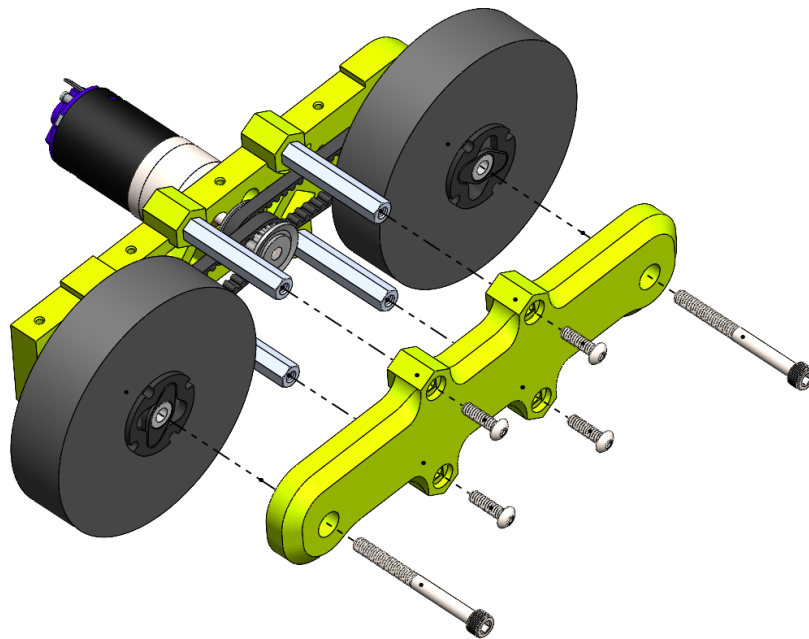
## Jolt! Kit – Frame Assembly

### 5. Insert wheels



- a. Insert two drive belts over the motor pulley and toward either end of the side wall as shown. Insert the pulley side of the assembled wheels into the other end of the looped belts.

### 6. Assemble wheel guards

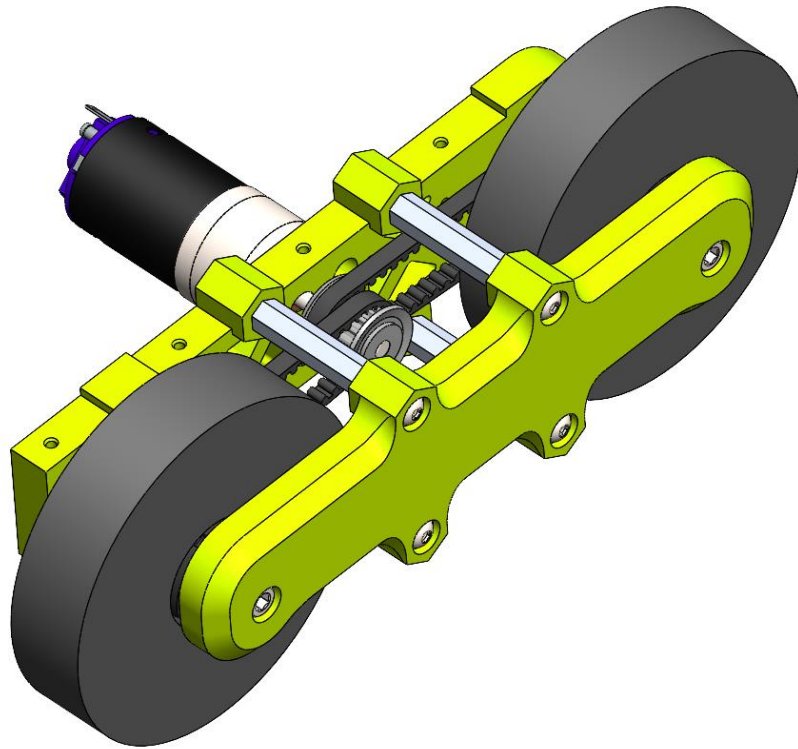


- a. Place the wheel guard onto the assembly as shown, inserting the wheel guard standoffs into the mounting holes, and secure with four 6-32 – ½” screws.
- b. Insert two axle screws through the wheel guard and wheel assemblies and screw into the threaded inserts in the side wall. Do not tighten enough that the screw bends the wheel guard inward, or this could interfere with the turning of the wheels.



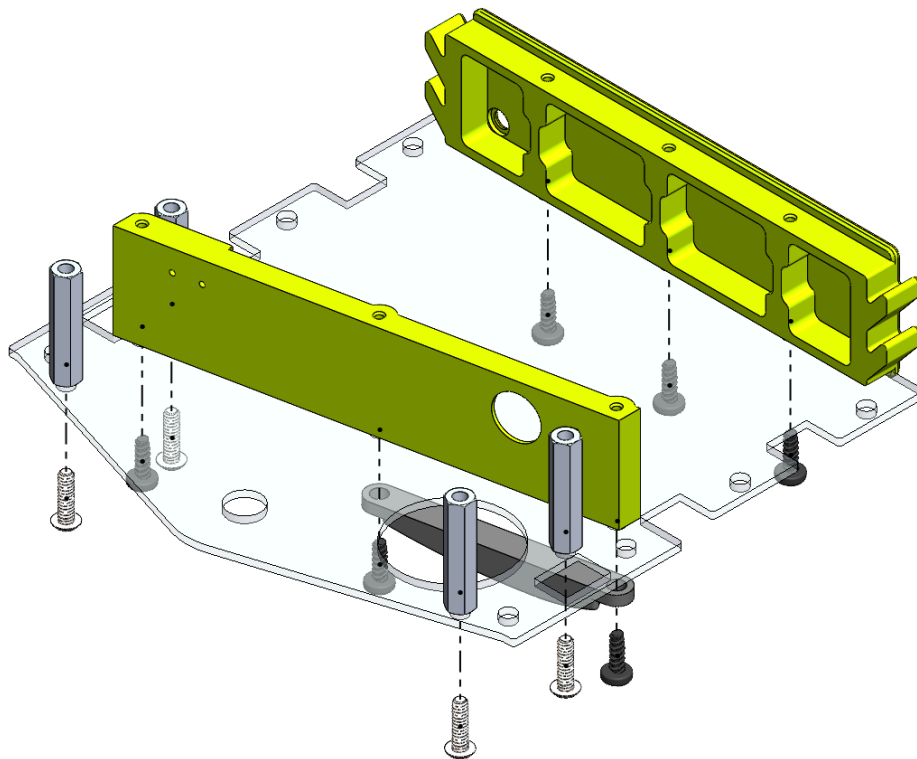
## Jolt! Kit – Frame Assembly

### 7. Assemble 2<sup>nd</sup> drive pod



- a. The first drive pod is complete. Repeat steps 1-6 to assemble the second drive pod, which will be a mirror image of the first.

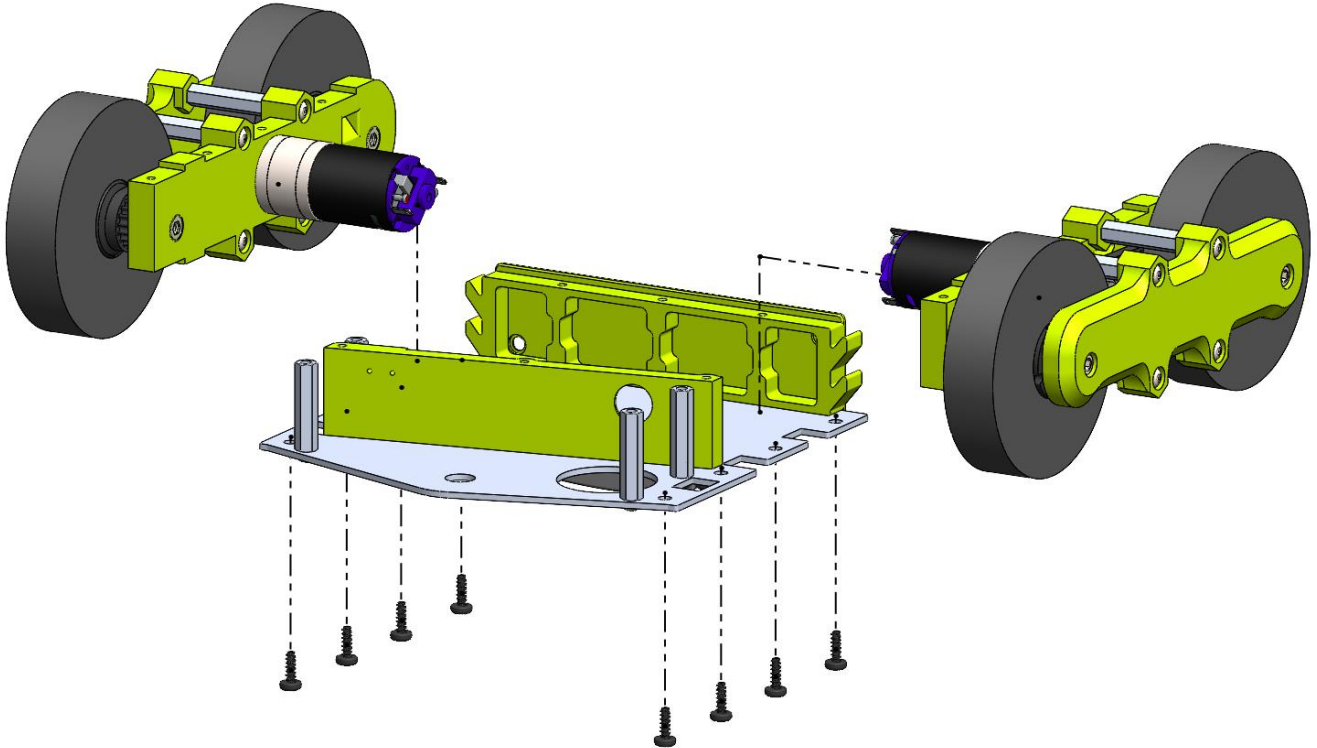
### 8. Mount front/back walls



- a. Use six #6 – 3/8" screws to secure the front and back walls to the base plate as shown. Two of the screws will pass through the blade strike guard before screwing into the front wall.
- b. Use four 6-32 – 1/2" screws to secure the four front standoffs to the base plate as shown.

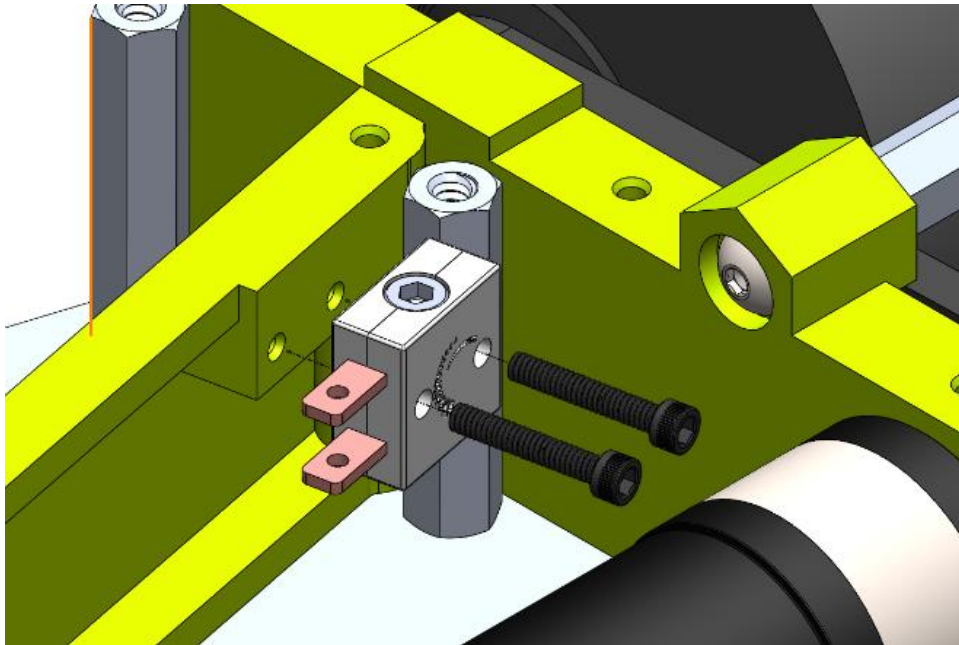
## Jolt! Kit – Frame Assembly

### 9. Mount the drive pods



- a. Insert the two drive pods onto the base plate assembly, and secure with eight #6 – 3/8" screws as shown. Note that the drive pods are not reversible. When assembled correctly the wheels should be offset slightly downward from the center line to provide enough ground clearance for the weapon.

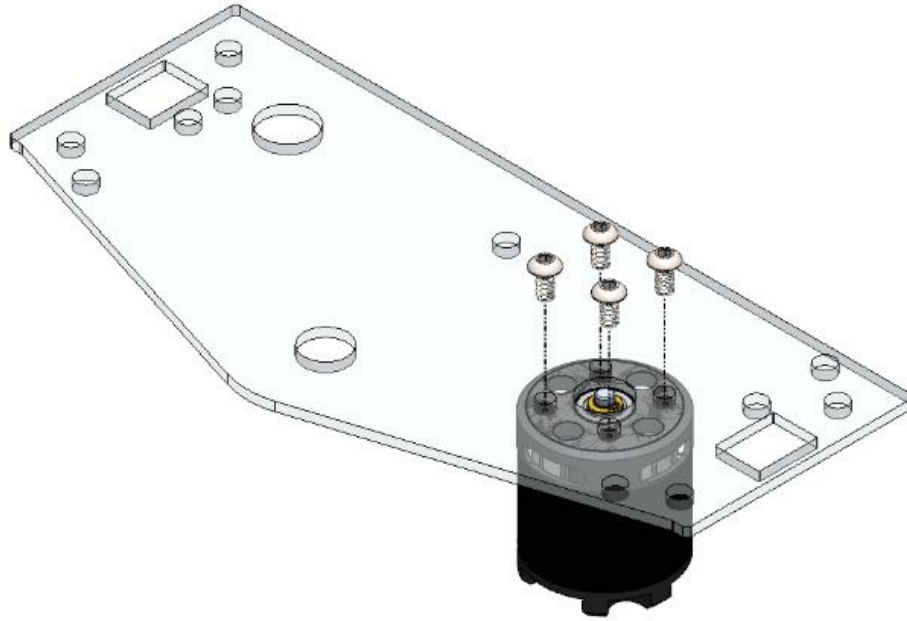
### 10. Mount power distribution



- a. Mount the power distribution switch and wiring to the front wall with two 2-56 – 1/2" screws as shown. The instructions for the assembly of the power distribution wiring can be found in the Electronics Assembly section later in this manual.

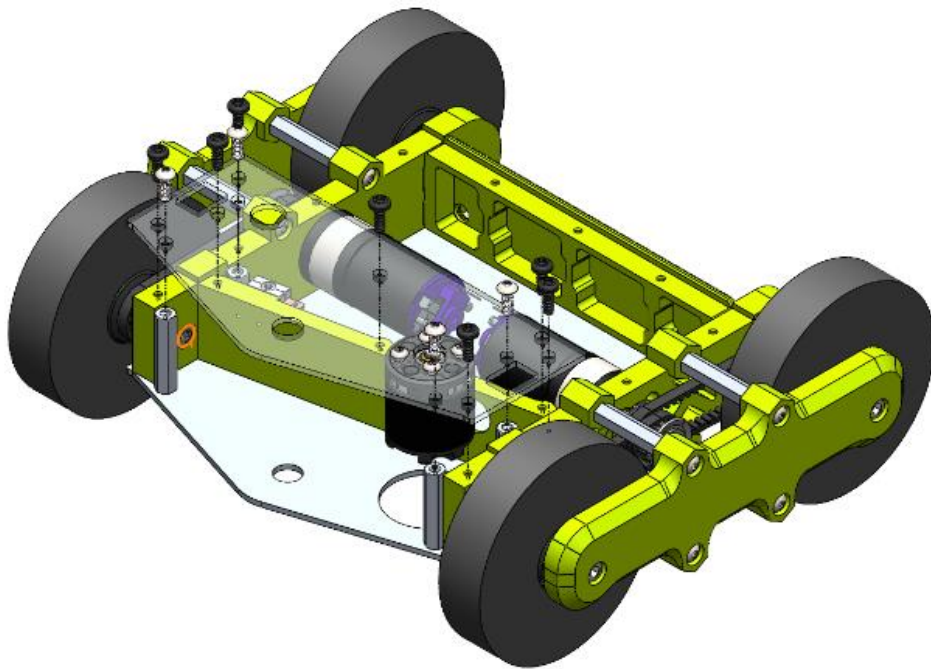
## Jolt! Kit – Frame Assembly

### 11. Mount brushless motor



- a. Mount the brushless motor to the top plate with four M3 – 6mm screws as shown. Make sure that the wires are pointing toward the flat back side of the plate.

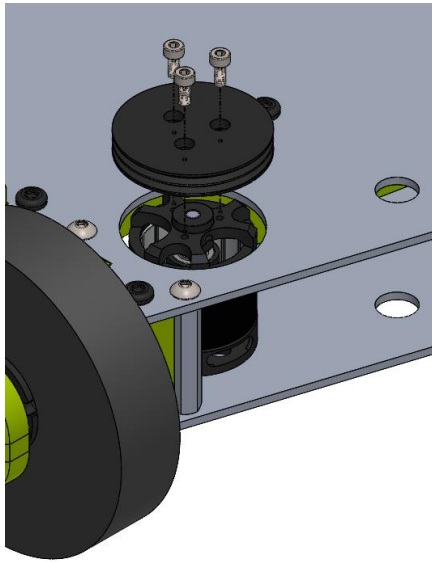
### 12. Assemble top plate



- a. Assemble the top plate onto the main frame as shown, placing the brushless motor wires through the hole in the front wall. Secure with seven #6 – 3/8" screws into the side and front walls, and four 6-32 – 1/2" screws into the front standoffs.

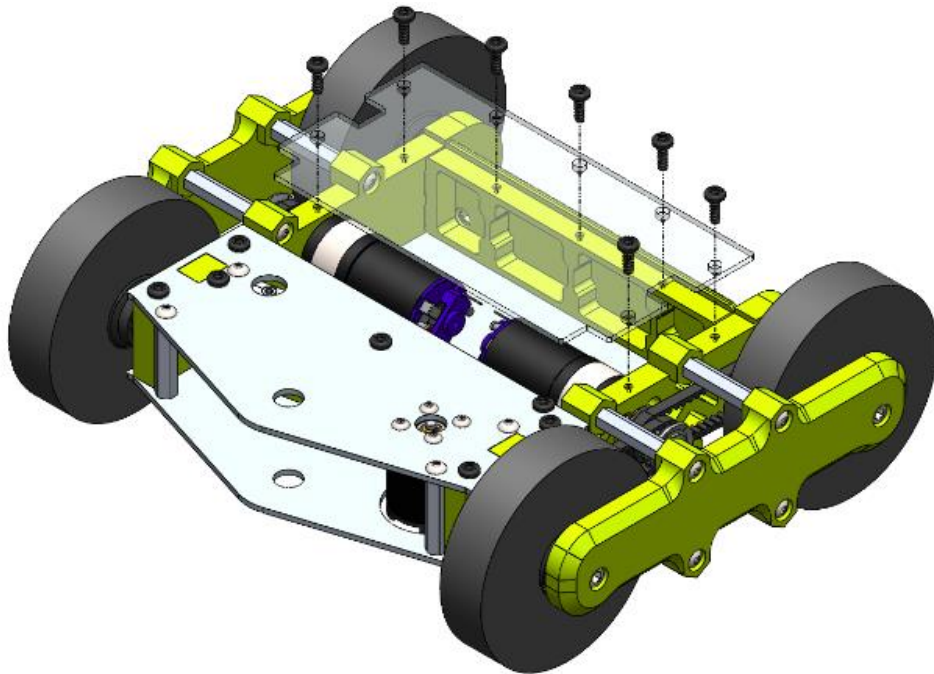
## Jolt! Kit – Frame Assembly

### 13. Mount motor pulley



- a. Mount the motor pulley onto the brushless motor as shown, and secure with the three M2 – 6mm screws.

### 14. Mount lid plate



- a. Mount the lid plate onto the main frame with seven #6 – 3/8 screws into the back and side walls as shown.
- b. It may be useful to delay this step until after you have completed the Electronics Assembly and placed all of the electrical components into the bot before closing the lid.

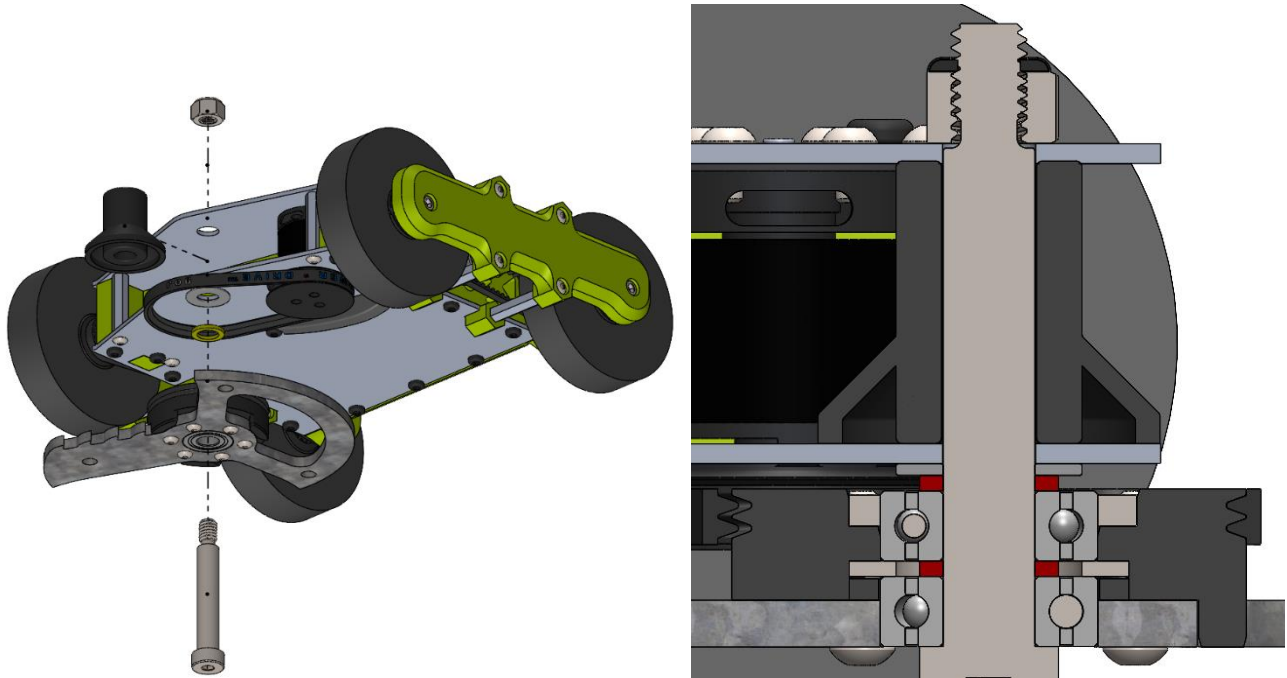
## Jolt! Kit – Frame Assembly

### 15. Mount weapon pulley



- a. Insert the disk bearing into the center of the disk, flush with the bottom side with the disk (the top side as pictured above). Place a small spacer washer in the center of the disk pulley, and insert the disk into the indentation in the pulley. Use 6x 6-32 – 1/2" screws to attach the pulley to the disk as shown. Although the blade can be oriented in either direction, it is recommended to place it in the orientation shown to best protect the motor with the strike guard.

### 16. Mount weapon shaft assembly



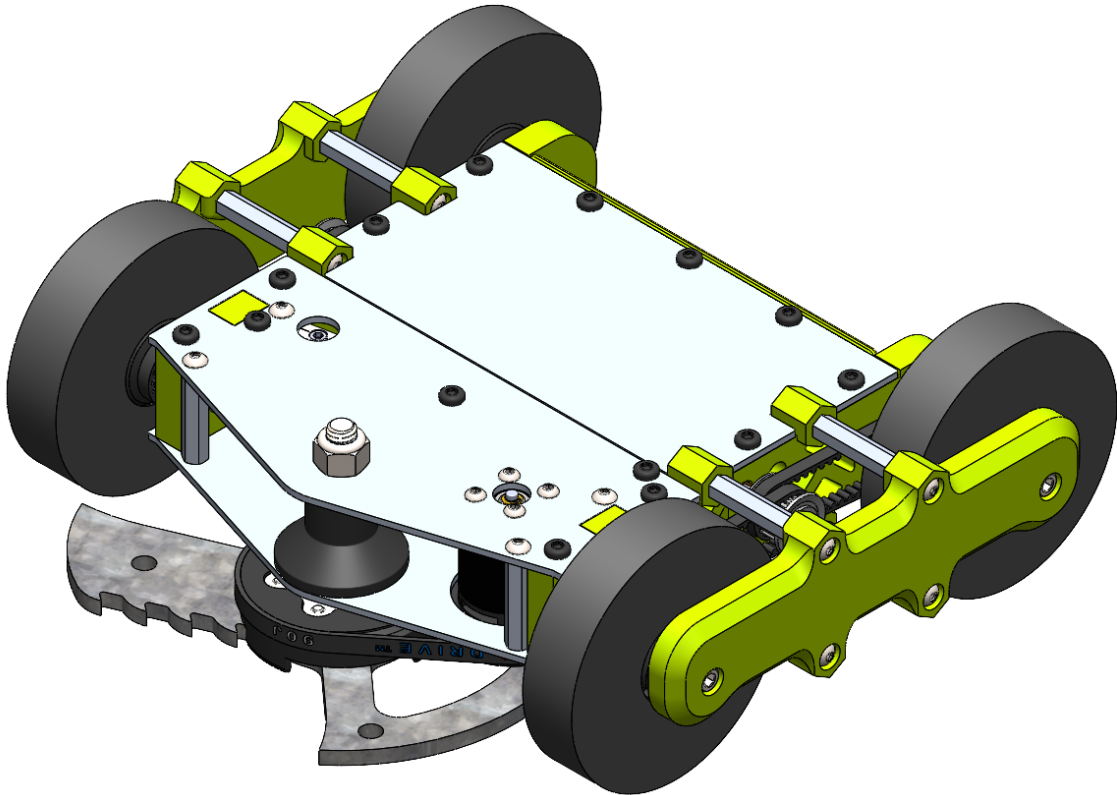
- a. Insert the front spacer between the top and bottom frame plates, aligning with the large front hole.
- b. Place the weapon belt around the motor pulley. Insert the shoulder bolt through the disk and pulley assembly, and place a small and large spacer washer on the bolt above the pulley.
- c. Position the disk assembly under the front of the frame and insert the shoulder bolt through the belt and into the frame, all the way through the spacer and top plate. Rotate the disk with the belt to allow the belt to stretch around the pulley and seat itself into the grooves.



## Jolt! Kit – Frame Assembly

- d. Use the lock nut to secure the disk assembly to the frame, and tighten the bolt with the largest hex wrench and wrench.
- e. Adjust the disk position if necessary. Slowly rotate the disk by hand and watch the gap between the disk and the motor pulley. If the spacing is not even at all points in the rotation, loosen the 6 disk screws very slightly, push on the disk to correct the angle, tighten the screws, and check the spacing again.
- f. Insert the safety pin through one of the provided holes in the disk. **This pin prevents the disk from spinning unexpectedly, and for safety should only be removed inside an appropriate test box or arena as the final step before a match.**

### 17. Finished



- a. The frame assembly is complete. You can now proceed to the Electronics Assembly section for instructions on how to wire the electrical components of the bot.

# Jolt! Kit – Electronics Assembly

- Brushless ESC

- i. Solder 3.5mm bullet connectors to the ends of the three motor wires, then apply 1in long sections of yellow heat shrink tube over the connectors and connections and apply heat.
- ii. Place 3/8in sections of green heat shrink over power wires, but do not apply heat yet.
- iii. Solder male XT30 connector to the power wires (black to (-) side, red to (+) side), then cover the connections with the heat shrink and apply heat.



(TIP: It can be helpful to have the male and female halves of an XT30 connector assembled while soldering to prevent the metal contacts from shifting while hot.)

- Motors

- i. Place two 3/8in sections of green heat shrink over the wires of a male JST connector, but do not apply heat yet.



- ii. Solder the JST connector wires to the terminals of one of the brushed motors, then move the heat shrink over the connections and apply heat. **(It may be helpful for fitting everything in later to shorten the wires to around 2in long before soldering in order to eliminate excess wire inside the frame.)**
- iii. Place one 1-3/4in section of clear heat shrink tubing over the drive motor and apply heat (the large metal motor acts as a heat sink so this may take a while). The tubing should be placed so that it covers the joint between the motor and gearbox as well as overhanging slightly past where the purple end cap meets the motor. This helps improve the durability of the motor.

- Power distribution

- i. Solder a 3in and a 2in length of red wire to the two terminals of the power switch, with the longer wire going to the terminal closer to the screw head, then apply 5/8in sections of green heat shrink over the connections to cover the copper tabs and apply heat.
- ii. Place a 3/8in section of green heat shrink over the wire closest to the screw on the switch, but do not apply heat yet.
- iii. Solder this red wire to the (+) side of a male XT30 connector, and a 2in length of black wire to the (-) side of the connector, then cover the connections with the 3/8in sections of heat shrink and apply heat. This connector will connect to the battery.



- iv. Solder 2in lengths of red and black wire to the remaining female XT30 connector, then cover the connections with 3/8in sections of green heat shrink and apply heat. This connector will connect to the brushless ESC.



- v. Take two 3/4in sections of blue heat shrink, place the black wires from a female JST connector and the female XT30 connector inside one tube, and place the red wires inside the other tube. Do not apply heat

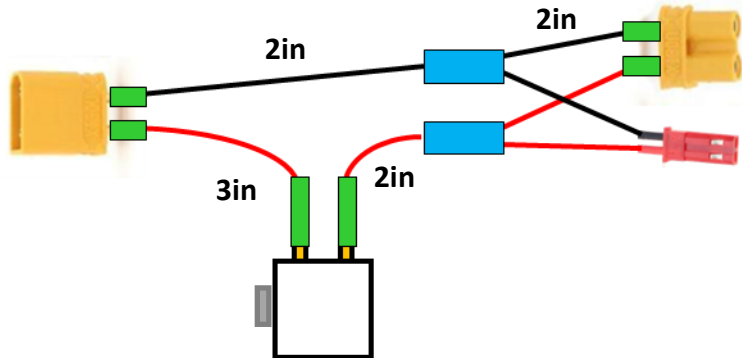


## Jolt! Kit – Electronics Assembly

yet, and push the tube as far down the wires as you can while keeping the ends together. The JST connector will connect to the dual brushed ESC.

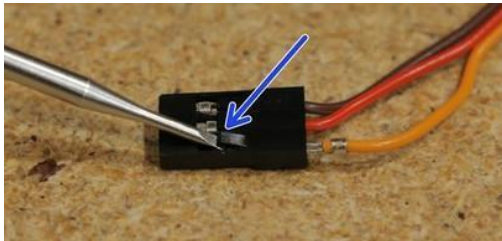


- vi. Solder the red wire on the switch assembly to the bundled red wires, and the black wire on the switch assembly to the black bundled wires. Cover the connections with the blue heat shrink and apply heat. **(It may be helpful for fitting everything in later to shorten the wires to around 2in long before soldering in order to eliminate excess wire inside the frame.)**
- vii. When finished, the power distribution wiring should look something like this: (wire lengths not to scale)



- Assembly

- i. After opening the lid, attach the power switch to the frame with the two 2-56 – ½” screws as shown in the frame assembly.
- ii. Connect the ESCs to the receiver, with the black wires farthest from the antennas as follows:
  - 1. Dual ESC single yellow wire to ch1 (steering) and 3-wire plug to ch2 (drive throttle)
  - 2. Brushless ESC to ch3
  - 2. Power light to ch4
- iii. Connect the dual ESC to the motor connectors, M1 to the left motor and M2 to the right motor.
- iv. Connect the dual ESC power input connector to the power distribution assembly. Do not reverse the connections; this could damage the electronics.
  - 1. (Recommended) Because both ESCs can provide power to the receiver, they can fight each other, which can reduce the lifespan of the circuits. On the brushed drive ESC use a small screwdriver, razor knife, or similar tool to lift up the plastic tab securing the middle wire into the housing, then gently pull the middle connector out of the housing. Cover this connector with tape so that it cannot make contact with any metal surfaces. This will allow only the brushless ESC to provide power to the receiver.

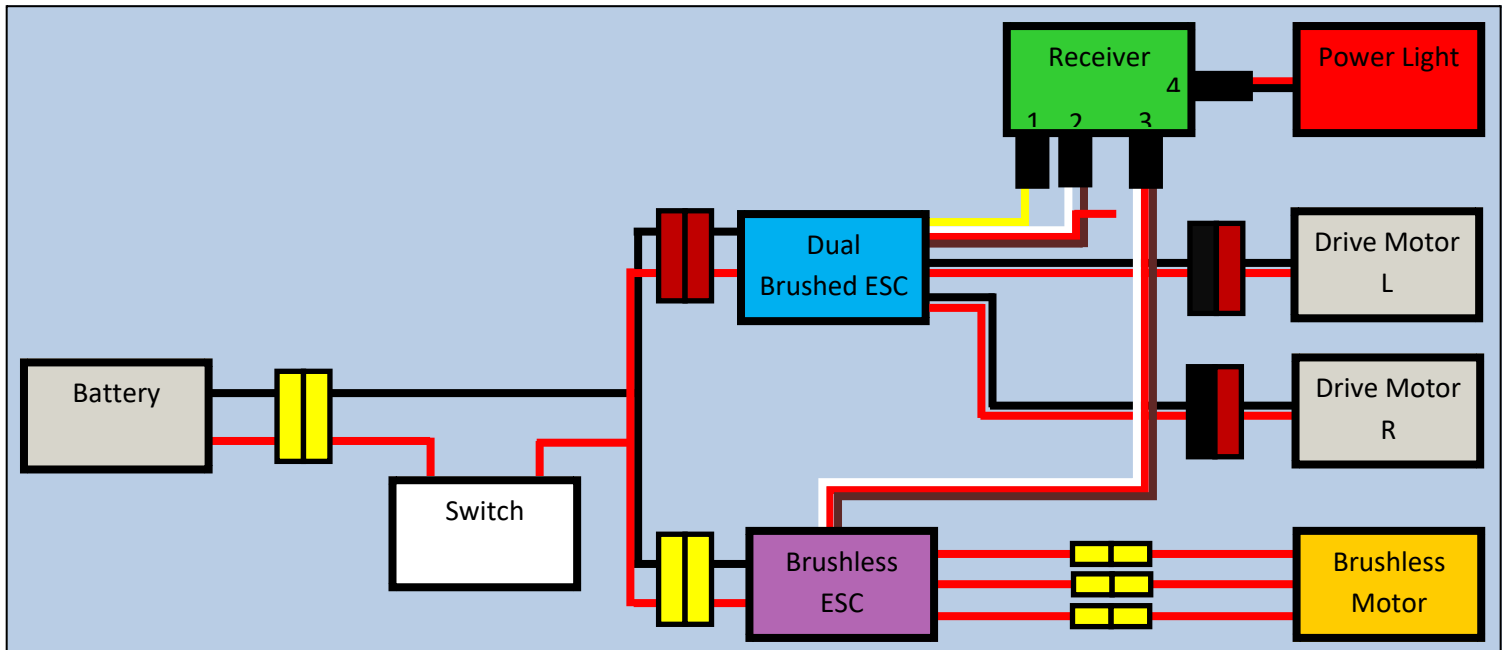


- 2. (Recommended) Turn on motor braking
  - a. Turn on the transmitter, and hold the right stick in the top left corner (ch1 low, ch2 high)
  - b. While holding the stick in place, turn on power to the dual ESC

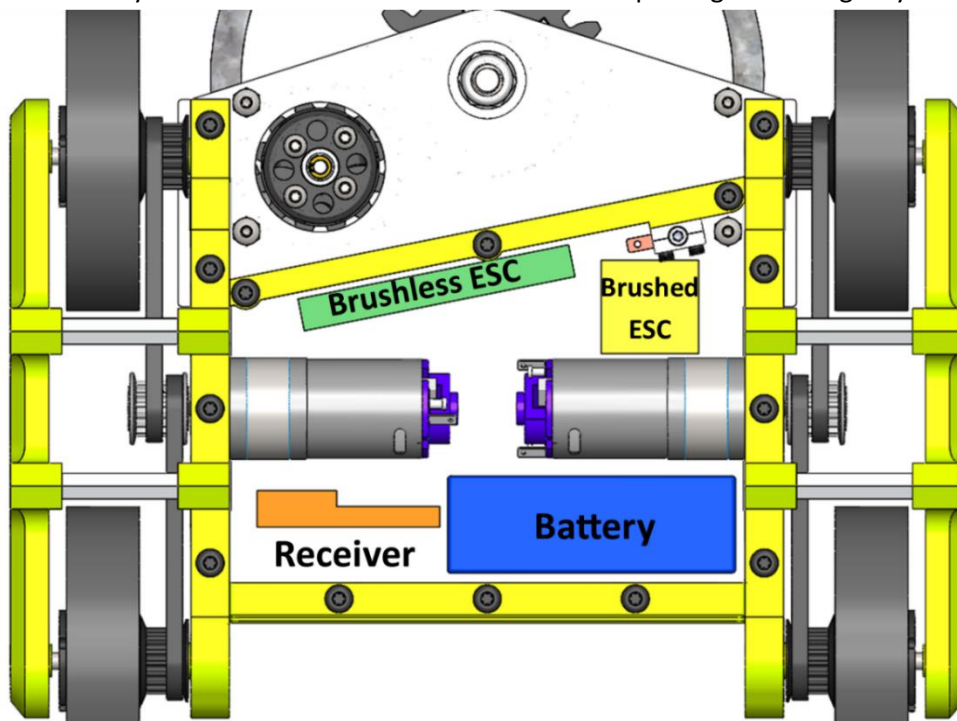
## Jolt! Kit – Electronics Assembly

- c. Wait for the startup tones to finish, then release the stick and turn power off. The motor braking should now be enabled.
- v. Connect the brushless ESC power input to the power distribution assembly.
- vi. Place the mounting clip for the power light through one of the holes in the back wall from the outside, then insert the light into the clip from the inside.

The assembled electronics should now be connected as shown below. (Not to scale)



- vii. Ensuring that the safety pin is in place and the wheels are off the ground, connect the battery.
  - Suggested placement of components is shown below.
  - Check that the weapon blade is spinning in the correct direction (clockwise when viewed from above), and reverse any two of the brushless motor wires if it is spinning the wrong way.



# Jolt! Kit – Radio Setup (Complete Kit/FS-i6 Transmitter)

These instructions offer only basic instructions to quickly get your kit up and running. For more detailed information on the different functions of your radio and how to use them, please see the guide at

[http://runamok.tech/RunAmok/flysky\\_i6.html](http://runamok.tech/RunAmok/flysky_i6.html)

- Step 1: Set Correct Failsafe
  - Flip all the toggle switches along the top of the transmitter 'up' and pull the left control stick all the way 'down'. Push the power switch 'up'.
  - From the initial screen, tap the 'Down' key to highlight 'System setup' -- tap 'OK' to select.
  - Use the 'Down' key to scroll down the list to 'RX Setup' -- tap 'OK' to select.
  - Use the 'Down' key to scroll down the list to 'Failsafe' -- tap 'OK' to select.
  - Pull the left stick all the way down, and leave the other stick axis spring centered.
  - Tap 'OK' to select channel 1, tap 'Down' to turn failsafe 'On', then 'OK' to return to channel selection. Tap 'Down' to the next channel and repeat for channels 2, 3 and 4.
  - With all channels correctly set, press and hold 'Cancel' to exit and save the failsafe settings.
  - Tap 'Cancel' two times to return to the 'MENU' screen.
- Step 2: Adjust turning speed
  - Tap the 'Down' key to highlight 'Functions setup' -- tap 'OK' to select.
  - Use the 'Down' key to scroll down the list to 'Dual rate/exp.' -- tap 'OK' to select.
  - Tap the 'OK' key to select the Rate.
  - Use the 'Down' key to reduce the rate for Ch1 to 50%. This setting affects your turning speed. You can adjust it later to suit your preferences.
  - Use the 'OK' key to scroll to 'Ch1', then the 'Up' key to change the settings for 'Ch2'.
  - Tap the 'OK' key to select the Rate.
  - Use the 'Down' key to reduce the rate for Ch2 to 90%. This setting affects your forward/reverse speed.
  - (These two values are a good starting point, but you can adjust them to find values that best fit your driving style and capability. The Exp setting can also be adjusted here, negative values are recommended to make the bot less twitchy with small movements of the stick.)
  - Press and hold 'Cancel' to exit and save the settings.
- Step 3: Adjust the weapon throttle speed
  - Tap the 'Up' key to highlight the 'End points' option -- tap 'OK' to select.
  - Tap the 'OK' button two times to select Ch3, then push the left stick to the top of its range.
  - Tap the 'Down' button to lower the end point to 80% for the upward direction. (This will lower the weapon speed to  $(100+80)/200 = 90\%$  of max, which will make the bot more drivable and less likely to bounce when the throttle is set to full.)
  - Press and hold 'Cancel' to exit and save the End point settings. You may now lower the throttle stick to the bottom.
  - Tap 'Cancel' two times to step back to the status display screen.

## *Jolt!* Kit – Radio Setup (Complete Kit/FS-i6 Transmitter)

- Troubleshooting
  - Given a forward command, only one motor responds -- given a right turn command, only the other motor responds.
    - i. You have either all mixing turned off, or both transmitter mixing and speed controller mixing turned on. Adjust so one and only one mix source is active.
  - Given forward command, robot backs up straight.
    - i. Use the transmitter Reverse function on both of the channels that feed your motor controller.
  - Given forward command, robot spins in place.
    - i. Reverse the polarity of the connector for the motor that is backing up.
  - Given right turn command, robot turns left, and vice versa.
    - i. Swap the receiver plugs for the two channels that control the motor controller(s). If you are using channels 1 and 2, unplug the receiver connectors and plug the connector that was in channel 1 into channel 2 and vice versa. You may have to correct the servo reversing for the two channels after doing this to get correct forward/reverse motion, but the turning control will be correct when you're done.

# Jolt! Kit – Miscellaneous Tips

- Miscellaneous tips
  - One of the most common causes of failure among amateur roboteers is from having screws simply shake loose from vibrations and impacts. The solution to this is to simply apply thread locking compound (not included) to your screws before inserting them (when screwing into metal connections like this kit only). The compound helps prevent the screws from loosening accidentally, but it can take 24 hours to cure, so it must be applied before an event rather than during it.
  - Check screws for tightness after matches to avoid any surprises
  - Tape all connections to prevent disconnections during matches
  - The foam wheels included in this kit are wonderful about absorbing impacts and taking a beating, but once an arena floor starts to get dirty the traction can start to decrease. Latex special effects body paint provides excellent traction, but it does not bond well to the wheels by itself. The answer is to first coat the outside edge of the wheels with a layer of rubber cement, let it dry, and then coat with a layer of latex paint. This results in a grippy surface that is well bonded to the wheel.
  - Adding foam inside the electronics compartment can help to save the battery and electronics from damage.
  - Consider “battle hardening” the drive motors as described in the following link:
    - [http://www.teamrollingthunder.com/Kitbots/Battle\\_Harden/body\\_battle\\_harden.html](http://www.teamrollingthunder.com/Kitbots/Battle_Harden/body_battle_harden.html)
- Useful links
  - <http://runamok.tech/AskAaron.html>
    - i. A veritable treasure trove of robot related tools and more than 6,000 answered questions on various robot related topics. If your question isn’t answered in the archives, you can submit it for an answer of your own.
  - <http://sparc.tools/>
    - i. Home of the default ruleset used by many competitions, as well as a useful getting-started guide
  - <http://www.buildersdb.com/>
    - i. One of two major sites used to find and register for various competitions across North America. Check here to see what events are nearby that you can attend.
  - <https://www.robotcombatevents.com/>
    - i. The second major site for finding and registering for competitions. This site is less US-centric, with events listed from across the globe.
  - <https://www.facebook.com/groups/RobotCombat/>
    - i. A Facebook group for builders of combat robots of all sizes.
  - <https://www.facebook.com/groups/Beetleweight>
    - i. A Facebook group for builders of 3lb combat robots.
  - <https://absolutechaosrobotics.wordpress.com/>
    - i. The robot building blog for the team behind this kit