Secrets of…

NITRO RC CARS

How To Get Started… Even if You Are a Total Beginner!

By

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About the Author

Hello Friend,

I have loved RC cars since I was 7 years old. Starting out with “toy” models, my parents eventually bought me my first hobby quality RC car in 1981. It was a Tamiya Ford Ranger XLT electric powered RC car.

My first electric RC car was so much fun, that my collection started to grow… Tamiya Wild Willy 1, Tamiya HotShot I, Team Associated RC10, Bolink 10, Tamiya Lamborghini Tamtech, and Tamiya Ferrari Testarrosa Tamtech.

Although I was enjoying electric RC cars, it was during the early 90’s when I read about gas powered RC cars. I became fascinated and excited at the though of owning gas powered RC cars because of the realism and speed of the 2-stroke engine.

I wanted to buy one. So I looked at a lot of models, compared prices, and eventually bought a 1/10 scale Kyosho Rampage. It was an off-road buggy similar to my RC10, except that it had a .12 size 2-stroke engine.

Being new to gas cars, I made a lot of mistakes, especially when it came to “tuning” the 2-stroke engine. I encountered various problems. There where days when the engine simply refused to start. And when it did start, the car ran very slowly, sputtered, and stopped.

It was frustrating at times, but when the car ran properly, I had a lot of fun. And as I gained more experience, I no longer had problems with the 2-stroke engine.

I bought two more gas powered RC cars. One was an OFNA Touring Car (1997), and the last was a NEO Touring Car (1999). It was the NEO Touring Car which I used to luckily win two major RC racing events in the Philippines: the 1999 Neo Gas Touring Championships, and the 1999 Futaba Open Gas Car Championship.

Today, 25 years later since my first RC car, I still enjoy and have fun, especially with my gas powered RC touring cars. I wrote this eBook “Secrets of Nitro RC Cars” to help you have a trouble free experience, and have lots of fun with nitro RC cars.

Enjoy!

Joel Mangilit

Equipment for Gas RC Cars

Gas RC cars are actually simpler and require less equipment than electric RC cars. All you need to buy are the following:

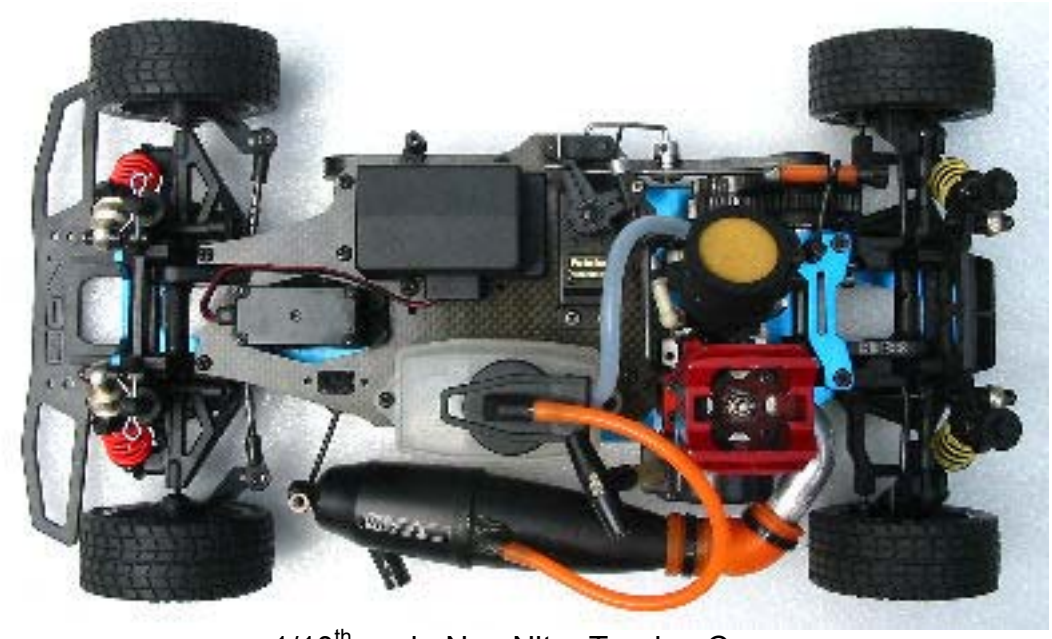
1. Car
2. 2-stroke engine
3. Radio control system
4. Glow plug igniter
5. Glow plug (included in the engine)
6. Fuel
7. Fuel bottle
8. AA-size batteries

The best part is companies are now selling ready-to-run (rtr) gas RC cars that come complete with all the equipment mentioned above. Simply open the box, put fuel, start the engine, and enjoy playing!

Cars

There are many types of gas powered RC cars to choose from. You can start out with the fast 1/10th scale gas cars, and as you gain experience, move on to the even faster 1/8th scale category.

1/10th scale gas cars are usually powered by .12 size engines that have around ½ to 1 horsepower. Normal speeds are in the range of 30 mph, but some are capable of speeds in excess of 50 mph.



1/10th scale Neo Nitro Touring Car

.21 size engines that have 2 to 3 horsepower power 1/8th scale gas cars. Twice the power of 1/10th scale, these cars are capable of racing speeds in excess of 70 mph! Definitely not for beginners.

2-Stroke Engine

A nitro RC car uses a 2-stroke engine. This use specially blended fuel, and will not run on regular gasoline.

There are two major sizes. There is the .12 size engine commonly used in 1/10th scale, and the bigger and more powerful .21 size engine commonly used in 1/8th scale.

O.S. CV 2-stroke engine

Engine Parts:

1. Air filter
2. Gears
3. Flywheel
4. Carburetor idle adjustment screw
5. Carburetor low-end adjustment screw
6. Heatsink
7. Pull-start mechanism

Air filter

The air filter is used to prevent dirt from entering and damaging the engine. For maximum power, it is important to clean, lubricate, and replace the air filter on a regular basis.

Gears

These gears are connected to the engine via a clutch system. The gears are used to transfer power from the engine to the transmission of the car.

Flywheel

Used in a bump start system and houses the clutch system.

Carburetor Idle adjustment screw

Rotating the screw clockwise or counter-clockwise increases or decreases the idling speed of the engine.

Carburetor Low-end adjustment screw

Rotating the screw clockwise or counter-clockwise makes the low-end mixture leaner or richer.

Heatsink

These engines are air-cooled. The heatsink is designed with “fins” to make the engine run cooler.

Pull-start mechanism

Used to start the engine, similar to a lawn mower.

Glow Plug

Similar in function to a spark plug.

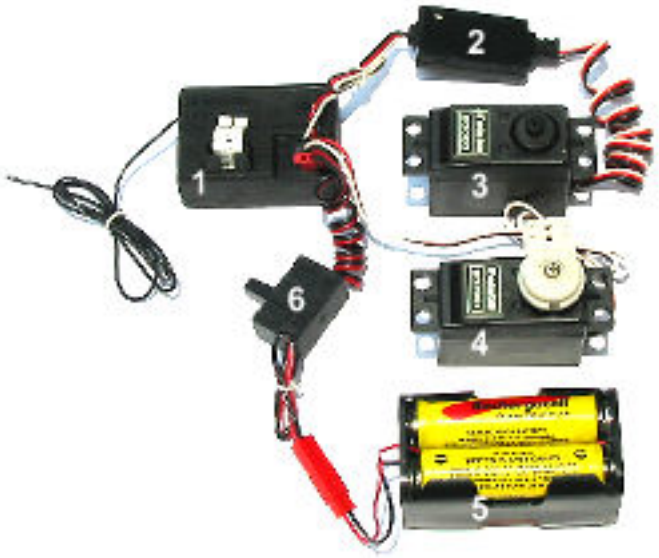
Radio Control System

In hobby quality RC cars, the radio control system is fully proportional. This means that the speed of the car can be finely controlled. You can go at 0% to 100% full speed, and any speed in between, just like a real car.

The same goes for steering the car. You can turn left gently, or turn left aggressively. You can turn right gently, or turn right aggressively.

Radio control parts that are installed inside a nitro RC car:

1. Receiver
2. Fail safe
3. Servo for carburetor and brakes
4. Servo for steering
5. Receiver batteries
6. On/off switch



Transmitter

The transmitter is what you hold in your hand. Your left hand is usually used to “squeeze” the trigger, which controls the speed of the car. The more you squeeze, the faster the car will go.

If you want to stop or brake, push the trigger towards the opposite direction.

Your right hand controls the “steering wheel” on the transmitter. This controls the direction of the car, whether to turn left, right, or just go straight.

The stick type used two “sticks”. The left stick is used to control the speed of the car, and the right stick is used to steer the car.

The pistol type uses a “trigger” and a steering wheel. The trigger is used to control the speed of the car, the wheel to steer the car.

Stick type

Pistol type

The transmitter needs a 12-volt supply to run, usually via eight AA sized batteries.

Receiver

The receiver is a small rectangular device mounted on the car. It has a wire (usually 19") that acts as an antenna to receive signals from the transmitter.

Gas cars need a 2-channel radio control system. 2-channel means that there are 2 servos connected to the receiver.

The receiver needs a 6-volt supply to run, usually via four AA sized batteries.

Futaba 2 channel receiver

Tips:

Never, ever, cut the antenna wire. I know… the wire is long… but still, resist the temptation to cut it.

To avoid radio glitches, keep the receiver and antenna as far away as possible form the 2-stroke engine.

Servos

The servos are small mechanical motors with decide the speed and direction the car will travel.

A gas car has two servos, one connected to the carburetor, another to the steering mechanism.

The servo connected to the carburetor controls the speed of the car. It also controls the braking mechanism.

The second servo is connected to the steering mechanism, controlling the direction of the car's front wheels.

Futaba servo

Frequency Crystals

The transmitter sends signals to the receiver on a specific frequency.

Removable frequency crystals, located at both the transmitter and receiver, determine this frequency.

Tip:
Be careful, the crystal with an Rx label is used for the receiver, and the Tx label for the transmitter.

The purpose of these frequency crystals is to ensure that signals from car do not interfere with signals for another car.

For example, if you are using a frequency of 27.255, make sure no one nearby is using the same frequency.

Operating two cars next to each other using the same frequency will cause loss of control and cause the cars to crash. Make sure that the people you play with are on a different frequency than what you are using.

Fail-Safe Unit

The fail-safe unit is inserted between the receiver and a servo, usually the servo that controls the carburetor and brakes.

Its purpose is to set the servo in a pre-set position should the receiver get signal interference. In other words, the fail safe will help prevent your gas car from going out of control should the receiver get interference (e.g. another person playing with the same frequency).

Or, if the transmitter batteries become weak, the fail-safe unit will activate and the servo will go to a pre-set position.

What is a good pre-set position? In nitro cars, the servo should be pre-set to a braking position.

Is it 100% fool proof? No. If the receiver batteries become weak, the fail-safe will not set the servo in the pre-set position.

High-end radio control systems usually have a fail-safe unit integrated into the design of the transmitter and receiver.

However, entry-level radio control systems do not have a fail-safe unit. Good news is that fail-safe units are cheap, and I recommend you buy one.

Glow Plug Igniter

2-stroke engines have a glow plug. The glow plug is the one that creates a spark inside the engine, which ignites the fuel/air mixture in the cylinder, causing the crankshaft to rotate. In short, the glow plug is similar to the spark plug on a real engine.

To start a 2-stroke engine, 1.5 volts must be applied to the glow plug. This will heat up the coil, which will then ignite the fuel/air mixture. Once the engine is running, the 1.5-volt supply is removed from the glow plug.

The glow plug igniter is the device that provides the 1.5-volt supply to the glow plug. It can be as simple as a sub-C battery with alligator clips, or can be a purpose made device powered by 1.5-volts.

Glow plug igniter powered by a 1.5v sub-C battery

Glow Plug

2-stroke engines have a glow plug. The purpose it to ignite the fuel/air mixture inside the cylinder, similar to spark plugs.

When starting an engine, the glow plug igniter provides 1.5 volts to heat up the glow plug's filament.

Once the engine has started, the glow plug igniter can be removed.

Tips:
A good glow plug will have a filament that heats up to a bright orange/yellow/red color.

Not all glow plugs are the same. Use only glow plugs specified in your engine's manual.

Fuel

The fuel used for RC cars are special type fuels which you can buy at your local hobby shop.

Be careful, fuel used by RC cars is different from gasoline and fuels for model airplane. Make sure you buy fuel made specifically for RC cars.

The fuel is made of methyl alcohol, nitro methane (i.e. nitro), and lubricants. The percentages used are normally guarded secrets, but in general it is 70% - 10% - 20% respectively.

Fuel and bottle

Fuel with higher percentages of nitro provides more power, and is also more expensive. Beginners would do well with 10% nitro, while racers would normally use fuel with 20% nitro.

Some fuels are blue, others pinkish. The color does not matter as long as it is fuel for RC cars.

Be extra careful with RC car fuel. It is flammable and poisonous. Avoid contact with eyes, do not drink, and store it in a cool place.

In case of eye contact, flush thoroughly with running water. If swallowed, induce vomiting and call your physician. Keep out of reach of children.

Fuel Bottle

The fuel bottle makes it easy to put fuel in the fuel tank.

They come with short and long nozzles, and what you buy depends on the type of car you have.

Some cars have gas tanks that are hard to reach, and require fuel bottles with long nozzles.

Fuel Tank System

The fuel delivery system of a nitro rc car:

1. Fuel tank
2. External fuel filter
3. Primer
4. Fuel line
5. Air pressure line

Fuel Tank

Fuel is stored in a fuel tank. Some fuel tanks have an internal fuel filter while others do not. An external fuel filter should be used with fuel tanks that do not have an internal fuel filter.

External Fuel Filter

To prevent debris from entering the engine, a fuel filter is placed between the fuel tank and the carburetor. If the tank has an internal fuel filter, there is no need to use an external fuel filter.

Primer

To start an engine, it must have fuel in the carburetor. The primer helps push fuel into the carburetor. This is done buy pushing the primer up and down several times. You can actually see the fuel inside the transparent fuel line move from the fuel tank to the carburetor.

Fuel Line

This is a rubber tubing allowing fuel from the fuel tank to reach the carburetor.

Air Pressure Line

Rubber tubing coming from the tuned pipe going to the top of the fuel tank. Exhaust air from the tuned pipe helps to pressurize the fuel tank, helping fuel move from the fuel tank to the carburetor.

Tip1:
To prevent confusion, try using different color tubing for the air pressure line and the fuel line. For example, use orange for the air pressure line and blue for the fuel line.

This will help prevent mistakes in connecting the line. For example, if you mix up the connection, your car will not start.

Tip2:
I personally prefer a fuel tank with a primer because I can easily force fuel into the carburetor before starting the engine.

Some fuel tanks do not have a primer, and I find it takes a few pulls on the pull-start to get fuel to even reach the carburetor.

Tuning 2-Stroke Engines

A finely tuned 2-stroke engine will provide power and reliability. That means longer run times and parts, such as glow plug, piston, sleeve, and rod will last longer.

1. Piston, 2. Sleeve, 3. Rod

On the other hand, an out of tune 2-stroke engine will run erratically. You might notice a loss of power and decreased reliability. Glow plugs will burn out faster, and the piston and sleeve will wear out quicker.

A finely tuned 2-stroke engine is therefore the most important item to achieve in order to have fun with gas RC cars.

Starting the Engine

It is easy… simply fill the fuel tank, pump the tank so that a small amount of fuel is in the carburetor, attach the glow plug igniter to the glow plug, then rotate the engine.

There are two ways to rotate the engine. The pull-start (ps) type of engine has a pull-start mechanism built into the back of the engine. Similar to a lawn mower engine, the cord is pulled to rotate the engine.

There are engines that do not have a pull-start mechanism. To rotate them, the flywheel is “bumped” against a rotating rubber disk.

My Personal Experience

My first experience with a 2-stroke engine was not pleasant. First, the engine refused to start. I kept pulling and pulling on the pull-start cord, but the engine will not start.

After several pulls, it became harder to pull the cord because the engine was becoming flooded.

Sidebar:
Pulling the cord of the pull start also causes fuel to enter the cylinder of the piston and sleeve. If this fuel does not ignite, it will accumulate, causing the engine to flood.

Once this occurs, the only solution is to remove the glow plug, and turn the engine upside down to drain the excess fuel. Then replace the glow plug and try to start the engine again.

What was the reason for the engine not to start? I found out that the battery of the glow plug igniter was weak.

So I replaced the battery with a NEW battery. This has happened to me MANY times, as I assumed that the battery I was using was freshly charged.

However, the rechargeable batteries lose their charge, so I suggest using alkaline batteries for the glow plug igniter.

Another possible cause was that the glow plug was burnt out. This means that the coil in the glow plug no longer produces enough heat to burn the fuel/air mixture. So replace old glow plugs with NEW ones.

Once I fixed these items, the engine finally started. Everything seemed fine, as puffs of blue smoke emitted from the exhaust pipe.

Visible blue smoke is desired. It is a rough indication that the engine is within the correct setting.

Sidebar:
What is the correct setting? Well the engine must not run too lean or too rich. Too lean means that there is too much air in the fuel/air mixture. This will overheat the engine and cause MAJOR damage.

Too rich means that there is too much fuel in the fuel/air mixture. The means the engine will run slowly or bog down. The reason is the engine is having problems burning the excess fuel.

A fine tuned engine is one that runs in between the two extremes, not to lean, not too rich.

But after a few hours of fun, I noticed that the engine started to run hotter, and the car ran slower. My assumption was that the engine was running lean, so I adjusted the carburetor to a richer setting. It did not solve the problem.

The problem was that the engine developed an air leak. That means unwanted air was entering the cylinder, increasing the amount of air in the fuel/air mixture. This caused the engine to run lean. The air leak also occurred in the part between the cylinder and the exhaust chamber, so adjusting the carburetor would not solve the problem.

The only way to solve the problem was to seal the air leak. So I removed the exhaust chamber, applied “sealant”, and reassembled. However, after a few minutes of running, the engine again started to overheat.

The reason was that the “sealant” I used was melting, causing the air leak condition. I therefore replaced the sealant with a high-temperature automotive sealant used to seal gaskets in a real engine. And this finally solved the air leak problem.

So, to ensure a fine tuned engine, the fuel/air mixture must be correct.

The difficult part is that days are different, some days are hot, and some days are cold. This means that a properly set carburetor during hot conditions will be wrong for cold conditions.

The goal is to set the carburetor in a ballpark setting, then fine tune the setting on the day you are running the engine.

Low-end High-end Settings

Some carburetors have single adjustment points to control the fuel/air mixture. Others have two settings, one to control the low-end, another the high-end.

The low-end setting determines how fast your car will accelerate. The high-end setting determines the top speed of the car. Both settings are dependent on each other. Adjusting the low-end will also affect the top-end, and vice versa.

Let me give you and example. Back in 1999, I was racing my gas touring car. I already had years of experience with gas engines, so I was confident in my tuning skills.

However, during my races, I noticed that my car lacked top speed. So I kept on adjusting the top-end setting of the carburetor. But no matter what I did, I could not get top end power from the motor. Cars were zooming past me in the long straights.

Eventually, I found out that my low-end setting was too lean. So what I think happened was at high speeds, the engine ran too lean, losing power.

But I was adjusting the high-end setting, when I should have been adjusting the low-end setting.

This happened to me in two major races. Fortunately, I still won despite my lack of engine tuning skills.

Troubleshooting

To begin, all 2-stroke engines are different. I strongly advise you read and follow the manual that comes with the engine.

Assuming you have followed the manual, yet still have problems, below are some common causes:

Problem 1: Engine Does Not Start

There are two main factors in making an engine start.

First, the glow plug must be working. This means that when 1.5 volt is applied, the filament will burn a bright orange. A bad glow plug will not generate enough heat to burn the fuel/air mixture in the cylinder.

Second, the engine cylinder must have the correct fuel/air mixture when cranking the engine (via pull-start or bump start).

If there is no fuel in the cylinder, the glow plug has nothing to ignite.

And if there is too much fuel in the cylinder (i.e. flooding), even a new glow plug will not have the energy to burn the excess fuel.

Problem 2: Engine Starts but Immediately Stops When the Glow Plug Igniter is Removed

Replace the glow plug.

Another possible cause is the fuel/air mixture is too rich. Readjust the carburetor.

Problem 3: Engine Temperature is Too Hot (Lean)

A lean engine will cause a lot of damage. An engine will run lean if there is too much air or not enough fuel in the fuel/air mixture.

The carburetor controls the fuel/air mixture. Adjust according to the instruction manual that comes with your engine.

If adjusting the carburetor does not solve the problem, chances are the engine has developed an air leak. That means air is entering the engine in places it is not supposed to, such as the section between the cylinder and the exhaust manifold. Another common source of an air leak is the section between the body of the engine and the pull-start mechanism or back plate.

Solving the air leak is easy. Disassemble the affected sections, apply a high quality, high temperature automotive gasket sealant, and then reassemble the sections. Make sure to read the instructions on how to use the gasket sealant.

A dirty fuel filter will also cause a lean setting. The dirty fuel filter will prevent fuel from reaching the carburetor. Solution is to clean the fuel filter.

Binding in the car itself will also cause an engine to overheat. Check that there is no binding in the car by checking how freely the transmission and wheels rotate. It should be easy to push the car by hand, and the car should roll a few feet.

Problem 4: Engine is Too Rich

An engine that has too much fuel in the fuel/air mixture has a *rich* setting. A rich engine setting will also have the tendency to flood the engine, causing it to die.

A rich engine will consume a lot of fuel and not generate enough power. The car will run slowly.

The solution is to readjust the carburetor per the instruction manual.

A weak glow plug may also cause an engine to run rich. This is because the glow plug is too weak to burn all the fuel. Unburned fuel will accumulate in the cylinder, causing the engine to run rich.

Frequently Asked Questions

What is the best nitro car or truck for beginners?

Technology wise, almost all RC cars today are durable. So if you ask me, I would buy a model that is popular with my friends and with an external look that appeals to me.

Today, the craze seems to be 1/8th scale nitro monster trucks and nitro on-road touring cars.

What are the best brands?

Associated, HPI, Kyosho, Losi, Mugen, OFNA, Neo, Tamiya, Serpent, and Schumacher are among the top of my list.

What model to choose from?

Beginners would do well to start with 1/10th scale, preferably off-road. You can choose from touring cars (on-road), to off-road models such as buggy, trucks, and monster trucks.

1/8th scale nitro cars are the ultimate RC cars in the hobby. Definitely for the experienced racers and not recommended for beginners.

What accessories do I need to buy?

If you buy a ready-to-run (rtr), you only need to buy minor items such as fuel, maybe paint for the body, and AA batteries for the radio system.

If you buy kit versions, you are just buying the car. You will need to buy the radio system, fuel, paint, glow plug igniter, and AA batteries. You might even need to buy the 2-stroke engine.

For beginners, save yourself the hassle and buy ready-to-run models.

Where to buy?

At your local hobby shop, or http://www.rccartips.com/rc-store.htm .

Spread the Word

I wrote this eBook to help beginners get into the exciting hobby of nitro rc cars, while helping them avoid the costly mistakes I have made along the way.

Feel free to email this eBook to all your friends. You may post this book on your web site, and give it away for free (as long as you do not modify the contents.)

Many thanks… Joel.

More Info

If you want to know more, visit my web site. It currently has over 70 pages and 100 images to help beginner with electric and nitro RC cars and trucks.

The web site URL is: http://www.rccartips.com

Feedback

Your feedback regarding this eBook and the web site is very much appreciated.

I do listen to you. In fact, this eBook is already in its second revision based on early feedback I have gotten from readers. And I think this second revision is more informative than the first release.

Disclaimer

All care has been taken to make sure that information in this document is accurate and will help beginners get started in gas powered RC cars.

Advice and information in this document is the personal opinion and experience of Joel Mangilit.

Joel Mangilit and www.rccartips.com is not responsible for any damages that might occur from following the advice in this document.