

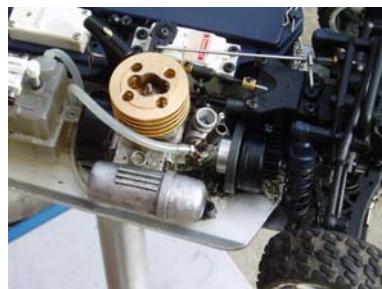
*****NITRO TUNING A BEGINNERS GUIDE *****

NITRO ENGINE TUNING – MY GUIDE

Based purely only on my experiences.

It is very important for you to understand at this point I accept NO responsibility for your engine and its performance or lack of performance if you choose to follow this guide.

This is just a guide based on my own experience of tuning Kyosho GX engines that were non runners and soon became flyers with some very simple tweaks and a little understanding of what's going on.



I am definitely NO expert and my advice is taken from my own experiences and from articles that I have digested from elsewhere and tried to put onto paper so I can follow it time and time again. I too am still learning from my own actions and mistakes - but if this helps you then good luck to you it works for me.

It is written in a way you can follow and hopefully understand without being to complicated or taxing on the brain. Some sections or my terminology may not be scientifically or grammatically correct but its how I see it and try to explain it in layman's terms – I am not an expert as I keep stressing.

I strongly recommend that you follow the manufacturers running in guide for new engines– I can't emphasize that enough, get that right and you're off to a good start, and you will get the most from your engine in the long run.

Always ensure you're using the correct concentrate / mix of fuel from a good supplier. If you are unsure ask your local supplier – again this is very important for the life span of your engine and its future performance

I strongly advise you use a solid steel stand that allows you to run your engine at high speeds in a safe and controlled manner.

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Understanding your engine and carb is the place to start.

Your main consideration when attempting to tune your nitro glow engine is to understand what's going on and not to be phased by it in anyway – Enjoy it and understand it.

When the basics are understood the penny will drop and it becomes easier.

Go back to basics every time and you will soon begin to learn and eventually you can tune your engine for maximum performance while at the same time, prolonging the life of your investment.

The part you are concerned with mainly and will become familiar with during the tuning process is the carb. This is simply the part on your models engine that mixes your fuel and air. ALL carbs have 1 main function too regulate engine speed – it couldn't be simpler.

It does this by metering the amount of air and fuel as required, to maintain combustion per the input of the throttle.

The carb has three main adjustments that allow you to set the following:

1. Setup the tick over.
2. Setup the bottom end mixture.
3. Setup the top end mixture.

When the two main elements are mixed in the carb, the mixture is passed into the engine through the intake. The natural operation of any engine causes the flow of gases to pass through the engine through the carb and out of the exhaust manifold.

We can see how the air gets into the engines chamber, its sucked through the air filter and we know that if we stop this flow of air to the engine it will die off and stop, but what makes the carb pull your nitro fuel from the fuel tank – models have no fuel pump like full size cars so it relies purely on the venturi-effect.

This is basically a sucking motion created in the engine to pull the fuel from the tank and feed the engine as required obviously as the engine accelerates it need more fuel and as it slows down much less, this fuel distribution need to be proportionally maintained at all times or the engine will stall, and usually not restart.

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The venturi-effect is all that is needed for the engine to get the fuel. I am not going to try and explain how this actually works - you just need to understand fully that your carb not only needs to be pulling fuel from the tank, but maintaining the increasing flow requirements during the acceleration and up to top speed – obvious really when you think what is happening .

This process is then started manually during start up by priming the fuel line (removing all air) with the plunger on the tank top. If you look you will see the fuel line fill up whilst priming.

Your engine starts and runs based on some very simple factors, fuel flow, air intake, (how the two are mixed) and of course your ignition element (glow plug). If this is heated to the required temperature then the correct mixture will cause your engine to fire and away you go. Incorrect proportions of AIR or FUEL and it will not run consistently and in most cases will not start at all.

Flooding is very common and so are damaged and worn out pull starts through too much effort and frustration.

Your first question is – does my engine start and run?

If Yes, then that's a good start it means you have a starting point and we can eliminate such things as faulty glow plugs, heaters and chargers almost straight away. If it runs for a minute or so then we can also eliminate total fuel starvation from the tank - the venturi effect is working and there are no blockages.

If No, then you need to try a new / proven heating element and or a glow plug. (usually the glow plug heater is cold and need recharging or replacing)
A cold plug charger will not start your engine no matter how much you try.
If in doubt buy a good quality new one – not a cheapo one or you will be back to the start before you have even got going.

Also ensure you are getting fuel to the carb to start with, remember the venturi effect - you will need to check the pipes are free from any obstruction or trapping and that the priming mechanism on the tank is working and the tank remains air tight. If this ends up being the source of the starting problem replace the tank with a new one. If need be to prove your point you can pour or squirt a small amount of fuel into the carb barrel manually and then prime it again.

The engine (if all other factors are proven to be ok) will probably start with that injection of fuel and then die off again when its all burned off - in which case there is a fuel flow problem.

One thing that works for me is I trim the throttle linkage servo a little so it opens

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the carb about $\frac{1}{4}$ - $\frac{1}{2}$ way open during start up, allowing me to hold the glow plug heater on whilst pulling the starter opening the carb with the filter off will enrich the mixture and it may well start if everything else is in our favour.

Just beware that when it does fire up you have the throttle open – not on tick over so hang onto it if it is not on a stand. When it does fire up don't remove the glow plug heater straight away leave it on for 5 or 6 seconds after it's started – no more.

Failing that you can remove the tank from the chassis and hold it or support it a few inches above the engine, the weight of the fuel will make sure the fuel flows down into the carb (gravity - not venturi effect). If your tank is pulling in air then simply seal up the ends by clamping or cable tying the pipe ends onto the tank and carb and check the lid seal.

Ensure that you keep the fuel lines & your fingers away from the cylinder head (top of the engine) – It gets very hot and will burn you!

When ALL these potential problems are confirmed as ok the engine will now be trying to start if not actually firing and starting to run.

Persevere at the start and you will find the reason it is not starting, but if its still not trying then it could be one other thing and that is lack of compression in the bore, get it tested by a local model shop, BUT this is unlikely if you engine was run in correctly and has previously been a runner.

Carbs I have played with have all been the barrel type and they seem to be simple and straight forward.

If yours is not don't panic – ALL the engines combustion fundamentals remain the same but the way the carb achieves the mix may be slightly different – your specific setting up procedure and movements will be found from the manufacturers handbook or via the internet.

The barrel type carb looks as described just like a barrel on the side of your engine With the engine now starting or at least trying to run we need to set the tick over.

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QUESTION 2 – ONCE STARTED WILL IT TICK OVER UN AIDED?

When we have got the engine starting and running we need to set the tick over. This is the easy. The tick over speed is governed by a small screw, you will need a flat head screw driver a very small terminal type – the screw will be spring-tensioned and it limits the closure of the barrel inside the carb body.

The barrel itself controls the air flow.

By rotating the barrel a hole cut in either side allows different amounts of gas and air mix to flow through the carb.

As the hole in the carb gets bigger (when you accelerate) the air intake becomes bigger down into the centre of the carb and the fuel and air keeps pace with what the engine is calling for (theoretically). If it doesn't that where our problem is.



I do ALL my initial assessments, adjustments and set up on any model with the car or the engine and tank on a very firm well built stand and the air filter off completely during initial setup.

Right or wrong it suits me and I explain why.

With the air filter off I can achieve 2 things.

1. I can actually see the size of the air hole inside the carb, and the effects of your adjustments straight away. You can actually watch it opening and closing.
2. It also allows you to put a little fuel into the carb manually to get a tricky engine started and warmed up initially – because as we now know if its not running its probably one of three things, AIR, FUEL & HEAT at the plug.

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ALWAYS REMEMBER TO REFIT THE AIR FILTER - THEY ARE PROVIDED ON YOUR ENGINE FOR A REASON – & FINE ADJUSTMENT MAY BE REQUIRED AFTER REFITTING.

With the air filter off you can actually see the hole if you look into the carb. The tick over is usually set so that the hole you can actually see in the barrel is about $\frac{1}{2}$ a full hole visible – may be less if required but the barrel is almost fully shut.

MAKE SURE YOU ARE NOT PULLING AGAINST YOUR THROTTLE SERVO AT THIS POINT CHECK RADIO GEAR & INTERFERENCE.

If need be disconnect the throttle mechanism altogether. You can operate (rev) the carb with your finger by manually moving the linkage on the end of the carb, anti clockwise movement of the linkage will rev it up – open the hole and clockwise will slow it down- close the hole up.

It's important to remember that the tick over speed doesn't effect the mixture of the fuel so don't panic all you are doing is setting the tick over / idle speed.

IT IS IMPORTANT TO SET THE TICK OVER SPEED TO THE ABSOLUTE MINIMUM POSSIBLE - SO YOUR MODEL WILL NOT RUN AWAY WHEN YOU START IT OR LET OFF THE BRAKE.

Set it to the slowest tick over possible, just before it begins to stall naturally. Adjustments take time to work through the engine cycle so be patient and give it chance. In between any adjustments let it run for a while (if possible) resist the temptation to keep adjusting until you have seen or heard some change.

With the tick over set there should be no speed / tone change on the engine when you apply hit the brakes - the car is in tick over or idle mode and the engine tone should not change or stall.

If the engine's RPM does drop off either your linkage isn't set right (disconnect it as previously advised) or the tick over speed still needs some fine adjustment. Adjust until the carb barrel doesn't move when you go from neutral to full brakes.

On your car stand with the air filter off you can monitor this easily and safely.

If your low end mixture is too rich the car will not tick over for more than a couple of seconds before the engine coughs, splutters and dies you will need to sort this out first.

To sum up what you have done or are still doing - the more closed the hole is, the slower the tick over will be, the larger the hole the faster the engine will tick over.

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To prove beyond doubt what you are doing try adjusting it to some extreme cases, $\frac{1}{2}$ or $\frac{3}{4}$ open throttle will make the engine race away at a high rpm and closed or almost fully shut and it will not tick over at all, find the happy medium at the lower end of the scale to suit your engine.

On tick over the car should run for at least a minute un aided and be a constant mono tone (with your radio gear on and trimmed in correctly) without surging, racing away or dying out.

To improve its performance we will need to adjust the mixture, either by adjusting how much of this gas & air mixture reaches the engine and then what proportion of gas to air passes on to the engine.

By reducing the amount of fuel against the amount of air - we make the combined mixture "lean". Therefore by increasing the amount of fuel, you are making the combined mixture "rich". SIMPLE

READ THE PREVIOUS FEW PARAGRAPHS AGAIN AND UNDERSTAND THEM, IT WILL HELP YOU SELF DIAGNOSE.

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QUESTION 3 - IS MY ENGINE RUNNING RICH OR LEAN?

There are two type of mixture adjustment on the nitro engine.

Bottom or low end mixture & Top or high end mixture.

1. The bottom end or low end adjuster is underneath and to the right of the main throttle linkage - It's usually a screw with a locknut – very small and fiddly. A clockwise rotation will "lean" the mixture and anti clockwise movement will "enrich" the mixture.

NOTE SOME CARBS WILL NOT HAVE THIS ADJUSTMENT – DON'T WORRY IF ITS NOT THERE - YOU CAN'T ADJUST IT – SIMPLE AS THAT.

2. Top end or high end adjustment, is the primary fuel mixture adjustment. This is on top of the engine where the fuel line goes in from the tank, usually adjustable by hand.

TOP END ADJUSTMENT WILL ALWAYS BE THERE IN SOME FORM AND THIS IS WHAT YOU WILL HAVE TO TWEAK A LITTLE 1/8th INCREMENTS

To determine whether the low-end mixture requires tuning, allow the engine to warm up completely, and then allow it to tick over, uninterrupted for at least a full minute. If the engine continues to run on after the minute then your low-end mixture is correct and you're ready for the high-end adjustment.

If it dies and cuts out after running a bit then there is a definitely a mixture problem – too rich or too lean. To determine which we need to listen to the engine tone during the tick over cycle.

If the engine's RPM revs up and surges (increases) just before it dies then it's running too lean.

To correct this, turn the bottom end mixture screw anti clockwise just 1/8th of a turn and retry the tick over for a minute or so. Persevere 1/8th at a time until it's correct.

Conversely if it begins to ease down a change in tone becomes obvious then your engine is running too rich. To correct this, turn the bottom end mixture screw clockwise just 1/8th of a turn and retry the tick over test. Persevere 1/8th at a time until this is correct.

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**TEMPTATION HERE FOR EVERYONE IS TO SCREW THE
ADJUSTMENT IN OR OUT A HUGE AMOUNT TO SPEED THINGS UP.
DON'T - IT WILL NOT SPEED THE PROCESS UP - IT IS A TIME
CONSUMING TASK JUST STICK TO 1/8th AT A TIME ONLY THE
RESULTS WILL COME.**

Once you have completed this simple set up your engine will now run uninterrupted over a minute without screaming itself to bits or constantly cutting out - you are ready to carry on and set the high end mixture.

REMEMBER – Settings never change immediately. You will have to run your engine for a few minutes for the full effect to take place.

If you have low end adjustment and managed to set it, any carb mixture problems can be isolated to the high-end mixture adjustment.

The obvious tell here is your models acceleration rate.

If you hit the throttle and it takes off up the street quiet rapidly then you have just proved you still need to get a good quality stand for tuning and set up (lol).

BUT if it suddenly dies or loses power then you have your main mixture problem, it is running too lean - So we need to back off & screw out anti -clockwise the main mixture needle out just 1/8th of a turn at a time and test again and again if need be until results change.

If it produces a very deep throaty echoed type sound - immediately when you advance the throttle or sounds like it's choking then it's running too rich. (probably smokey at this point too) So a leaner high end mix is required. So we adjust this by screwing the main mixture valve in clockwise just 1/8th of a turn at a time and test until results change and the rpm is notably increased and becomes much sharper.

Classic signs of running too rich are an oily residue all over your chassis and parts, very poor fuel consumption, fuel runs out quickly, and the exhaust fumes can be visually very smokey and are unpleasant when in contact with your eyes and back of your throat even when the engine has been running and hot.

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**HAVING CHECKED AND ADJUSTED THOSE 3 BASIC THINGS YOUR
ENGINE SHOULD NOW BE RUNNING MUCH BETTER & YOU WILL BE
PLEASED WITH THE RESULTS.**



The only real fool proof way to determine what needs to be done to your model engine beyond reasonable doubt is to check the engines temperature. That is the sure scientific way of working out what is or is not happening inside the engine.

The temperature is critical to your engine because that temperature controls what happens to your very expensive nitro fuel mix within the engine.

I believe a properly tuned nitro engine should run between 210° and 220° F. (VERY HOT) Some engines will run hotter upto 260-270° F, but long term performance and reliability is sacrificed. If your body shell does not allow air flow through it via air holes or cut outs in the shell - then the engine WILL get hotter and ultimately effect the performance in the same way as the weather would in extreme conditions– so think before you re-adjust your previous settings.

How do I check the temperature I hear you cry –

This is usually done with a thermometer or sensor that measures the heat around the glow plug inside the top of the head, BUT we can cheat here with no expense at all.

The cheap and very easy alternative is to drip a bead or a few beads of water down the head around the glow-plug and see whether it boils off. This is a good enough indicator to the temperature of the engine. This may take some practice and patience but once we know the facts we can improve our tuning even further with fine tuning.

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If the droplet of water you have dripped lands where you have aimed it around the glow plug area and it slowly simmers then the engine is probably running about right at 210 – 215/220° F.

If it boils quickly then the engine is too HOT obviously so this means the engine is still too lean and needs to be enriched further. Refer to your manual or look it up your engine will have an optimum running temperature for best long term performance, if you can get this great if not proceed with care and run rich.

If it just sits there and doesn't boil at all, then it's running way too rich the engine is probably less than 210° F and therefore needs to be leaner. Proceed with caution and only tweak it 1/8th of a turn at a time, there is no rush and it will take time to get it right, any rash tweaking and you may seriously damage your engine. It will soon get very hot, very quickly – Remember running rich is OK and encouraged.

CAUTION PLEASE TAKE NOTE.

An engine that is running too lean will run hotter and exceed the 220° F limit.

In most cases this WILL without fail reduce the long term life of your engine. It is a proven fact this will knacker up your engine. Trust me - RUN RICH.

You need to understand and remember that the glow fuel you put into your engine is the ONLY means of lubrication the engine gets, hence the gooey oily residue it produces when heated and worked.

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IMPORTANT FINAL SUMMARY

- Give your adjustments time to take effect. Remember that most adjustments won't be immediately noticeable give the engine chance to complete its cycle.

- Always drive your engine through its full range; low throttle up to high throttle gradually - for at least a minute if not more.

- Always use a good quality solid stand for tuning, clamp your car down and tune away in complete safety.

- Make sure you make ANY adjustments in small 1/8th turns only, don't go mental and start frantically turning all the screws ease up and remember what and when!

- Always run on the rich side SAVE YOUR ENGINE running too lean may give you better performance but this WILL scrap your engine.

- IF your engine has been running and is warmed up nicely (very hot to touch) and all of a sudden it wont start, then recharge glow plug starter kit before making any more adjustments – All your good work could be undone

- BEWARE your engine MUST get the proper amount of lubrication at all times. Temperature is very important, monitor it.

- Only use good quality fuel from a quality supplier - this is very important to prolong the life of your engine and performance. Use the correct % fuel for your engine if in doubt **ASK** your local model shop.

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I am certain your model will now be running much better and your understanding of what is happening will have improved and keep improving – take it steady don't rush in.

As with any process practise makes perfect, the more you do the better you will get.

If not then don't give up it is not an exact science. Each engine set up is different but the fundamentals and principals remain the same in ALL applications.

FUEL, AIR and GLOW HEAT, it will start - so don't give up.

REMEMBER TO ENSURE YOUR STARTER IS CHARGED IF IN DOUBT GET ONE WHAT THAT HAS AN INDICATOR ON IT SO YOU CAN BE 100% SURE.

IF YOU HAVE BEEN USING IT TO START UP ALL DAY THEN IT MAY NEED A BOOST – BOOST IT.

If you end up in a situation where you have completely messed up the carb settings (and you probably will or have through frustration) you will need to go back to the factory recommended settings as a start point.

Ensure before you start to set up again that you have loosened off the original settings and start again, remember running rich is a good start and will ensure you have an engine tomorrow.

IMPORTANT - HAVE FUN & BE SAFE.

