



Electric Vehicles

INSTRUCTION MANUAL

www.redcatracing.com

WARNING!

READ ALL INSTRUCTIONS INCLUDED WITH VEHICLE BEFORE OPERATING



Age warning: This radio controlled vehicle is not a toy! You must be 14yrs of age or older to operate this vehicle. Adult supervision is required.



RISK OF FIRE!

RISK OF EXPLOSION!

There is a risk of fire and explosion when dealing with Fuel and Batteries.

Nitro fuel contains Nitromethane and Methyl alcohol. These chemicals are highly flammable and explosive. Only use in well ventilated areas. Keep away from fire, spark, and heat. Store in a cool place away from heat. **NEVER SMOKE AROUND FUEL OF ANY KIND!**



Only use in a well ventilated area. Never run your engine indoors.

Rechargeable batteries may become hot and catch fire if left unattended or charged too quickly. Use extra caution when charging LiPO batteries. Use only LiPO specific chargers. Charge away from flammable materials. Never charge at a rate higher than 1S. (2000Mah pack = 2amps charge rate). Overcharging can lead to fire and explosion. Always store battery packs in a cool place.



POISONOUS!

Fuels contain Nitromethane and Methyl alcohol and are toxic. Injury or death can occur if swallowed. May irritate skin and cause injury if absorbed into the skin. Injury or death can occur from breathing the toxic fumes. **KEEP AWAY FROM CHILDREN AND PETS!** Always follow manufacturer's recommendations on fuel container.



RISK OF BURNS!

The engine, exhaust pipe, batteries, electronic speed controller, electric motor, and other areas of the vehicle get hot. Burns can occur if touched after vehicle operation. Allow adequate time to cool before handling.



RISK OF ELECTRICAL SHOCK!

Use caution when charging batteries. Do not touch positive and negative leads together. Do not lay battery on metal. Use only chargers specified for the battery type being charged. Keep batteries and chargers away from water.



RISK OF INJURY!

Hobby grade RC vehicles can cause serious injury or death if not operated correctly. Never use vehicle in crowds. Never chase people or animals. Drive in safe open areas only. Keep body parts away from moving parts.



RISK OF DAMAGE!

Never operate RC vehicles on public roads. Damage of vehicle and property can occur. Only operate on open private property.

Welcome to the world of hobby grade RC

Recommended for ages 14+ (with adult supervision)

Congratulations on your new hobby grade radio control vehicle. Hobby grade RCs offer many advantages over radio controlled vehicles sold in the toy department. One of the greatest advantages to hobby grade RC vehicles is the ability to set up the vehicle the way YOU want it. This includes using different battery packs for top performance, changing gear ratios to better suit your terrain, tuning the many adjustable suspension components like changing ride height and geometry, as well as customizing the overall appearance of your vehicle. Redcat Racing hobby grade RC vehicles were designed with all these characteristics in mind to provide you with much fun and adjustability.

Redcat Racing hobby grade RC vehicles are incredibly fast with some reaching speeds of 40 mph. While this is fun and exciting, it also comes with a great deal of responsibility. A 10-20 pound RC vehicle traveling at 30 mph carries much momentum. Getting hit in the leg at that speed is like being hit with a sledge hammer and serious injury may occur. Property damage as well as damage to your RC vehicle are also possible. Great care must be used while operating these vehicles.

This is not a toy and should not be treated as one. Follow the included instructions closely and be sure to keep hands away from the hot motor and electronic speed controller after running the vehicle. Make sure you read all included manuals completely before attempting to charge your battery pack and running your new RC vehicle.

Hobby grade electric motors come in brushed and brushless configuration. We will talk more about the differences in the motor section, but for now, let's talk about the similarities. The electrical current flowing to both a brushed or brushless motor is regulated using an electronic speed controller. This is the electrical device which connects to both the motor and the battery. The motor, electronic speed controller (ESC), and battery may get warm or hot during use. Be careful when touching these directly after use. Allowing the ESC and motor to cool before running the vehicle again will prevent damage to the electrical components. Allow battery packs to cool before recharging.

Redcat Racing radio controlled vehicles are engineered for performance as well as durability. This means shedding weight where ever possible and using complex suspension components that offer many tuning options. This allows the operator to make adjustments that will effect the way the vehicle responds to all aspects of the terrain. As you may know, any RC vehicle, whether it be hobby or toy grade, can break. How and when it breaks depends solely on your driving style. Unlike toy grade RCs, hobby grade RCs are designed with parts replacement in mind. Spare parts are readily available from Redcat Racing and more durable aluminum parts are available as well. It is recommended to keep spare parts on hand so if you run into that oak tree at full speed, you will have the necessary replacement parts to get you up and running again quickly.

Appearance is just as important as speed and handling. Who wants to go fast and look good doing it? You do! That is why Redcat Racing has also designed their vehicles to look as good as they perform. Accessories may also be added to your vehicle to customize its looks. As mentioned earlier, Redcat Racing hobby grade RC vehicles are completely customizable and that is where all the fun is at.

Imagine yourself being on the pit crew of a full scale monster truck. Making suspension adjustments for smoother landings or changing the gearing to get that hole-shot from the start. That is the feeling you will get when adjusting the suspension on your new Redcat Racing vehicle. Increase ride height so you can clear the driveway with a single jump or thicken the oil inside the oil filled shocks to make high speed laps around your front yard. The possibilities are endless with Redcat Racing, so put on your favorite pit crew cap, grab your Redcat Racing vehicle and have the time of your life!

Unpacking and setting up your new vehicle

The moment you've been waiting for is finally here. Your new Redcat Racing package has arrived. Before you go crazy from excitement, let's go over a few simple steps.

Unboxing your Redcat Racing RC vehicle

- Be sure you've removed all parts, equipment, tools, and documentation from the box. It's easy for small parts to get hidden in the packing materials and overlooked.
- Completely read all documents and instructions included with your vehicle.
- Acquire any necessary items such as battery packs, chargers, transmitter batteries, and any additional tools and supplies that may not be included.

Looking over your Redcat Racing vehicle

1. Be sure to look over your new Redcat Racing RC. This may save you some hassle in the future.
2. Check all screws to make sure they are tight. Do not over tighten screws nested into plastic as this may damage the plastic threads. Avoid using power tools for this step.
3. Check all nuts, bolts, and clips to ensure they are tight and secure.
4. Add medium strength liquid threadlock (like blue Loctite) to any screws threaded into metal parts, especially the motor mounts. Do not apply threadlock to screws threaded into plastic parts, this may damage the plastic threads. Threadlock can be found at auto parts stores.
5. Check all electrical connections. Loose connections create heat that may shorten battery life or worse, cause damage to the vehicle and components.
6. **Perform a radio range check.**
 - Thread the vehicle's antenna through the plastic antenna tube and turn on the transmitter.
 - Keeping fingers away from potentially moving parts, hold the vehicle off the ground and turn on the ESC switch found in the vehicle.
 - Check that the controls are working properly. The steering wheel should operate the steering and the trigger should operate the motor. Pulling the trigger should make the vehicle go forward, pushing the trigger should apply brake and reverse.
 - You may need to adjust the throttle trim found on the transmitter to keep wheels from spinning while trigger is in neutral position.
 - Have a buddy hold the vehicle and walk 50 yards away. You and your buddy decide on a routine since it will be difficult to communicate with each other while testing. An example would be.... turn wheel left and count to ten, turn wheel right and count to ten, Pull trigger and count to ten, and push brakes and count to ten. You will want to repeat these steps moving further out as you progress until you are beyond the maximum distance you plan to run the vehicle.
 - If the radio performed without any glitches or twitching, you are ready.

Electric motors

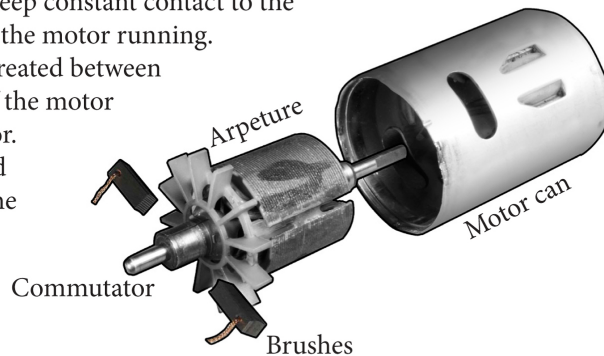
There are two types of electric motors used in RC vehicles, brushed and brushless. Redcat Racing offers vehicles with brushed motors as well as vehicles with brushless motors. In this section we will compare the two.

Brushed motors

Brushed motors use magnets mounted to the inside walls of the motor can. The center shaft, called an armature, contains wire coils used to create positive and negative charges. In order for these coils to work, they must have power supplied to them. Brushed motors use brushes to transfer power to the center shaft through the commutator, located toward the top of the shaft. A typical motor uses two brushes as seen to the right. These brushes must keep constant contact to the commutator in order to charge the coils and keep the motor running.

As you can imagine, lots of heat and friction are created between the brushes and commutator. Keeping this part of the motor clean is important to having a good running motor.

Motor cleaning sprays are sold at hobby stores and come in easy to use spray cans. Spray the end of the motor that contains the brushes with motor spray every couple of runs to keep it working properly. Thin bearing oil can be used to lubricate the bearings or bushings after cleaning.

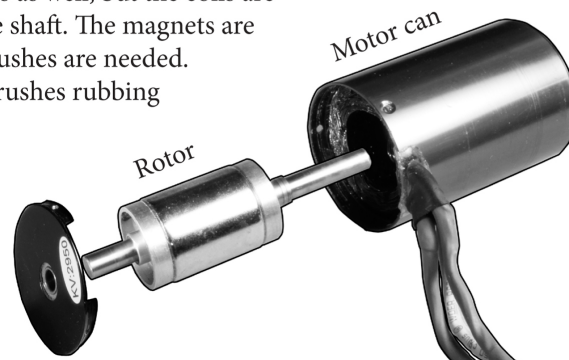


Brushless motors

Brushless motors need an electrical supply to the coils as well, but the coils are mounted to the inside of the motor can instead of the shaft. The magnets are mounted to the center shaft, called a rotor, and no brushes are needed.

The lack of friction and electrical arc caused by the brushes rubbing

the commutator allow brushless motors to run more efficiently than brushed motors. This means more power and longer run times. Although brushless motors are efficient, they still create heat and over heating any electric motor can cause failure.



Understanding battery packs

We will go over three different types of battery packs in this section. NiCd, NiMH, and LiPo. Although these three types of batteries have their differences, they also have some things in common. Such as, needing to be charged with a charger designed to charge that specific type of battery. Below are some terms used when talking about batteries.

What is cell count?

This is the number of battery cells used to make a battery pack. The more cells a battery pack contains, the higher the overall pack voltage.

Summary: The higher the cell count, the more voltage a pack has which causes the vehicle to go faster.

mAh rating?

MAh stands for Milliamp-hour and is used to rate a batteries capacity. The higher the mAh rating, the more capacity a battery can hold allowing longer run times.

It is easiest to think in terms of amp hours (Ah) instead of milliamp-hours (mAh). To get this figure, divide the mAh rating by 1000. If you have a battery rated at 3000 mAh, it is equivalent to a 3 Ah rating. Battery companies use milliamp-hours because it looks more impressive than amp-hours do. A battery rated at 3000 mAh = 3 Ah. That means if this battery was being discharged at a constant 1 amp, it would last for 3 hours before completely discharging, hence 3 amp-hours.

Summary: The higher the mAh rating, the longer the run times.

C rating?

The C rating is basically the capacity at which a battery can safely discharge without damaging it's cells. C ratings are multiplied by the pack's Ah to give you the safe amp discharge rate of a battery. For example: A 3000mAh , 20C pack will safely discharge at 60 amps.

3000 mAh = 3 Ah. 3 Ah x 20C = 60 amps.

Summary: The higher the C-rating, the higher the ESC & motor amp draw can be used.

NiCd

NiCd stands for Nickel-cadmium. NiCd batteries were used in RC for a long time. They were the first of the three to be developed. NiCd batteries are similar to alkaline batteries, but NiCd batteries can be recharged. A NiCd battery can be discharged at high rates without damage but they are limited in terms of capacity. NiCd packs were the standard for toy department RC cars.

NiMH

NiMH stands for Nickel-metal hydride. NiMH batteries have larger capacity capabilities than NiCd batteries but they tend to self discharge quicker. While a NiCd would be preferred in a remote, the NiMH batteries high capacity makes it a great choice for RC vehicles.

LiPo

LiPo stands for Lithium-ion polymer. LiPo batteries are a completely different chemistry than both NiCd and NiMH batteries. LiPo batteries don't require pressure as do NiCd and NiMH which allows them to be constructed without the same metal casings the other cells use. LiPo batteries are superior in performance but require more care when being used. LiPo batteries must be charged with a LiPo specific charger and must be used with a voltage cut off device. If a LiPo battery is completely discharged it will not be usable again. Many of the brushless vehicles come with a LiPo ready ESC which has a built in voltage cutoff for that reason. Most brushless systems work best with LiPo batteries because of their large mAh ratings and lighter weight.

Battery comparison chart

	Nicd	NiMH	LiPo
Nominal Cell Voltage	1.2v per cell	1.2v per cell	3.7v per cell
Typical sizes used in RC	6 cell = 7.2 volts 7 cell = 8.4 volts	6 cell = 7.2 volts 7 cell = 8.4 volts	2S = 7.4 volts, 8.4v max. 3S = 11.1 volts, 12.6v max. 4S = 14.8 volts, 16.8v max.
Capacity rating	Low	High	Very high
Advantages	<ul style="list-style-type: none"> • Handles fast discharge rates because of low internal resistance • Many chargers can charge NiCd batteries 	<ul style="list-style-type: none"> • High discharge ratings • Do not form memory from not discharging 	<ul style="list-style-type: none"> • Very high capacity ratings • Light weight • An even discharge rate through out charge
Disadvantages	<ul style="list-style-type: none"> • Must be discharged before recharging or cells will form a memory which will prevent the battery from completely discharging and can shorten the life of the battery • Can get hot during charging which damages the cells 	<ul style="list-style-type: none"> • Higher self discharge rate than the other battery types when left unused 	<ul style="list-style-type: none"> • Will be damaged if over discharged • Could explode and catch fire if over charged • Cells need to be balanced • Must use an ESC with a voltage cut-off designed for LiPo batteries
Self discharge	Low self discharge	High self discharge	Low initial self discharge
Cautions	<ul style="list-style-type: none"> • Best if completely discharged • Monitor heat during charging 	<ul style="list-style-type: none"> • Best if not completely discharged • Must used NiMH rated charger 	<ul style="list-style-type: none"> • Do not over discharge • Do not over charge • Use a protective battery bag (sold at RC stores) when charging • Must have LiPo voltage cut off on the ESC to use these batteries. • Must have LiPo specific charger

Maintaining your Redcat Racing vehicle

There is much fun to be had running RC vehicles. To ensure that fun continues throughout the years, here are some maintenance tips to follow.

Chassis maintenance:

Many substances such as dirt, grass, & grime can find its way onto your RC chassis. It's a good idea to clean this off after each days use. There are many ways to clean an RC vehicle. Here are a few examples.

1. One of the most effective ways to clean the chassis is with a used tooth brush, old paint brush, and rag. These three tools work well for removing dirt and debris.
2. Pay close attention to areas with moving parts such as suspension components, steering components, and drive train. It is important to get these areas clean to help prevent wear.
3. Though running your vehicle through water is never recommended, moisture may still make its way into the vehicles bearings. Here are some tips on drying, cleaning, and oiling the bearings.

Your Redcat Racing vehicle may have bearings in various locations like wheel hubs, steering linkages, gear supports, and drive shaft supports. First you must have access to all the bearings. Remove all four wheels and any other parts blocking bearing access.

- Spray the bearings with a water displacer such as WD40 or Wire Dryer. This will flush out moisture, dirt, and grime.
 - After a good spraying with a water displacer, the bearing will be left dry and in need of oil. Use a light bearing oil found at the hobby shop or auto parts store. *This step is important* Failing to re-oil the bearing will cause them to wear prematurely and replacements will be necessary. A few drops of oil per bearing should be fine. Spin the bearing to work the oil into the inner race.
4. Check all screws and moving parts
 - It's a good idea to quickly go over the entire vehicle after each run to ensure all screws remain tight and there isn't any excess slop in the moving parts.
 - Thread lock should be used on any screws that fasten into metal parts, especially the motor mount.
 5. Checking for cracks and excess wear is also a good way to save yourself from headaches down the road.

Maintaining your Redcat Racing vehicle

Electronics:

Be sure to check your electronics after each use. The electronics are the life line of the vehicle and if they aren't working properly, a crash is almost certain.

- Periodically range check your radio system to ensure proper operation.
- Check batteries regularly. It is important to have fresh batteries in the transmitter.
- Check the antenna on both the receiver and the transmitter. Make sure there are no cuts or breaks in the receiver antenna. This will cause glitches and possible signal loss.
- Using the transmitter, check the steering servo by turning the wheel back and forth. Check that it is operating smoothly and no clicking noises can be heard.
- Make sure all electronics stay dry. Water can short out the circuit boards inside the electronics causing failure.
- Brushed motors should be sprayed with electric motor spray found at your local hobby shop. This will prolong the motor's life by keeping the commutator and brushes clean. Remember to re-oil the bearings or bushings with a light bearing oil. Brushless motors do not need cleaning.
- The electronic speed controller should be inspected after each use. Make sure all connections are tight and no wires are in harm's way. Check the fan (if included) on the ESC for any debris. The fan is an important component in keeping the ESC cool. Make sure the ESC stays dry and never store with a battery pack plugged in.

Driving Tips

Here are some tips to help improve your driving skills.

Perspective:

The single most difficult aspect of driving RC vehicles is perspective. Perspective involves your relation to the vehicle. Are you behind the vehicle, in front of the vehicle, or beside it?

Driving an RC vehicle while standing behind it is like driving a full size car or go-cart. When you turn left, it goes to the left and when you turn right, it goes to the right. Simple.

What if the vehicle is coming toward you? When to turn the wheel to the left, will it go toward your left? No! Because the vehicle is coming toward you, the controls seem reversed. The controller doesn't actually change, it just seems like it does because of perspective.

Always imagine yourself sitting inside the vehicle, not standing outside with a remote. Imagine you are driving and the wheel on the remote is the actual steering wheel inside the car. Keeping this mind set will help you make the correct steering decisions no matter which direction the RC vehicle is pointed.

Controlling Steering and throttle input

The steering and throttle inputs are both proportional. This means slightly pulling the trigger will make the RC vehicle move slowly. Pulling the trigger all the way back will cause the RC vehicle to go fast. The same applies to the steering.

The most common mistake with new RC enthusiasts is over correction. Over correction is when a slight amount of steering or throttle is needed and full throttle or steering is applied causing "crazy driving".

It's a good time to learn how to control your movements. This may sound silly, but nerves and adrenaline have a lot to do with over correction. It is sometimes difficult to control our movements when we are excessively excited and I promise you, when this vehicle blasts across your yard and the grass starts flying, you will get excited.

As you become more familiar with your RC vehicle, you will tend to relax a little more making it easier to concentrate on small control inputs instead of great big ones.

Look where your going

While controlling a vehicle going 30 mph it's important to look where it's going instead of where it's been. Looking a good five-to-fifteen feet in front of the vehicle will give you time to react to uncertain obstacles. It also prevents trees from jumping out in front of you.

Advanced driving tips

As you become comfortable driving your Redcat Racing RC vehicle, you may want to drive smoother and with more precision so you can go faster. Here are a few driving tips that are sure to add some excitement.

Drifting:

Driving on loose surfaces like dirt or gravel can be fun, but how do you keep from spinning out?

Counter steering is the answer to that question. Here is a rule of thumb to go by. Always keep the front tires pointed in the direction you want the car to go. This is true regardless which direction the vehicle itself is pointed.

Here is an example:

Let's say you are driving in loose dirt. You are traveling at full speed and you want to make a left hand turn while maintaining most of your speed. You turn the wheel left spinning the vehicle 360 degrees resulting in a complete loss of speed.

Try this! Get the RC up to full speed again, only this time, turn left and when the vehicle starts to spin, turn right keeping the front tires pointed where you want the car to go. When done correctly, the vehicle will enter into a slide or "drift" allowing you to turn while maintaining most of your speed. Practice this many times in both directions and you'll be drifting like a pro.

Jumping:

When done correctly, jumping is by far the most impressive maneuver done with RC vehicles. All RC's can go up, but how they land determines whether it was a success or a mess. Anyone can hit a jump at full speed, I'm going to teach you how to land on all four tires.

The wheels on an RC vehicle act as gyroscopes. All this really means is, you can drive the vehicle while it's in the air. The amount of throttle or brake applied while in mid flight will control whether the nose is up or down. Applying throttle will raise the nose and applying brake will lower the nose.

This is good to know if you hit a jump and your vehicle's nose is pointed at the ground. Hit the gas! Hitting the gas will raise the nose to help level out the landing. The amount of throttle used is in direct relation to the amount of correction needed.

This is where it gets complicated. Adding steering input in conjunction with throttle inputs will cause a whole new outcome.

Let's say you are in mid flight, your left front tire is closest to the ground, and you want to level the vehicle out. In this case you would steer left and apply throttle. This will raise the left front tire. Applying too much throttle will raise the left front tire too high.

Here is a good rule of thumb. Steer into the front corner of the vehicle you want to correct and apply the appropriate trigger response. Remember, applying throttle raises the nose and applying the brake lowers it.

This will take much practice so be sure to have some spare parts on hand. Bad landings can do lots of damage.

Driving with minimal braking:

Let me clarify what I am talking about. Do not disable the brakes at any time on your Redcat Racing RC vehicle. I am talking about planning ahead and looking where you are going.

Find a large field or empty lot you have permission to be on. Set out some small cones or plastic cups to mark the corners of an oval. Drive around your newly created test track and see how it goes.

Now drive around the same track but this time, look at the corner before you get there. Let off the throttle before you get to the corner and plan how you will get around it. Using this technique, try to make it around the whole track without using the brakes. Let the vehicle coast around each corner and apply throttle as you exit. Continue this over and over, increasing speed with each lap. If it gets too exciting in the corner, let off the throttle sooner. This will teach you to look ahead eliminating surprises. Use caution! If you think you might hit something, hit the brakes instead.

SETUP TIPS

Redcat Racing cars, trucks, and buggies offer many tuning options to help you achieve the exact feel you like in a vehicle. These tuning options include shock position, ride height, camber, toe in or out, shock stiffness, and over all suspension geometry.

SHOCK POSITION:

Shock position plays a big role in how your vehicle handles bumps as well as turning stability. The effects of shock position effect the area of the vehicle you change. For instance, if you change the front shock positions, it will effect the traction and stiffness of the front tires.

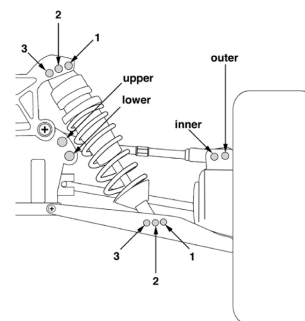
FRONT SHOCK POSITION:

POSITION: top=1 & bottom=3

The straighter up and down the shock is, the stiffer it will feel. This may also decrease bump handling stability as well as decrease traction. The benefit of this position in increased steering response.

POSITION: top=3 & bottom=1

Shocks in a more leaned position will give a softer feel. This increases bump stability and front traction however, it decreases steering response.



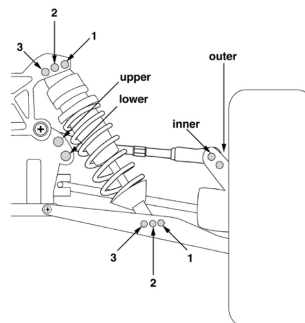
REAR SHOCK POSITION:

POSITION: top=1 & bottom=3

The straighter up and down the rear shocks are, the stiffer the feel. This decreases rear traction which increases steering, but gives less stability over bumps.

POSITION: top=3 & bottom=1

Leaning the rear shocks in decreases steering by providing more rear traction and increases bump stability.



RIDE HEIGHT:

Adjust ride height by moving the top spring collar up or down on the shock body.

Increasing ride height allows you to drive over larger obstacles but also raises the vehicle's center of gravity (C. O. G.). A higher C. O. G. means less stability.

Decreasing ride height increases stability but decreases the size of the obstacles you can maneuver over.

SHOCK OIL:

Heavier weight shock oil (bigger number) will provide more dampening and slow down the speed at which the shock travels. This will reduce chassis roll for more stability.

Lighter weight shock oil (smaller number) will offer less dampening allowing the shock to recover quicker. This is better for rough terrain but offers less high speed stability from increased chassis roll.

UPPER LINK ADJUSTMENTS:

Adjusting the upper link effects the vehicle's "roll center". Adjusting "roll center" will effect the way the chassis rolls at its center of gravity.

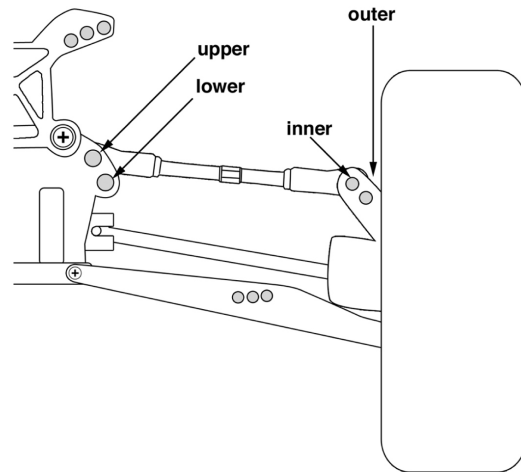
There are two mounting positions to chose from on the chassis side and hub carrier side of the upper link.

Two things to watch for are upper link length and upper link angle.

UPPER LINK LENGTH:

The longer the upper link, the more the chassis wants to roll in turns. While chassis roll may not seem good, it adds traction in the turns. This is good for a loose track where much traction is needed.

The shorter the upper link, the less the chassis will roll. This is good for a high bite track where stability is needed.



UPPER LINK ANGLE:

The angle of the upper links also effect chassis roll.

Parallel upper link:

When the upper link is parallel (level) to the lower arm, the chassis has a tendency to roll more giving more cornering traction on low grip tracks.

Angled upper link:

You must first understand, when I refer to an angled upper link, I'm referring to the inside of the link angling downward. This will give the vehicle a more stable feel with less overall traction. This is good for high bite tracks where stability is needed.

FRONT or REAR:

Keep in mind, changes made to the rear effect the rear and changes made to the front effect the front. Both front and rear traction effect the vehicles turn-ability. Less traction in the front will make the vehicle more difficult to steer, but less traction in the rear will make the vehicle steer more easily.

TOE IN & OUT:

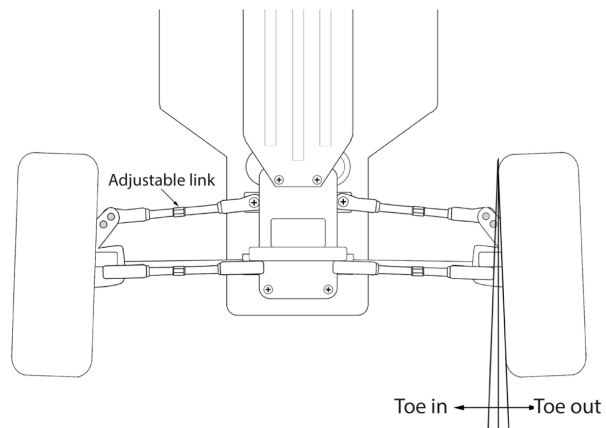
Toe in and out refers to whether the front of the tires are angled in or out.

Toe out:

Toe out gives less straight line tracking (darty feel) but more steering. 2 degrees of toe out is usually good for the front.

Toe in:

Toe in gives less steering and more straight line tracking. 0-2 degrees of toe in are usually good for the rear.



CAMBER:

Camber is the vertical angle at which the tires sit in relation to the ground.

NEGATIVE CAMBER:

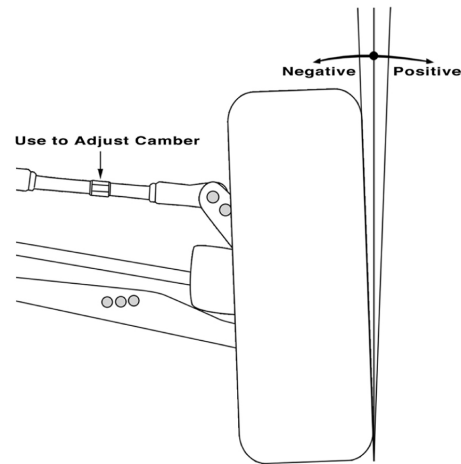
Adding little negative camber (1-2 deg.) will lean the tops of the tires inward providing more traction while cornering.

POSITIVE CAMBER:

Adding little positive camber will lean the tops of the tires outward providing much less traction while cornering. Positive camber is usually not used.

NEUTRAL CAMBER:

No camber added will set the tires straight up and down offering the most straight line traction but slightly decreased traction while cornering.

**SLIPPER CLUTCH ADJUSTMENTS:****INCREASING SLIP:**

The small nut on the end of the slipper clutch (large spur gear next to motor) allows you to tune the vehicles traction to your driving style. Loosening the nut provides more clutch slip which reduces the amount of wheel spin. Be careful not to loosen the nut too much. Over loosening the slipper clutch will cause excess slip to the spur gear resulting in high levels of heat from friction. This can quickly ruin a gear.

DECREASING SLIP:

Tightening the small slipper nut will reduce gear slippage sending the power to the ground resulting in more wheel spin. The slipper clutch also acts to protect the inner gears from shock failure. This occurs when landing while on full throttle or hitting something while on throttle. Over tightening the slipper clutch will result in less protection for all gears.

SETTING THE SLIPPER:

The slipper should slip slightly (not easily) when rolling the vehicle while holding the spur gear. If it slips easily, it is too loose. If it will not slip at all, it is too tight.

GEARING:

Gearing the vehicle down will provide more initial power and less top speed. Gearing the vehicle up will provide more top speed and less initial power.

GEARING UP:

There are two ways you can gear up for more speed. Increase the size (more teeth) of the pinion gear or Decrease the size (less teeth) of the spur gear (large gear on the slipper clutch)

GEARING DOWN:

There are two ways to gear the vehicle down for more power. Decrease the size (less teeth) of the pinion gear or increase the size (more teeth) of the spur gear (large gear on slipper clutch)

Altering Gear Ratios:

Altering the speed and performance of Redcat Racing RC vehicles with different gearing ratios is easy.

Two options are available for tuning gear ratios. Replacing the spur gear and/or the pinion gear.

Which do I change?

Which gear to change depends on availability and the amount of change desired.

Changing the tooth count on the spur gear will offer smaller changes than changing the tooth count on the pinion gear. If a large change is desired, start with the pinion gear and then fine tune with the spur gear.

Changing the pinion gear:

The pinion gear is the small gear found at the end of the motor's shaft.

You may change the tooth count on the pinion gear to tune the vehicle's speed and acceleration.

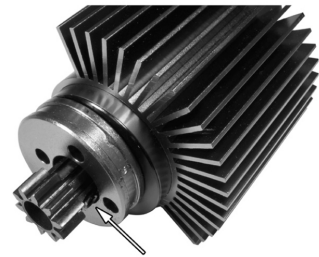
Go Faster

To make the vehicle go faster, replace the pinion gear with one that has more teeth. The bigger the tooth count difference, the bigger the speed difference.

NOTE: The faster you gear your vehicle, the less low end torque it will have. Gearing too high may over stress the motor and ESC causing them to overheat.

More Power

If more pulling power is needed, replace the pinion gear with one that has less teeth. This will increase power, but decrease top speed.



Changing the Spur Gear:

The spur gear is the large gear meshed with the pinion gear. The spur gear is usually mounted to a slipper clutch assembly or center differential.

Go Faster

To add top speed, replace the spur gear with one that has less teeth. This will increase speed, but decrease bottom end torque.

More Power

For more power, install a spur gear with more teeth. This will increase power, but decrease top speed.



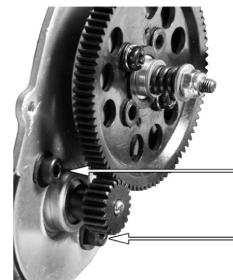
Gear Mesh:

Replacing the pinion or spur gear will require resetting the gear mesh. Gear mesh refers to how the gears fit, or mesh, with each other.

Using a regular piece of white printer paper can help achieve the perfect mesh.

After loosening the two screws that hold the motor to the motor mount, push the pinion gear against the spur gear, sandwiching the piece of paper between them.

Tighten the motor mount screws adding a drop of blue loctite to each screw. Remove the paper. There should be a small amount of play between the gears.



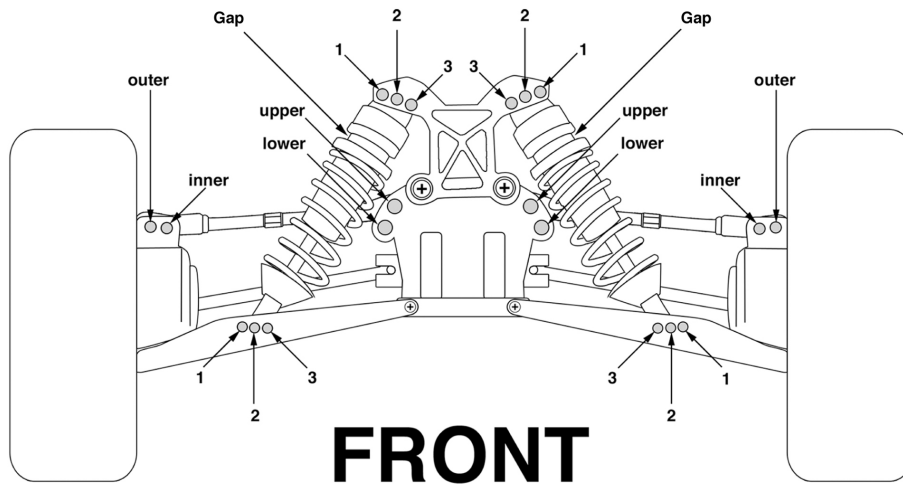
Performance upgrades

There are many options from Redcat Racing that are geared more toward hardcore performance. Performance that makes your hair stand on end and your blood boil. Hardcore Redcat Racing performance! Performance that allows you to blast around the back yard or track while leaving everyone else in the dust! Performance that allows you to take that big jump you used to break parts on! I'm talking aluminum! Redcat Racing offers many aluminum performance upgrades that not only add durability, but precision. The kind of precision and added tune-ability impossible to achieve with stock plastic parts. I'm talking hardcore performance aluminum upgrades from Redcat Racing.

To see which hardcore performance upgrades are available for your model, go to:

www.redcatracing.com

Set-up Sheet



Shock Position:

Top: 1 ☐ 2 ☐ 3 ☐
Bottom: 1 ☐ 2 ☐ 3 ☐

Upper Link Position:

Inside: Upper ☐ Lower ☐
Outside: Inner ☐ Outer ☐

Shock oil: _____ wt.

Camber Deg:

Negative: _____ degrees
Positive: _____ degrees

Spring pre-load "Gap": _____

Toe:

Piston inserts: _____ (1, 2, or 3 holes)

In: _____ degrees
Out: _____ degrees

Additional notes: _____

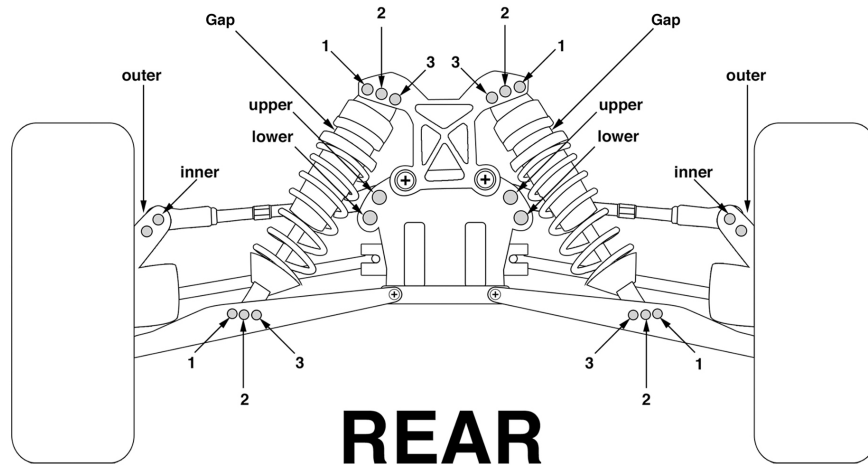
Battery:

LiPO: _____ Cell, _____ Mah, _____ C
NiMH: _____ Cell, _____ Mah _____
LiFE: _____ Cell, _____ Mah, _____ C

www.RedcatRacing.com



Set-up Sheet



REAR

Shock Position:

Top: 1 ☐ 2 ☐ 3 ☐
 Bottom: 1 ☐ 2 ☐ 3 ☐

Upper Link Position:

Inside: Upper ☐ Lower ☐
 Outside: Inner ☐ Outer ☐

Shock oil: _____ wt.

Camber Deg:

Negative: _____ degrees
 Positive: _____ degrees

Spring pre-load "Gap": _____

Piston inserts: _____ (1, 2, or 3 holes)

Additional notes: _____

Pinion Gear: _____ teeth

Spur Gear: _____ teeth

Spur Gear: metal ☐ plastic ☐

Tires: _____

www.RedcatRacing.com



Trouble shooting guide

Trouble shooting symptoms	Possibly problem	Possible correction
Vehicle won't steer or move	<ul style="list-style-type: none"> • Transmitter not turned on • Transmitter batteries are dead • ESC not turned on • Battery pack not charged or plugged in 	<ul style="list-style-type: none"> • Turn on transmitter • Replace transmitter batteries • Turn on ESC • Charge battery pack and plug securely into ESC
Vehicle steers but won't move	<ul style="list-style-type: none"> • Battery pack not charged • Motor wires are damaged or unplugged • ESC needs to be reset 	<ul style="list-style-type: none"> • Charge battery pack • Check motor lead wires for damage and plug in • Follow manual to reset ESC
Car has grinding sound	<ul style="list-style-type: none"> • Gears are worn out or stripped 	<ul style="list-style-type: none"> • Check all gears starting with the spur gear and replace worn out or broken gears
Motor spins but car won't move	<ul style="list-style-type: none"> • Slipper clutch too loose • Spur gear melted • Hex inside a wheel is rounded out 	<ul style="list-style-type: none"> • Tighten slipper clutch • Inspect and replace melted spur gear • Check all wheels to make sure they are tight. Replace if needed
Car bounces and wobbles when going fast	<ul style="list-style-type: none"> • Dirt or debris stuck inside rim • Bent axle or drive shaft 	<ul style="list-style-type: none"> • Clean all rims • Replace bent parts
Car turns to the side automatically	<ul style="list-style-type: none"> • Steering trim on transmitter needs to be adjusted • Servo saver too loose • Front wheels have too much toe-out • Steering linkage needs to be adjusted • Steering servo horn needs to be re-aligned • Gears in servo are stripped 	<ul style="list-style-type: none"> • Adjust steering trims on transmitter • Tighten servo saver • Use the tuning guide to reset the toe-out of the front wheels • Adjust the steering linkages with a small wrench • Remove the steering servo horn, reposition so wheels are straight, and reinstall • Replace servo
Makes clicking noise when steering and constant steering trim is needed	<ul style="list-style-type: none"> • Gears in steering servo are stripped • Servo horn is stripped 	<ul style="list-style-type: none"> • Replace the steering servo • Replace servo horn
Sluggish steering	<ul style="list-style-type: none"> • Servo saver too loose 	<ul style="list-style-type: none"> • Tighten servo saver
Loss of control	<ul style="list-style-type: none"> • Transmitter batteries low • Electronics may have gotten wet 	<ul style="list-style-type: none"> • Replace transmitter batteries • Unplug battery, dry electronics, and replace if needed
Battery pack won't charge	<ul style="list-style-type: none"> • Using wrong charger • Loose connector • Bad battery pack 	<ul style="list-style-type: none"> • Use charger rated for type of battery • Check connectors • Replace battery pack
Car moves with no throttle input	<ul style="list-style-type: none"> • Throttle trim on the transmitter is not set properly or got bumped 	<ul style="list-style-type: none"> • Adjust the throttle trim on the transmitter
Suspension is overly bouncy and the lower arm is wet	<ul style="list-style-type: none"> • Shock leaking oil 	<ul style="list-style-type: none"> • Check the shock with the wet spot for oil. Refill with oil and tighten seal

WARNING!

READ ALL INSTRUCTIONS INCLUDED WITH VEHICLE BEFORE OPERATING



Age warning: This radio controlled vehicle is not a toy! You must be 14yrs of age or older to operate this vehicle. Adult supervision is required.



RISK OF FIRE!

RISK OF EXPLOSION!

There is a risk of fire and explosion when dealing with Fuel and Batteries.

Nitro fuel contains Nitromethane and Methyl alcohol. These chemicals are highly flammable and explosive. Only use in well ventilated areas. Keep away from fire, spark, and heat. Store in a cool place away from heat. **NEVER SMOKE AROUND FUEL OF ANY KIND!**



Only use in a well ventilated area. Never run your engine indoors.

Rechargeable batteries may become hot and catch fire if left unattended or charged too quickly. Use extra caution when charging LiPO batteries. Use only LiPO specific chargers. Charge away from flammable materials. Never charge at a rate higher than 1S. (2000Mah pack = 2amps charge rate). Overcharging can lead to fire and explosion. Always store battery packs in a cool place.



POISONOUS!

Fuels contain Nitromethane and Methyl alcohol and are toxic. Injury or death can occur if swallowed. May irritate skin and cause injury if absorbed into the skin. Injury or death can occur from breathing the toxic fumes. **KEEP AWAY FROM CHILDREN AND PETS!** Always follow manufacturer's recommendations on fuel container.



RISK OF BURNS!

The engine, exhaust pipe, batteries, electronic speed controller, electric motor, and other areas of the vehicle get hot. Burns can occur if touched after vehicle operation. Allow adequate time to cool before handling.



RISK OF ELECTRICAL SHOCK!

Use caution when charging batteries. Do not touch positive and negative leads together. Do not lay battery on metal. Use only chargers specified for the battery type being charged. Keep batteries and chargers away from water.



RISK OF INJURY!

Hobby grade RC vehicles can cause serious injury or death if not operated correctly. Never use vehicle in crowds. Never chase people or animals. Drive in safe open areas only. Keep body parts away from moving parts.



RISK OF DAMAGE!

Never operate RC vehicles on public roads. Damage of vehicle and property can occur. Only operate on open private property.