

Viper

# R/C COMBAT ROBOT KIT



USER MANUAL

FingerTechRobotics.com















## **TABLE OF CONTENTS**

<b>Included In Your Kit</b>	<b>3</b>
<b>Safety</b>	<b>4</b>
<b>Before You Begin</b>	<b>6</b>
<b>Assembling The Viper</b>	<b>8</b>
<b>Binding Your Radio</b>	<b>18</b>
<b>Upgrades</b>	<b>19</b>
<b>Moving Forward</b>	<b>22</b>
<b>Troubleshooting</b>	<b>23</b>







**It is recommended to read through all of the instructions to familiarize yourself before starting.**

**INCLUDED IN YOUR KIT**

-  1 Anodized 6061 Aluminum Chassis
-  2 "Silver Spark" 33.3:1 Gearmotors
-  2 "tinyESC" Motor Controllers
-  2 2.25x0.75" Foam Rubber "Snap Wheels"
-  2 3mm x 0.75" "Snap Hubs"
-  1 Power Jack and Plug
-  1 7.4V Lipoly Battery
-  2 Mini Terminal Blocks
-  2 Polycarbonate Armor (Top and Front)
-  4 2-56x1/8" Screws
-  10 6-32x1/4" Screws
-  1 0.05" Hex Wrench
-  1 5/64" Hex Wrench
-  1 Snap Ring Pliers

**Not Included (available as add-on options):**

-  1 2.4GHz 6-Channel Transmitter (+ 8 AA batteries)
-  1 2.4GHz 6-Channel Receiver
-  1 Lipoly Battery Charger
-  1 12V Power Supply (for charger)

## SAFETY



### Take every precaution when building your robots

The Viper kit itself does not pose much hazard beyond pinched fingers. As you surely will be adding new parts and upgrades in the future, it is important to know how to safely handle them.

Batteries, motors and electronics each have their own dangers. If you are unsure how to safely handle them, ask someone who knows!

- 🧨 Events must be run with strict rules to keep competitors and spectators safe, but it is up to you to keep your work area safe.
- 🧨 More builders get injured in the construction process than during combat robot tournaments. Power tools can be dangerous if used incorrectly.

## **SAFETY**

- **Make sure a responsible adult is present when building and operating your robot.**
- **Wear safety glasses, hearing protection, and a dust mask when necessary.**
- **Have the robot's wheels off the ground when turning it on. If not and the settings are wrong, the robot may drive right at you.**
- **Weapon testing should be done inside a heavy wooden box with a thick polycarbonate window to contain possible flying debris.**
- **Remember to always turn the transmitter on before powering on the robot, and always turn the transmitter off after powering off the robot. This way any spurious transmissions picked up by the receiver will not cause the robot to twitch.**

## BEFORE YOU BEGIN



### An important note about lithium polymer (lipoly) batteries!

Lipoly batteries have an enormous energy density which makes them fantastic for this sport - where a lighter battery can mean weight available for stronger armor or weapons. But this battery chemistry must be treated properly or could become dangerous.

If a lipoly pack is discharged below 3.3V per cell (6.6V for a 2S pack) then they will not be safe to recharge. If your robot starts to slow down, it needs to be recharged!



You can also purchase a Low Voltage Alarm that plugs into the white balance plug of the battery. It displays the pack voltage and will sound an audible alert when it is time to recharge.

If a pack is ever damaged or seems puffed up, do not try to charge it. Replace the pack and recycle the old one.

The included Galaxy 7.4V 300mAh pack can be charged at a maximum of 0.6A. (This is set on the charger.)

## BEFORE YOU BEGIN

- ☞ Make sure you have all of the kit contents plus a lipoly charger for your battery (most require 12V power supplies).

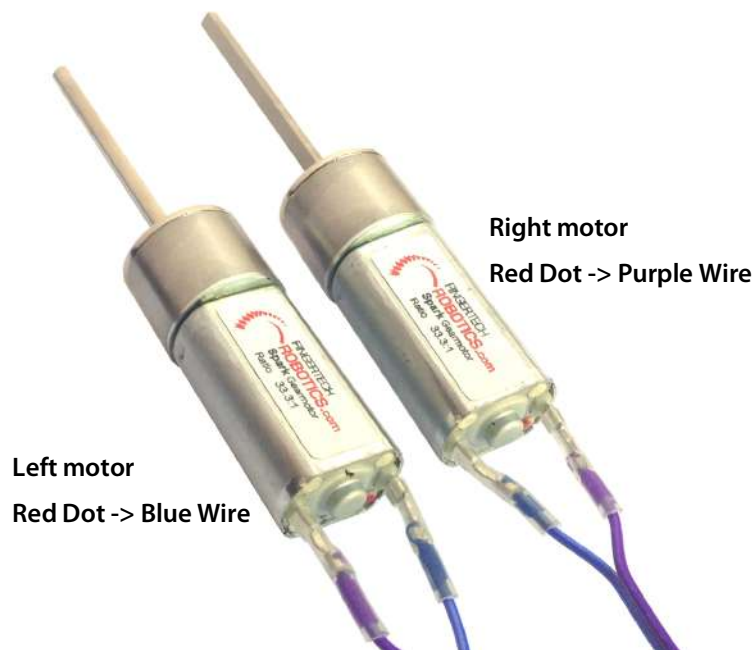


- ☞ Your transmitter requires 8 AA batteries. If you plan to use it frequently, you may want to purchase a rechargeable 3S (11.1V) lipoly transmitter pack (available on our website) or AA-size NiMH rechargeable batteries.



## ASSEMBLING THE VIPER

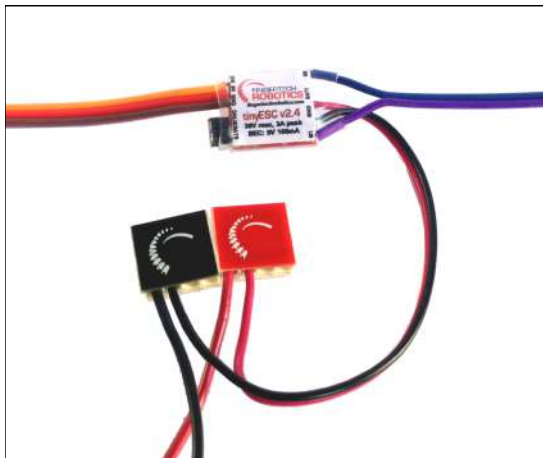
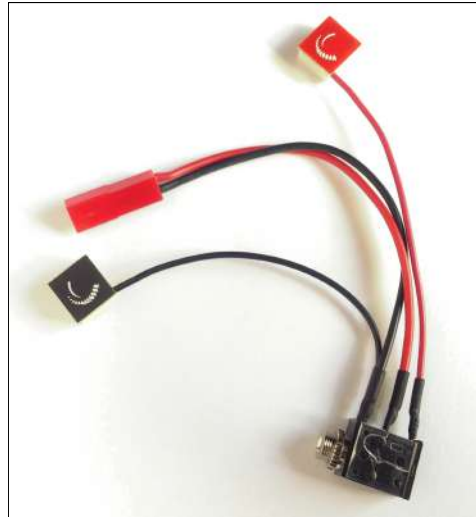
1. The **tinyESCs** in the Viper kit have special “MiniQD” push connectors crimped onto the motor leads so you don’t have to solder the connections.
2. Connect the blue wire (labeled “M2”) of one **tinyESC** onto one **Silver Spark motor’s** red terminal. Connect the purple wire (labeled “M1”) to the **motor’s** second terminal. This will be the LEFT motor.
3. Connect the purple wire (“M1”) of the other **tinyESC** to the right **motor’s** red-dot terminal. Connect the blue wire (“M2”) to the **motor’s** other terminal. This will be the RIGHT motor.





## ASSEMBLING THE VIPER

4. The **Power Jack** comes with a female JST lipoly connector plus one red and one black wire.

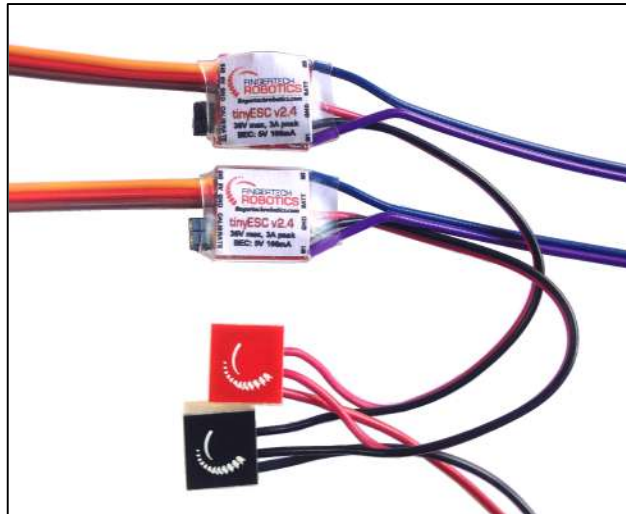


5. The red/black wires are plugged into the red/black **Mini Terminal Blocks**. Plug the red/black wires from both **tinyESCs** into these terminal blocks too.

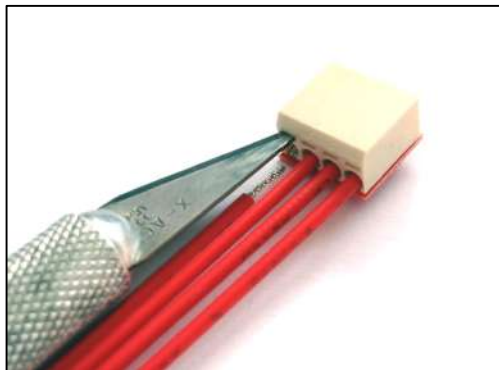
**Note:** This **Power Jack** is wired so that rechargeable batteries can be charged through it (see page 16). Because both positive and negative battery leads are in this switch, do not use a solid metal rod in place of a lost power plug! Use only a "3.5mm Mono Headphone Jack" or you will cause a short circuit.

## ASSEMBLING THE VIPER

With all the wires plugged in, there will be one free spot in each **terminal block** for future upgrades.



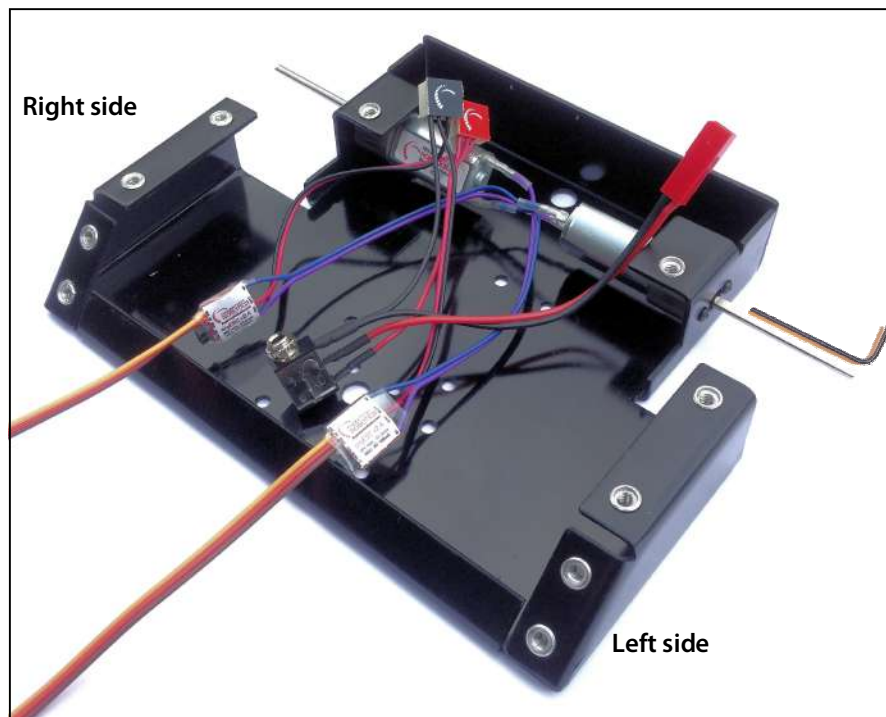
If you need to release a wire from the **terminal block**, push a flat tool into the slot above the wire and it will freely come out.



## ASSEMBLING THE VIPER

6. Slide the left **motor** into the left motor mount hole, and the right **motor** into the right motor mount hole.
7. Tighten the **motors** into place with four **2-56x1/8" screws** using the **0.050" (smaller) hex wrench**.

Have the motor wires angle towards the front of the robot.



## ASSEMBLING THE VIPER

8. Tighten the **power jack** onto the **baseplate** using its finger-nut. Pliers can help get it tight.



9. Slide the **Snap Hubs** onto the motor shafts and tighten the setscrew in each onto the flat of the motor shaft using the **5/64" (larger) hex wrench**.



10. Push the **Snap Wheels** over the **Snap Hubs**, then the hub's red washer.



11. Load a snap ring onto your **Snap Ring Pliers**. Squeeze and compress the tire and push the washer past the snap ring groove. Hold the washer in place with one hand and install the snap ring. (Installation video available on our website.)

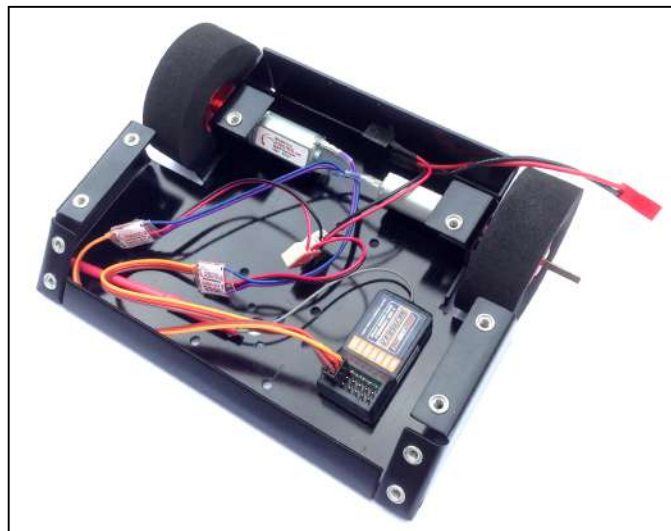
## ASSEMBLING THE VIPER

12. Plug the right **tinyESC** into Channel 1 of the **2.4GHz receiver**.

\* Make sure the ground wire (black or brown for all motor controllers and servos) is closest to the edge of the **receiver**.



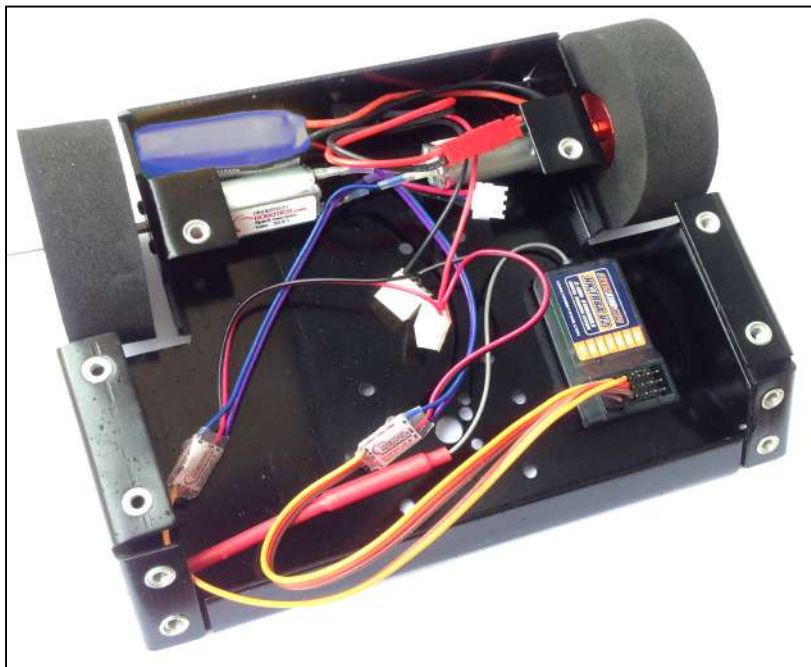
13. Plug the left **tinyESC** into Channel 2 of the **receiver**.
14. Fix down your **receiver**. Electrical tape, double-sided foam tape, or adhesive-backed Velcro all work well.



## ASSEMBLING THE VIPER

15. Time for a test! Make sure the **Power Plug** is inserted in the **Power Jack** on the bottom of the robot (so the robot is off).

Set the robot on something so that the wheels are off the ground.



16. Plug the **7.4V Lipoly Battery** into the **female JST connector** and tuck it behind one of the motors.

## ASSEMBLING THE VIPER

17. Turn your **Radio Transmitter** on then remove the **Power Plug** to turn the robot on. (Always follow this order for safety.) When the robot is on, each **tinyESC** blinks to say different things:

Slow blink (red)	No data coming from the radio. (See troubleshooting section.)
Rapid blink (green)	Transmitter stick is in the forward half of its travel
Rapid blink (red)	Transmitter stick is in the reverse half of its travel
Solid on (green/red)	Transmitter stick is at full travel in either forward or reverse
Solid on (red)	Indicates calibration mode has been entered. (See tinyESC FingerTech webpage for calibration details.) *Not usually required.

## ASSEMBLING THE VIPER

### 18. Test the drive motors.

The transmitter has been programmed with Channels 1 and 2 mixed for single-stick driving.

With the robot facing away from you, move the right stick up. Both motors should turn forward.

Moving the stick to the right should reverse the right motor and vice versa for the left. If either motor turns the wrong way, see the troubleshooting section.

If the motors are spinning while not pressing the transmitter sticks, adjust the trim levers on the transmitter (located just beside and below the stick) until the motors stop. Trims are for fine adjustments.

### 19. When everything is running correctly, turn the robot off by reinserting the **power plug**.

Don't forget to turn the **transmitter** off too.

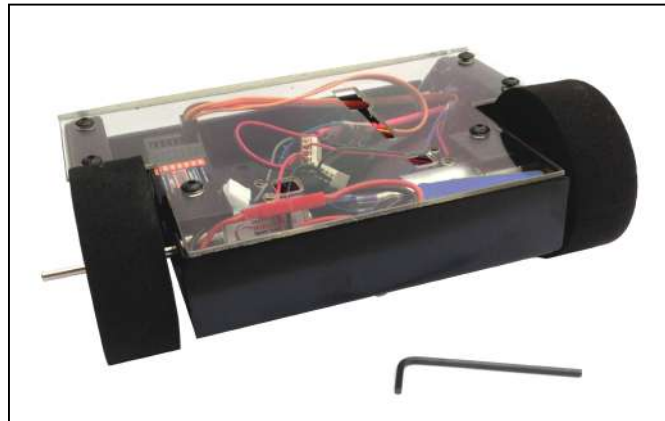


\*The **power plug** has a Male JST Connector to enable charging the battery without removing it from the robot. You can plug your **Battery Charger** onto this connector the same way you would plug it onto the battery!



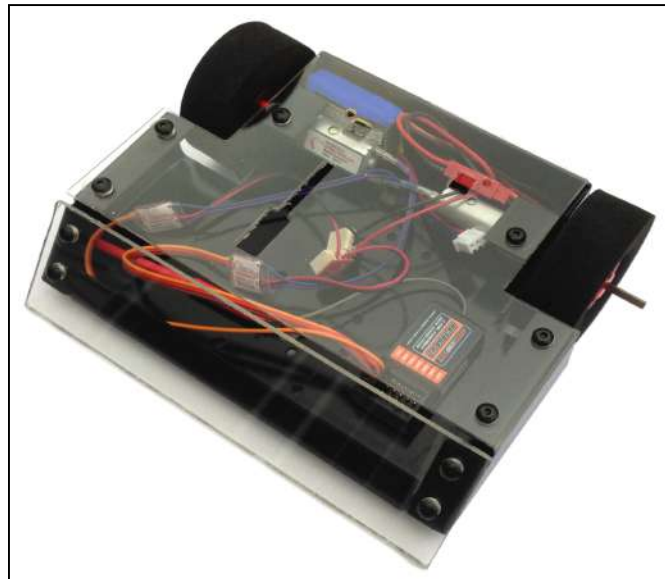
## ASSEMBLING THE VIPER

20. Fasten on the top and front **Polycarbonate Armor** using ten **6-32 x 3/8"** screws with the **5/64"** (larger) hex wrench.



Your kit is complete!

Power it up and take it for a test drive!



## BINDING YOUR RADIO

This process is already done for you, but for future robots it is good to know how to bind your transmitter to more receivers.

The **2.4GHz radio set** included with your kit does not use crystals to pair the **receiver** to the **transmitter** like older radios. Instead they are “bound” together by programming. To bind, start with everything turned off. Insert the included “bind plug” into the battery port (BAT) of the **receiver**.

Power on the **receiver** by removing the robot’s power plug. A dim red LED inside the **receiver** will start flashing.

Holding the BIND button on the **transmitter**, turn on the **transmitter**, and wait for the red LED inside the **receiver** to go from flashing to solid-on. Remove the bind plug and it’s done! Turn the robot off, then **transmitter** off. (Always follow this order for safety.)



## UPGRADES

The Viper Kit is a fantastic starting point when new to combat robotics. It is designed to teach you all the basics and give you a head start that other builders might take two or three events to catch up to. It is specifically designed NOT to win events right out-of-the-box. In robot combat, the real goal is to win by putting time and effort into your creations - study the competition, eliminate weak spots, upgrade your robot, and learn along the way.

With that in mind, here are some upgrades you can do to make your Viper into a winner!

### Titanium Armor and Wedge

Polycarbonate is great at taking impacts and its transparency is nice for troubleshooting, but it can be damaged easier than most metals. A sheet of 1mm



thick titanium on the top and 2mm thick for the wedge will be nearly indestructible. You can also make the wedge wider and slope the sides to protect against horizontal spinners.

(Titanium and other materials are available at FingerTech Robotics.)

## UPGRADES

### Lithium Polymer Batteries

Your kit comes with a 2-cell (aka 2S or 7.4V) lipoly battery. For more power and speed, it can be upgraded to a 3-cell (3S or 11.1V) pack. If you are adding a servo or other electronics, make sure they can handle the higher voltage! (Most servos cannot.)



If you want your robot to last longer, choose a pack with a higher mAh capacity. Just be aware that the pack's size and weight increase with capacity.

### Threadlock Liquid

For competition, it is highly recommended to use a medium strength threadlock liquid on all screws and setscrews so they do not vibrate loose during combat. Threadlock takes a day to cure properly, so get your robot done and tested well before the event!



- 💣 But do not let threadlock touch ANY polycarbonate - it will develop cracks in seconds!



## UPGRADES

### Adding Active Weapons

Your radio transmitter has four channels besides the two for drive that you can use to control additional active weapons.

Some combat robot events have added “Sportsman” weight classes that require active weapons. This is defined as “a weapon or device intended for use in attacking the opponent, independent of the robot drive train.” These include but are not limited to lifters, hammers, clamps, flamethrowers and spinning weapons.

The Viper combat kit has optional add-on packages for turning the basic Wedge robot into either a Lifter or a Spinner. Visit our website for more information!

### Shedding Weight

If you want to add things, you will need to make some weight for them! You can drill holes in the baseplate, shorten the motor shafts, remove the plastic case of the receiver, shorten/sharpen the front wedge, and shorten/solder all the wires. You can swap the 0.75” thick wheels for 0.5” thin, change the 300mAh lipoly battery for a smaller one, or even replace all the steel screws with aluminum ones! Every gram counts!

## MOVING FORWARD

### The SPARC Forum

The SPARC forum is where builders from

across the globe discuss robot designs, share progress reports, ask questions, and find out about combat robot events. The people there are very knowledgeable and helpful.



<http://sparc.tools/forum/>

### The Combat Robotics Facebook Page

A more public page to chat about robot designs and events. You will need to ask to join the group—it's how they keep out spammers!



<https://www.facebook.com/groups/RobotCombat/>

### FingerTech Robotics Facebook Page

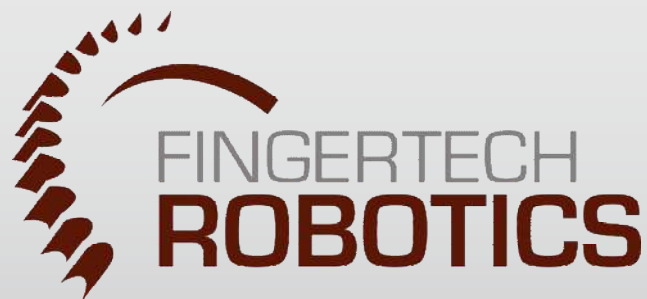
Find out about new products and see pictures of other peoples' creations! Send us your robot pictures and we will post them in our album!



<https://www.facebook.com/FingerTech>

## TROUBLESHOOTING

Problem	Solution
tinyESC LED is blinking slowly.	Check that your transmitter is on. Try re-binding the receiver to the transmitter.
Motor turning the wrong direction.	Swap the motor wires to the opposite motor leads.
Motor spins slowly when not holding transmitter stick.	Adjust the transmitter's trim lever for the corresponding channel.
No response with power switched on.  Receiver might blink only once when powered on.	Are tinyESCs plugged into the receiver backwards? Brown wires should be towards edge of receiver. Make sure the bind plug is out of the receiver. Try re-binding the receiver to the transmitter.
Batteries getting hot.	Make sure no red/black leads are connected to each other. This would create a short circuit.



**HANDS-ON INNOVATION**

Motors and Servos ■ Motor Controllers

Connectors and Switches ■ Wheels

Radio Equipment ■ Hardware

Pulleys and Belts ■ Battery Chargers

Autonomous and R/C Robot Kits

**FINGERTECHROBOTICS.COM**

Questions or comments regarding our products or your purchase can be directed to [sales@fingertechrobotics.com](mailto:sales@fingertechrobotics.com)