Introduction

"Setting up" a race kart chassis seems to be as much art as science. Even major championship repeat winners often differ greatly with regard to set-up solutions. The manual is based on both the specific recommendations of the CRG Factory Race Team and the dominant, if not exclusive, opini ons of kart racing champions.

All recommendations come from reliable sour ces, but keep in mind that when making chassis/kart adjustments, "If it doesn't get better going one way, try going the other". There are many paths to be taken on the r oad to good handling and maximum speed.

Finally, if you just want a very workable overvi ew to get you on the track as soon as possible, look at the "Basic" chapters, including the Troubleshooting char t at the end of the book.

Later, if you want more detail, go to the more "advanced" and "theory" sections and you will find much deeper explanations of what is really happening with virtually ev erything that affects the chassis performance of your kart.

Basic Chassis Setup

Base Setup (Normal Track Conditions)

The following settings are recommended as a starting point for a dry track with normal levels of grip (not “green” or slippery and also not with high amounts of rubber on the track, causing high grip).

- Weight distribution should be 43.0% front, 57% rear and 50/50% side to side.
- Front toe should be set out to 1/16” to 1/8” (1-3mm). For hard compound tires, set toe out at 1/8” to ¼” (3-6mm).
- Caster/Camber adjusters at front spindles should be set at II top & II bottom.
- More caster may be needed over the weekend to fight tire wear and/or loss of grip.
- Front bumper should always be tight.
- Front width should be 45-1/2” to 46”.
- Side pod bars need to be loose, but with bolts tight.
- Seat should be at standard mounting points.
- Rear wheel hubs should be medium length.
- Rear ride height should be as low as possible.
- Rear track should be set just below the legal limit, within the rules (55” for many classes, 50” for junior classes. A good starting point would be 54-3/4” for most applications.
- Axle should be the medium stiffness.
- Seat struts should be in place.
- Torsion bar should be in horizontal position.
- Rear bumper should be tightened.

Tire Pressures

Hard compound tires (cold)	12-13 psi
Medium compound tires (cold)	9-10 psi
Soft compound tires (cold)	8-9 psi

Basic Chassis Tuning

If front end of kart is not gripping in corners (understeering):

- Move out one wheel spacer on both spindles.
- If front of kart becomes too wide, move wheels back to original spacing and change caster/camber adjusters from II/II to II/III or III/III (be sure to re-check toe settings).
- Fit shorter hubs to rear axle. Be sure to measure from the hub face that meets the wheel to the chassis first (typically around 8-3/4”), so you can keep the same rear width measurement.
- Raise the hot rear tire pressures .5 to 1 psi.
- Remove seat struts, if fitted.
- Use a softer rear axle.

If back end is sliding (loose) at entrance of the corner or there is too much front bite:

- Move in one wheel spacer on both spindles.
- Lower .5 to 1 psi in the rear tires.
- Move weight away from the front of the kart.
- Lower the front of the chassis (be sure to re-check toe settings).
- Put less caster in. Adjusters at I/II or I/I (be sure to re-check toe settings).
- Tighten the front bumper, if not already tight.
- Check to make sure your toe is set properly. 1-1.5mm on each side, while the kart is on a stand (slightly more for heavier drivers).
- Fit a stiffer axle.
- Fit longer rear hubs. Be sure to measure from the hub face that meets the wheel to the chassis first (typically around 8-3/4”), so you can keep the same rear width measurement.
- Fit seat struts (maximum of 4 total).
- Tighten rear bumper if not already tight.
- Raise rear ride height.

The kart is hopping in the corners:

- Set the rear track as close to the legal limit, if not already there.
- Fit shorter wheel hubs on the axle. Be sure to measure from the hub face that meets the wheel to the chassis first (maximum legal width will be around 8-7/8” at the hub face), so you can keep the same rear width measurement.
- Raise the air pressure in the rear tires by .5 to 1 psi.
- Lower any ballast to a lower vertical position (especially in the rear of the kart). This includes the driver. In some very high grip situations, moving the seat forward, then angling the rear of the seat down will greatly lower the kart’s center of gravity (cg).
- Lower the rear ride height to the maximum, if not already done.
- Change to a softer axle.
- Remove seat struts.

Advanced Techniques and Theory

General Theory

To enable us to properly set up a kart chassis, we must first understand the most basic principals of the racing kart, which is a unit made up of tubes and front steering geometry, propelled through a live axle (one without a differential). Making adjustments to enable the race kart to turn without oversteer or understeer is difficult and challenging. Achieving a well-balanced chassis set up is part art and part science.

Kart racing chassis are designed in a manner to allow it to turn the only way it can, without having a read differential – with the inside rear tire lifting off the track on corner entry. The outer rear tire drives "around" the outer front tire, allowing the chassis to efficiently turn into the corner because the rear tire is off the track surface.

If the inner tire does not lift, no matter how much you turn the steering wheel, the front of the chassis wants to keep going straight, creating an understeer or "push" condition.

Note: If the driver is not changing the direction of the kart properly, it is possible he/she is making a well-tuned kart behave badly. While this guide does not delve into driving techniques, here's something to make sure you are on the right track:

> *Observe where the proper apex (clipping point) is for each turn on the track. When you're driving, each time you pass an apex in a corner, you should be starting to smoothly move the steering wheel back to the center. If you do it properly, you will not have to "hold" the steering on, past the apex of the corner. If you follow this technique and run out of usable track at the exit of the corner, you may have turned-in too shallow at entry or your apex was too late. If you follow the technique and have too much usable track at the exit of the corner, then you may have rotated the kart too hard at entry or your apex is too late in the corner.*
>
> *If you are holding the steering past the apex, you are holding the kart down, and you probably need to work on your corner entry techniques. While this dynamic changes somewhat in shifter karts, the basic principal still holds true: The kart (and you) should do most of the work (change of direction) early in the corner, so you can drive smoothly off the corner and not bind the kart down. Before completely changing your baseline kart set up, be sure the problem isn't the nut behind the wheel.*

When a chassis lifts up the rear wheel properly, then the chassis can pivot and turn. Therefore, the kart must be set up with sufficient side grip to enable the inner-rear tire to lift upon entry, as it is faster to drive the kart through the corner than to try and slide through.

Generally, when the chassis elements (axles, torsion bars, hubs, etc…) are on soft settings, the kart has less grip. As the chassis elements are made more rigid, grip will be increased. However, there are points of diminishing return where the chassis will get too firm to perform properly.

The modern race kart will typically perform best when the rear width is set as wide as possible and the front width is as narrow as possible, while still providing a fast, well balanced and stable package. You cannot simply set the chassis on these min/max settings and hit the track, but this concept will help create a target for your efforts to tune a happy chassis.

It is best to work on the end of the kart that is not handling well. If, for example, the problem is understeer, try to solve the problem by first adding more grip. If that is not successful, try taking grip away from the rear to balance the chassis.

When a kart is properly set up, steering effort will be reduced and it will seem to "float" through the corners. Remember, the front and rear of the kart must be in balance, with neither end too tight or too loose. If you turn the steering wheel and the motor load increases, the chassis is "bound" and wasting horsepower. Free up the chassis and gain horsepower!

Engine power is wasted in several ways, including:

- Brake pad drag
- Friction in the wheel bearings
- Incorrect wheel alignment
- Misaligned engine/sprockets

Such problems cause increased rolling resistance, which means more power is required to achieve the same acceleration and speed. Since the engine doesn't magically gain power to overcome rolling resistance, the kart just goes slower. If the increased rolling resistance is due to bad alignment, the kart will probably also handle poorly. Small improvements all add up to faster lap times and race wins on the track. You may not think a blink of the eye amounts to much, but at most races it will mean everything.

Often the most stable set up is one where the kart tends to understeer just a bit into corners while under brakes and then turns to neutral steering when the power is applied and the kart is driven out of the corner. This is not massive understeer, just enough to show that understeer may be present. A kart set up this way is very stable into corners and is easy to drive. Remember, oversteer may be tons of fun and look very exciting to the spectators. However, it is (unfortunately) slow!

When setting your kart chassis, it is a good idea to find the longest corner and set the kart up to bounce just a bit (just this side of hopping) on this corner. This bounce should not be enough to put you off line. It should be kept within easily controllable limits. The chassis is simply telling you that you aren't sliding with too little grip and you aren't hopping with too much grip. If the kart is set up this way, then it will be giving maximum grip through the longest corner and this is where the greatest saving in lap times is available.

General Set Up Conditions

Chassis Attitude
The chassis attitude (frame in relation to the ground) should slope from front to rear, the front being slightly lower than the rear. Adjusting the ride height with axle carriers in the rear and/or kingpin shims up front, attains this.

Engine Types
Generally, 100cc karts will be set up to control understeer, as they do not have the power to require maximum rear grip. Excessive grip will slow the kart down overall. Shifter karts require a higher amount of weight on the rear wheels and more chassis tuning to create increased rear grip.

Tall Drivers
Tall drivers in 100cc karts will want to make adjustments to reduce grip in order to overcome the additional leverage their higher center of gravity can produce. This may be done with more flexible seats, a “MET30” or softer axle, maximum rear tread width, medium to short wheel hubs or no seat struts. Drivers over 6’ may have to bolt-on (or have welded-on) and extended front porch. This will help lower the driver’s legs and maybe even allow the seat to be moved forward, then angled back in an effort to lower the center of gravity (cg) and “spread” the driver’s weight along the length of the kart instead of on a vertical plane. Without these measures, it will be increasingly difficult for a tall driver to tune a chassis as grip levels increase.

Terminology

Axle run-out: The variance of an axle from being perfectly round. This is usually measured with a dial indicator.

Ballast: Weight, normally lead, added to raise he combination of kart and driver up the minimum legal weight for the racing class.

Bearing Carrier: The element, normally three, in which the rear axle bearings are mounted.

Caster: The tilting to the rear, of the top of the kingpin on which the front wheel spindle pivots.

Camber: The tilting in, of the top of the front tires toward each other is negative camber. Tilting out is positive camber.

Chassis Lift: The raising of the inside rear wheel on corner entry. The lift or "jacking" is caused by a combination of frame stiffness, axle stiffness, caster and other factors.

Chassis Bind: A combination of elements including too much frame stiffness, overly stiff axle, etc. that cause the kart to have too much grip, restricting performance.

Chassis Scaling: Weighing the kart and driver, preferably on digital scales, to determine weight distribution.

Clutch Kart: A single-speed kart with an automatic centrifugal clutch. Typically, this type of kart will have a low revving four-stroke or a high revving 100cc two-stroke engine.

Darting: An unstable condition where the kart is overly responsive to steering input.

Digital Scales: Highly accurate electronic scales used to determine weight distribution.

Frame Tweaking: The gradual bending of a kart frame to achieve optimum weight distribution.

Grip: The level of adhesion between the kart tires and the track.

Hopping: The kart bounce as throttle is applied near the apex of the turn.

Jacking Effect: The raising of the inside rear wheel on corner entry. The lift (or "jacking"), is caused by a combination of frame stiffness, axle stiffness, caster and other factors.

Kingpin: The pin (bolt) on which the individual front wheel spindle pivots.

Live Axle: A single piece rear axle without the differential that allows the outside wheel to rotate independently of the inside wheel when the vehicle is cornering. This forces both rear tires to try and rotate at the same speed. Since they are moving around a different radius, one tire must lose this fight. Race karts are specifically prohibited from using axle differentials.

Nylock Nuts: Nuts with a nylon center that allow it to lock securely to the bolt and avoid loosening.

Oversteer: A tendency for the rear of the kart to slide outward at corner entry or mid-corner. It's important to understand this tendency must be occurring as the kart enters the corner, not on corner exit when application of power can cause "power induced oversteer".

Power Induced Oversteer: A tendency for the rear of the kart to slide outward at corner exit, under hard power application. Steady state throttle should not upset the chassis balance.

Push/Kick: Occurs near the apex of the turn as the kart transitions from brakes to application of throttle. The kart rear kicks out suddenly at the apex.

Pyrometer: A device used to measure the temperature of the tread of a kart tire, upon returning to the pits.

Rear Track: The overall measured width of the rear, taken from the outside edges of the rear tires.

Ride Height: The distance of the kart chassis from the track surface.

Road Race (Enduro) Track: Normally a winding track that is over a mile in length and typically also used for automobile racing.

Seat Strut: A brace mounted between the seat back and the bearing carrier to add chassis stiffness to the rear of the kart chassis.

Shifter Kart: A kart with a gearbox (normally six-speeds) and a manual clutch. Most shifter karts have an 80 or 125cc two stroke engines.

Side Bite: lateral adhesion between the kart tires and the track surface.

Slick Tires: Tires without tread to be used on a dry track.

Spindle Bolt: The pin on which the individual front wheel spindle pivots.

Sprint Track: A track, normally between ½ and ¾ miles in length, intended primarily for kart racing.

Torsion Bar: Used to add or reduce chassis stiffness by adding reinforcement to the kart frame.

Tire Compound: The degree of relative hardness (or softness) of a tire, influencing both adhesion and durability.

Toe: ***In*** - The condition of front-end alignment when the front edges of the tires are closer to each other than the rear edges. ***Out*** - The condition of front-end alignment when the rear edges of the tires are closer to each other than the front edges.

Understeer: The kart will not turn into the corner due to a lack of front end grip. Also known as "push".

Weight Distribution: The percentage of total weight on each tire or half of the kart.

Wet Tires: Soft compound tires with full tread to be used under wet track or rain conditions.

Wheel Spacer: A metal ring that slides over the front axle to change the front width of the kart.

Front End Adjustments

Some of the most important handling adjustments are made at the front of a kart. Problems that occur when entering a corner are frequently due to an improperly adjusted front end. Front end bite and steering response can be corrected by simple adjustments and toe setting is a good place to start.

Set steering dead ahead during front wheel alignment and keep wheel movement suppressed by attaching a short bungee cord to the bottom of the steering wheel and running it either to the top of the seat or back over the seat to the rear bumper area. This should keep the steering wheel in place while adjustments are made.

Toe In/out:

Toe settings will affect weight distribution, top speed and cornering response. The more toe in or toe out, the slower top speed becomes due to excessive drag by the tires. Despite this negative effect, increasing the toe out will increase initial cornering response, this giving the driver a better turn into the corner and reducing understeer. However, if the kart is overly sensitive to steering wheel movement at the point of turn in and begins to oversteer, the toe out settings may be too high. With toe out, the inside front wheels moves down in relation to the chassis more than it will with zero toe or toe in. On a dry surface, a toe setting of 0-3mm out is recommended. For a very high speed track, setting close to zero toe may help top speed. Toe in is not normally used on a kart.

Remember that the kart chassis will deflect under the driver's weight and this deflection can affect toe, caster and camber settings in particular. Generally, the goal is to have zero toe when the chassis is loaded with the weight of full fuel and driver, sitting on the track. Therefore, a heavier driver will need more unloaded toe out than a lighter driver.

On road racing tracks in particular (as opposed to the tighter sprint tracks), most karts will probably handle and accelerate better with the toe set to absolute zero when the kart is on the ground.

However, on sprint tracks, slight toe out will help turn-in to corners, but rarely more than 2mm (on each side), except in wet conditions, when larger toe out setting can be helpful.

When setting the amount of toe, make sure that the toe is equal on each side.

If you reset caster and camber settings or front ride height, you will have to reset toe as well.

Ackerman:

Ackerman steering makes the front tires turn at a different rate. For example, the front inside tire will turn faster than the outside tire when turning into a corner. This creates a faster steering response, thus causing flex through the chassis when turning. Adding Ackerman makes the kart steer more positively and lift the inside rear tire at an increasing rate as steering is added. At the same time, the driver will notice a decreased amount of steering input needed to turn the kart (because the inside rear wheel is being "jacked" more. As a result, the kart becomes more sensitive to the driver's input. In contrast, decreasing Ackerman makes the kart steer more slowly and more steering is needed to corner.

The spindles will usually have 2 tie rod hole locations; the inside hole increases Ackerman, while the outside hole decreases Ackerman. The tie rods can be lengthened or shortened to fit either hole. Make sure you have sufficient threads on the rod ends when using the outer holes.

Caster/Camber Adjusters:
The adjusters at the front spindles should start at a II/II (top/bottom) setting. Refer to the CRG caster/camber chart at the end of this manual for the effect of various settings. Generally, karts are quire sensitive to caster adjustments and are not as sensitive to camber changes.

Caster has the greatest effect at corner entry and during the first third of the corner. Camber has the greatest effect in the middle third of the corner. The final third of the corner is controlled largely by rear axle setup. If changes in none of these areas net any real change on the track, it's probable that your seat position is not correct and you are out of the tuning "window".

When caster and camber are both set correctly, there will be even wear across the tire face.

Caster:
Caster affects the grip of both the front and rear of a kart. It does this by transferring weight to the opposite rear wheel during cornering. Although it may seem complicated, there are a few simple rules to follow concerning caster.

If the caster is decreased (less kingpin angle), the kart will be easier to steer. Some drivers have noted that it adds "feel" to the kart and increases bite on the front end. It may be advisable to decrease the caster setting if the track conditions are providing too much grip. The kart will free up and be more drivable if the caster is removed in this scenario.

The driver may want to add caster if the conditions are cold or if the class requires hard compound tires. This will offer more front grip, less rear grip and help eliminate understeer. For most applications, use the II/II settings on the front end adjusters. Smaller drivers will tend to run decreased caster, while larger drivers should run increased caster.

Many teams take caster out of the chassis for qualifying, when tires are fresh and not fighting for grip. Caster also causes change of camber when the steering is turned, resulting in more negative camber on the outside front wheel and more positive camber on the inside front wheel.

Importantly, increased caster also increases the jacking effect on the front wheels which helps unload the rear axle (inside wheel) more on corner entry. If a soft rear axle is being used, it is possible that increasing caster will alleviate an understeering condition by unloading the rear axle more and help balance the chassis. Since the rear tire is lifting sooner in the corner, there is (in effect) less rear grip at this point.

Generally, karts are fairly sensitive to caster changes. Therefore, it is quite effective as a primary tuning tool.

Camber:
Camber is measured by how far the front tires are leaning in or out as viewed from the front of the kart. If the tire is leaning "in", the kart has negative camber. If the tire is leaning "out", the kart has positive camber.

Camber is usually adjusted when the track surface is wet. In these conditions, the driver can negatively adjust the camber to find more grip. Camber is the setting mostly responsible for maintaining the maximum outside front tire rubber on the road in the corners, particularly mid-corner. Setting camber to zero will nearly always be the best starting point and can be fine tuned using tire wear as a guide (or tire temperatures across the tread).

Front Width:
The most common adjustment made to change the handling of a kart is by working with its front track, or front end width. Widening the front track will create more of a jacking effect when the wheels are turned. This will result in more front end grip and quicker turn in. Narrowing the front track will have the opposite effect. This will result in slower turn in and less front end bite.

Also, the lack of jacking effect will not raise the inside rear tire (as much) on corner entry, preventing the kart from rotating into the corner (as much) and increasing a “push” condition due to the excess traction provided by both rear wheels remaining on the track.

If the kart pushes or understeers entering a corner, widen the front track. If the front track is at maximum width and the kart still pushes, move the front wheels back to your starting position ad increase the caster. In this scenario, you might also re-examine your seat position. If the kart is over gripping or “binds” on the front when the wheels are turned, reverse the procedure.

A very general rule of thumb is; the less available grip, the more scrub radius (increase in front width), caster and starting tire pressure should be used. For more detail on the relationship between starting (cold) tire pressures and racing (hot) tire pressures, read the selection on tires.

Rear End Adjustments

The rear end adjustments include wheel hub length, track, rear ride height, axle stiffness, bearing locations and seat struts. Changes to these settings are usually made when handling problems occur on the exit of the corner.

Some have said that the entire kart should be regarded as a tuned spring. When you change the rear axle stiffness, hub length or rear width, you're actually tuning the spring's "frequency". You can "tune" the frequency and alter how/when the inside rear wheel comes up on corner entry, holds through the center of the corner and then sets back down on corner exit.

Wheel Hub Length:
CRG makes three different wheel hub lengths for their chassis. It's highly recommended that a kart racer purchase all three of these sizes, as they are the most commonly adjusted setting on the kart and have a significant impact on chassis balance.

Think of the relation of the rear hubs to the axle and chassis as you would your hand to a pry-bar and an object at the other end of the bar. If you hold the bar at the farthest end of the bar or hold it with less of your hand, you will have less leverage. Rear hubs on the axle work in much the same way.

Longer hubs tend to provide more rear grip because the inside rear wheel will spend more time on the track surface. So if the kart oversteers as it exits a corner, a longer hub may be desirable.

Short hubs are used when the kart understeers at the exit of the corner. If the driver runs out of track surface as he/she exits the corner the kart has a "push" on exit. While it's not the only possible change, switching to shorter hubs will reduce grip at the rear and may be desirable in a situation like this. The shorter hubs have a lower "frequency" and will allow the inside rear tire to stay off the track surface longer, and the kart will have less grip on corner exit.

Overall choice of hub length should ultimately be based on how flat the tire is wearing. If the kart is running little caster, a soft axle and generally feels good, but the rear tires are "coning" (the inside of the tire is wearing faster than the flat or outside), decrease the rear width. If the problem persists, increase the hub length or turn the bearing carriers facing out to support the axle end more.

Rear Track:
The general rule is to run the rear of the kart as wide as feasible, assuming the chassis is performing well. For sprint racing in the US, most rules dictate a maximum rear track of either 52 or 55 inches.

Most CRG manufactured chassis are specifically designed for rules allowing a 55" rear track width. Therefore, it is important to set the kart's rear track to the maximum that the rules allow. Also, a wider rear tread will provide a smoother ride.

There is an interrelationship between rising/falling grip and stability in the 52" to 55" range with maximum grip in the 54" range. Smaller track width dimensions will provide more grip, but at the expense of stability.

However, this adjustment is made as a last resort. The driver should change to short wheel hubs before decreasing the rear track width narrower than 54-1/2". If necessary, narrow the rear track in 1/8" increments, as most chassis are very responsive to minor changes if the seat is in the correct position.

Generally, it's best to start at 54-3/4", as this gives the ability to narrow or widen the rear for slightly more or less grip if needed to balance the chassis. Each side is only 1/8" away from the maximum of 55". It becomes necessary to narrow the track when the rear of the kart has too little grip. Keep the operating range of movement on the rear width in a fairly small range.

Narrower: more grip, but less stable
Wider: more stable, but less grip

Axle Stiffness:
There are a wide variety of axle hardness available for CRG chassis. *The axle has a very strong influence on rear grip characteristics.* In almost all cases, you will use a mid-range axle. The hard or stiff axle is used when the weather is cold, in slippery track conditions or when rules mandate the use of harder compound tires. The softer axle is used if conditions are extremely grippy or where excess rubber has built up.

In general, higher horsepower karts need stiffer axles for more traction. Lower horsepower karts have a greater need to "free" up the chassis and will run softer axles. Remember the spring frequency "tuning" comparison. The softer the spring, the more/longer the inside rear wheel will stay up.

Tall drivers generally will need softer axles to help reduce grip.

Axle Offset and Length:
If you've moved the rear track to 55", installed a soft axle and short hubs and still just need a little less grip on one side of the kart (for a track with the longest turns in one direction). If you find yourself wishing you could go to 55-1/4" on one side, you could try offsetting the rear axle to the other side of the kart. If all the other measurements (rear track width and type of hubs) stayed the same, the side with the shorter axle will have less leverage and therefore less grip.

Another way of accomplishing this for both sides is to install a shorter axle of the same hardness. In this case, both sides will have less leverage. In either case, be sure the hub still has enough axle to hold onto.

Rear Ride Height:
Most chassis have two settings for the rear ride height. The chassis should be run with the higher ride height for better grip. The higher ride height creates more leverage, which gives more weight transfer to the outside tires. The result of this is increased grip for the driver. Lowering the ride height will have the opposite effect and cause the kart to have less rear grip and possibly oversteer. Only in cases where there are very tacky track conditions should the ride height be decreased.

Remember that ride height is literally how high the kart is above the track. So raising ride height of the rear of the kart will require placing the bearing carrier bolts in the *lower* bolt holes.

Wheels:
Wheel stiffness has a smaller effect on grip (at both ends of the kart) than axle stiffness. Softer wheels such as spun aluminum will have less grip than cast or forged magnesium wheels. Softer wheels can also promote uneven tire wear. A soft wheel will tend to wear the inner portion of the tire. It is generally best to run a stiffer wheel.

Using rear wheels with less offset effectively stiffens the rear axle, as it will be necessary to move the hubs inward in order to maintain the same overall rear width. Therefore, an offset that allows the hubs to be moved outward will effectively soften the rear axle.

Seat Struts:
Most conditions will call for two seat struts on each side of the seat for a total of four. These struts should run from the very top of the seat to the two outer bearing cassettes. On the motor side, it may only be possible to use one strut. The seat struts allow the high leverage point of the driver to transfer load to the rear tires. This essentially creates more rear end bite. When seat struts are removed, the driver's high leverage point is not taken advantage of and minimal load is transferred to the rear tires.

Usually, one would want to remove or loosen seat struts if trying to reduce rear grip. Tall drivers, for example, will have less need for seat struts.

Rear Torsion Bar:
The rear torsion bar can be left out when you want to reduce rear grip. However, if you want to increase rear grip, place the torsion bar in the flat position.

Even more rear grip can be achieved if the torsion bar is placed vertically. In a low grip situation (as in a slightly damp or perhaps a dusty track), the installation of the torsion bar in any capacity will net the rear end more grip due to the fact that it will not allow the chassis to transfer weight and lift up the inside wheel as much (or as long), therefore coming down and driving the kart off the turn sooner.

Bumpers:
The front and rear bumpers should remain tight at all times. There is a school of thought that loosening a bumper (front or rear) will provide less grip at that end of the kart. However, the current generation of CRG manufactured karts perform most consistently with the front bumper tight.

Side Pod Bars:
In almost all circumstances, leave the side pod bars loose. Tightening the side pod bars will give the kart more side bite and generally tighten the chassis. Let the bars fit loosely in the chassis, but be sure the bolts themselves are tight (use Nylock nuts).

Tire Pressures:
Tire pressures can range from as low as 6 psi up to around 30 psi, depending on the compound of the tire, temperature, track surface and overall chassis set up. For most applications, you should stay between 10 psi and 14 psi.

In general, the higher the tire pressure, the faster the tires will come up to temperature and the more grip one will have. However, if too much air pressure is used, the contact patch with the track surface will be reduced, the usable section of the tire may overheat and pressures could climb even higher and as a result adhesion and tire life will be reduced. See the section on tires for more detail.

Bearing Carriers:
The axle bearing carriers can have an influence on the axle stiffness since the portion of the axle between the bearing and the hub is the part that flexes. If you widen the rear track, you are losing a bit of traction because the distance from the bearing carrier to the hub is greater. The normal installation is with the long bearing race (carrier) pointed inward.

To effectively soften the rear axle a bit, the third bearing can be set loose in the frame housing. The normal bolts are replaced by bolts of a smaller cross-section and the bearing is not secured with locking screws to the axle.

Turning the long race of the axle bearings outward will stiffen the axle ends and gain grip. Bolting the third bearing securely in place and tightening the set screws to the axle will also stiffen the axle and increase grip.

Remember, the bearings all function like fulcrums with the axle working like a lever, so the flexing on both sides of the bearings affect the overall stiffness of the rear assembly. If the bearing is not moving smoothly in the hanger, it can absorb and release energy in an uncontrolled manner which can cause hopping in the corners.

Rear Axle Assembly Run-Out:
The wheels, axle, hubs and tires will all inevitably have a certain amount of run-out or deviation from being perfectly round. Sometimes these small individual irregularities can add to each other to form a significant out of round condition. This will, in effect, often feel like an out of balance tire and will tend to upset the kart at the middle and exit of the turn when dynamic loading is greatest.

The kart may feel loose and hoping, but the effect can be subtle to the driver. The tuner may keep trying to tighten the kart to the point of binding, but the problem could be run-out.

Careful assembly of components will help minimize run-out by using the irregularities of each individual element to balance each other and not provide a cumulative problem.

Maximum Grip Setup (Low Grip Track)

The following settings are recommended as a starting point for a dry track with little grip. These types of tracks are often referred to as “green”, given the inherent lack of grip in them. The attempt here is to gain more grip from the kart. The following recommendations should aid in this.

- Weight distribution should be 43.0” front, 57%.0 rear and 50/50% side to side.
- Toe should be set out to 1/16”-1/8” on each side.
- Caster should be at maximum. Set adjusters to III/III settings.
- Front bumper should always be tight.
- Front width should be 45” to 46”.
- Front ride height should start in the middle. Use both shims under the front spindle to raise height is more front grip is needed.
- Side pod bars need to be loose
- Seat should be set according to factory recommendations.
- Rear wheel hubs should be medium to long (for maximum rear grip).
- Rear ride height should be as high as possible (axle in lowest position).
- Rear track should start at 54” to 54-1/2” for maximum grip.
- Axle should be medium to stiff.
- There should be at least two seat struts on each side of the seat.
- Rear torsion bar should be in, positioned in the flat setting to start.
- Rear bumper should be tight.

Minimum Grip Setup (High Grip Track)

The following settings are recommended as a starting point for a dry track with a high amount of grip, perhaps one with a lot of rubber laid down. The attempt here is to lose grip from the kart. The following recommendations should aid in this.

- Weight distribution should be 43.0” front, 57%.0 rear and 50/50% side to side.
- Toe should be set out to 1/16”-1/8” on each side.
- Camber should be set at -1/2 degree (negative ½) to 0 degree
- Caster should be at III/III settings. Try less caster as grip comes up, more as tires wear.
- Front bumper should always be tight.
- Front width should be 44” to 44-1/2”.
- Side pod bars need to be loose
- Seat should be set as low as possible.
- Rear wheel hubs should be the shortest length (for minimum rear grip).
- Rear ride height should be as low as possible (axle in highest position).
- Rear track should start at 55” for minimum grip.
- Axle should be soft.
- Loosen or remove the seat struts.
- Rear torsion bar should be removed.
- Rear bumper should be tight.

Rain Set Up

Obviously the first change is fitting rain tires. Beyond that, racing in the wet is extremely challenging, even more so if you're stuck with a dry set up. The changes below will serve to soften the chassis and improve adhesion in the wet.

First, a word or two about driving in the wet. Get some RainX for the outside of your visor, a good anti-fog agent for the inside of your visor and a plastic rain suit to wear over your driving suit.

The typical racing line contains oil, water and rubber. This is not a good combination. You want to spend as little time on the normal racing line as possible. In the wet, the proper driving line is to "square" the corners and cross-over the normal racing line, instead of following it. A good portion of body English is also useful in an effort to properly load the outside front tire when turning into a corner.

- Move the front wheels out as far as possible. Some manufacturers have extensions that attach to the spindle, making it possible for the front track to increase even more.
- Rear track should be moved in as far as possible. Move the rear wheels in until the centerline of the rear tread aligns with the inside edge of the front tires.
- Set front ride height as high as possible.
- Set front end for maximum caster (III/III) and increase camber if possible (III/II).
- Toe should be set from 1/8" to ¼" out (each side).
- Front and rear bumpers should be tight.
- Increase tire pressure. The fronts should be at least 15 psi and the rears should be around 20 psi. This will make the tires heat up faster. Low tire temperatures can be a significant problem in the wet. See the section on tires for more detailed information.
- If you have time, run a medium stiffness axle.
- Short rear hubs.
- Aluminum wheels if possible (magnesium will corrode).
- Remove torsion bars.
- Move the rear of the seat up around 1" to 1-1/4" above normal settings. If time will not allow such a change, place a thick folded towel in the seat to raise the driver.
- Rear ride height should be as high as possible.
- Loosen the seat struts.
- Shield water from splashing on the brake rotor. Taping up the seat struts or fixing a number panel in front of the brake caliper should accomplish this.
- Tape each side pod closed.
- Spray ignition with a water repellent such as WD-40 (water displacement-40).
- Drill two holes in the seat bottom for drainage
- Cut 1/3 the length from an empty one gallon milk jug and tape the remaining milk jug to your air box in such a way that if serves to block water from directly entering the air inlets.

Chassis Set Up Procedure

Measuring the Chassis

In order to effectively determine if the chassis is straight, it will be necessary to remove the seat and set the kart on a stand.

First measure the parallel relationship between the front stub axles and the rear axle (with the wheels set straight ahead). Measure each side of the kart from the back of the rear axle to both the bottom and the top of the kingpin bolt. Both sides should be equal.

If these dimensions are not the same, it will then be necessary to "stretch" the side of the chassis that is shorter. This can be achieved by jacking between the bearing hanger at the rear and the king pin post. Normally it will be necessary to jack the chassis a little further than the difference, as it will spring back. However, be cautious and go in small steps to avoid too large an adjustment. It is vital that the kart be the same length on both sides before attempting further adjustments.

Now check to see if the rear axle is located centrally in the chassis. This is best done by first measuring from the chassis tubes and then checking the axle diagonally with the tops of the king pins. This diagonal check is important and will tell you if the chassis runs out of line from center. If the diagonal check shows up a fault in the chassis, it is best to simply leave the chassis alone and simply offset the axle slightly to overcome the problem.

Once the chassis is the same length on both sides and the axle is properly centered, it is time to center the steering with regard to the front hubs being parallel to the rear axle. This is necessary in order for the kart to steer evenly in both directions and track in a straight line.

First, lock the steering wheel into a straight-ahead position by either using Vise-Grips on the nylon steering block or (preferably) by using a bungee tie-down from the bottom of the steering wheel to the rear bumper. Then, by placing a carpenter's level (or even a long fluorescent light tube) against one rear wheel, adjust the corresponding front wheel to be exactly parallel to the guide. In effect, the distance from the front edge of the wheel rim will be identical, compared to the distance at the rear.

Once the first wheel is set (with the steering straight ahead), then set the opposite wheel to zero toe. This should establish your central reference point. Now if you wanted a total of 3mm toe out (without the driver), move the front of each wheel out 1.5mm (for a total of 3mm). Now your steering is perfectly straight and your toe out is set as well.

Progression of Chassis Set Up in the Shop

- Measure the chassis front to rear and side to side
- Set caster and camber to the recommended settings
- Center the steering and set the front wheels straight
- Set the toe out
- Weigh the kart to be sure the chassis corner weights are correct
- Set the front and rear track, ride heights, etc.

Progression of Tuning at the Track

While there are many different ways to troubleshoot a chassis handling on the track, the essence of what you're trying to do is just simply figure out where the chassis is lacking. In other words, are you having to "wait" for it or adjust your driving to make up for something the chassis is doing (or not doing)? When testing at the track, one method of determining this is to drive a corner as fast as you can and then ask yourself what is keeping you from going through the corner faster (besides you). Careful thought will normally help you determine if the kart is sliding in the front (understeer), sliding in the rear (oversteer), hopping, etc… Once you know what the problem is, you can begin solving it.

In general, start with an axle that you feel will work (given the track conditions). Use medium hubs and set the rear track width in the middle of the proper range. Then change track width to adjust for oversteer, understeer or hopping. As you reach the limit of the rear track adjustment, switch hubs and go back to the center of the track width range for more testing with the front end settings.

Never change more than one item as a time or you won't know what is helping or hurting your setup!

The following are the most common adjustments at the track:

- Tire pressures
- Reposition weight (seat or lead ballast weight)
- Adjust Frame stiffness (add/remove torsion bars, 4th rails, seat struts, etc…)
- Adjust front and/or rear track
- Adjust ride height
- Change rear hubs
- Softer or stiffer wheels

Proper record keeping is critical. Write down every change so you can refer back to your base settings if your changes are not helping.

Maintenance

First, pull every bearing and moving part off the chassis. Then, thoroughly clean and oil where necessary. Make sure each moving part is in good condition and if it appears compromised, replace it. Aerosol white lithium grease is excellent for rear bearings. It is sometimes desirable to remove the debris shields on the bearings to ease maintenance.

Make sure that all king pins bearings are fitted properly and not worn. The same applies to steering shaft bearings, tie rod ends and wheel bearings. Check the kart for any cracks and repair where necessary. Then reassemble using new Nylock nuts throughout.

Finally, you must be certain the rear axle, brake disc and the front wheels all run free. Wheel balance is also important, although fronts are a bit more critical than the rears.

Kart Scaling & Weight Distribution

Weight distribution on a kart has a huge influence on the final performance of the kart on the track. The mass of the driver is often greater than the kart itself, so this mass must be positioned properly. Scaling the kart is perhaps the most important thing a driver or team can do to ensure proper handling of their machine.

When the kart is scaled properly, ideal weight distribution is achieved. Therefore, the kart will have the potential to perform at its optimum level. If the kart is not scaled properly, the opposite will be true. The machine will never perform at its optimum level, nor will it respond positively to chassis adjustments. In other words, if you make changes and the kart doesn't seem to respond, then the seat is in the wrong position and the kart isn't scaled correctly.

Some problems of an improperly scaled kart include understeer, excessive or insufficient load on any one tire, chassis binding and lack of side bite in cornering among many other problems. An improper weight distribution can also lead to incorrect diagnosis of handling problems at the track. For most karts, the following weight distribution is recommended as a starting point:

43% Front weight
57% Rear weight
50/50 Left/right weight

Any lead that might be added should be added as low as possible unless your primary track(s) are very low grip (green). The four seat bolts should be very tight with no movement. The torsion bars should be disconnected when scaling the kart. For most chassis, the seat bottom should be about 2cm (3/4") below the bottom of the frame. A tall driver can go as little as ¾" ground clearance from the seat bottom. Tall drivers should also consider using a more flexible seat to help reduce chassis stiffness.

These are just recommended starting points. Weight can be moved around at the track to fine tune the handling characteristics of the chassis. Moving weight to the front of the kart will provide more front end grip. However, please be careful to not add too much front end weight, as it can make the kart prone to larger understeer and oversteer swings when at the traction limit. If weight is moved to the rear of the kart, the effect will be more rear end grip. Weight can also be moved vertically up or down. Moving the ballast weight upwards will provide more grip (weight transfer).

Seat Placement & Adjustment

The seat placement is the single most important weight adjustment on the kart and is done before the scaling process. Proper seat adjustment may result in almost perfect weight distribution before the weight is added to the kart. You may find that after running the kart a bit, you will have a number of mounting holes drilled in your seat to allow you to shift the seat for changing track conditions. For example, you might move the seat forward to fight an understeering kart by more effectively transferring weight to the front end. A good starting point for an average weight driver is to use the following:

Rear edge of upper seat back directly to the rear axle:	23cm (22.5 for a 50mm axle)
Front left edge of seat to front frame rail at the floor pan tab:	60cm
Seat bottom below frame:	2cm

Scaling the Kart

The following steps are very important to the scaling accuracy of your kart:

- Use digital scales for highest accuracy and repeatability.
- Be certain the floor is level. If necessary, place shims under the appropriate corner scales. This is very important.
- Set caster and camber evenly on both sides of the kart.
- Set spindle heights evenly on both sides of the kart.
- Set toe (always after setting caster, camber and ride height).
- Check that tire pressures are at race settings (15-17psi should be fine).
- Fill the fuel tank to halfway.
- Secure the steering wheel to the center position.
- Carefully place the kart on the scales and secure the brake pedal with a bungee to the bumper.
- Have the driver sit in his/her normal driving position (hands on the wheel) before the scale reading is taken. Try to avoid any unnecessary movements of the head or arms.
- Be sure to properly document all corner weights before making any changes.

Adjusting Kart Weight

If necessary after scaling the kart, adding weight can aid in perfecting the distribution. With many drivers, weight usually has to be added anyway. A good general rule for the location of added ballast weight is to center the weight somewhere on the seat, given that the mass of the kart needs to be centered as best as possible. Adding weight to the seat aids this. The area under the front edge of the seat is excellent for a 4-5 pound weight. Generally the weight should be added as low as possible. Lead shot in the frame should not be used. Be sure to either double-nut or safety wire the lead weight bolt securely to the kart so another driver doesn't hit it at 70mph.

If the driver does not need to add weight, they are probably at the weight limit of their class. Drivers in this case are often reluctant to add weight just to improve their weight distribution. However, there is evidence that adding the weight to refine the weight distribution is more beneficial than leaving the five or ten pounds off the kart.

After the correct distribution is achieved, the driver should make one more observation The front wheels should weigh within five pounds of each other. The same situation applies to the rear wheels too. If this is not the case, re-check the factors effecting weight distribution given above and re-scale the kart. If the problem still exists, you may have to re-adjust the seat and start the process all over again.

Tweaking the Chassis

If the side to side weights are outside an allowable range, you may need to "tweak" the frame in order to achieve proper side-to-side weight distribution. There are several means of adjusting the chassis. The following is one method.

If the front corner weights are not equal (by more than 5 pounds), place the kart on a flat floor. Place an extra wheel or a floor jack under the front wheel (or king pin) that is heaviest. Then, with someone standing on the rear wheels (leaning against the seat), push down on the light side of the kart sticking up in the air. This should be repeated until both front wheels carry the same weight. Once the front has evened-out, the rear should also.

Tires (Care & Feeding)

Tire Pressures

The first thing that must be determined for a kart tire is correct inflation pressure, if you want to get the best performance. That is easily said, but the real problem is the word “correct”, because its meaning varies with conditions such as driver, frame, course layout, road surface, weather and temperature to name a few variables. The manufacturer’s approved pressure is usually from around 10 to 18 psi. The proper inflation pressure should be selected from that range to match individual conditions.

Lowering inflation pressure improves grip because the effective contact area of the tire is increased. However, If pressure is lowered too far, contact becomes uneven and driving is more difficult. Increasing inflation pressure generates heat faster and allows the tire to begin to grip sooner. However, too much inflation pressure will distort the tire cross section, lift the tread and lose grip.

Try for pressures that do not increase more than 2-3 psi in a “race” length session. This is why careful note taking is important. You must record the pressures before you drive a session (cold), then immediately after returning to the pits (hot). Finding the correct balance between heat/grip/wear is the key to success.

Start at 10 psi. Generally, when a tire is at approximately the correct inflation pressure, it will rise about 2 psi from cold to hot readings. Depending on the track layout, the four tires on your kart will build pressure at different rates. Adjust each tire’s pressure up or down to hit that 2 psi rise. In other words, if you go out at 10psi and when you return from your session, the right-rear tire is at 14 psi and the right-front tire is now at 13 psi, you could drop that right-rear tire pressure 2 psi and the right-front pressure 1 psi. The next time you go out on cold tires, reset the right-front pressure to 9 psi and the right-rear pressure to 8 psi. Just remember the lower the cold pressure, the longer that tire will take to “come in” and develop proper grip in that session.

- Soft compound tires (cold) 8-9 psi
- Medium compound tires (cold) 9-10 psi
- Hard compound tires (cold) 12-13 psi

Pyrometers

An even better means of evaluating pressures is the use of a digital pyrometer to measure tire temperatures across the tread face.

These should be taken immediately upon re-entry to the pits after a little to no cool down lap. While laser type pyrometers are easier to use, the surface probe types are more accurate as they are not measuring a rapidly cooling surface, but they actually "probe" a bit beyond the surface of the tire tread, where the heat is better held.

Be sure to get the temperature readings in 3 places across each tire's tread. Since this must be done quickly, either have a helper with a pen and paper or use a pyrometer model with a built-in memory. Try for equal temperatures across the tire face. Temperatures will vary somewhat, from one tire to another.

Here are some basic troubleshooting guidelines:

- Too much heat in the center of the tread usually indicates too much pressure in that tire.
- A cooler center usually indicates too little pressure in that tire.
- Hottest on both interior edges can mean too much negative camber.
- Hottest on both interior edges and a turn-in oversteer can also mean too much caster.
- Too cool on the interior edge may mean a need for more negative camber.

An alternative that will come your way with experience is to simply examine the surface of the tire. A properly inflated tire on an properly aligned chassis will have a slightly grained surface (not unlike sandpaper). A tire that is running too cool, is a hard compound or just not being used aggressively enough to build up heat, will be smooth with no graining. If you see smooth graining, but the interior edge of the tire is showing small strips of rubber or much more aggressive rubber deposits that look like the rubber is being overheated, then you are probably running too much caster, camber or there is another condition that is overheating that edge. The point is, that edge will look different than the rest of the tire because it is running hotter.

Varying Conditions

Understeering / Over steering:

Raise rear tire pressure about .5 to 1 psi to correct understeering and lower the inflation pressure in the rear tires by the same amount to counteract an oversteer condition. The opposite is also true for front tire inflation pressure. This should not be changed to extremes however, because sidewall stiffness caused by the proper inflation pressure is needed on the front wheels. This effect may vary with different tire designs and manufacturers.

Generally, if using soft compound tires, rear pressures less than 10 psi should not be used to correct oversteer. Look elsewhere (hubs, rear width, axle, etc…) for a solution.

Change in Atmospheric Temperature:

The general rule is to raise inflation pressures slightly as the temperature falls and lower it as the temperature rises. If there is a significant difference between morning and afternoon temperatures, raise the inflation pressure a little in the morning for better grip by increasing the load to generate heat. Lower it in the afternoon to reduce generation of heat by the tire. This rule applies for summer and winter also.

Compounds:

Tire pressure can be raised when using hard compound tires. With high grip compounds, pressures can be lowered.

Variations in Track Surface:

Lots of rubber residue on the track surface causes greater resistance. On such a surface it is good to lower air pressure to reduce heat generation by the tire. This holds especially true in the summer.

Rain Tires:

In wet conditions, raise the pressures significantly. However, when the track starts to dry out, a heavy load is imposed on the tread pattern blocks of rain tires. The remedy is change to slicks as soon as possible. As an intermediate measure you might still run rain tires, but lower the pressures.

Extreme wet conditions:	25-30 psi
Moderate wet conditions:	20-25 psi
Drying conditions:	15-20 psi

Rim Width:

Overall stiffness is changed uniformly as inflation pressure is varied but by changing the rim width, vertical stiffness and especially lateral stiffness can be greatly varied. Furthermore, since the contact area does not change appreciably as it does with an alteration in inflation pressure, grip remains the same but fine changes can be made in maneuverability. For example, if the rear slide is not smooth a wider rim than standard may be called for. However, the range in which rim width can be varied is within +/- .5 inches (approx. 13mm).

Tire Diameters:

The external diameter (circumference) of a tire varies in response to different conditions. This must be taken into consideration also when selecting the gear ratios. It is generally accepted that the gear number must be changed for each 12-15mm change in the length of the tire's circumference. This amount of change in diameter occurs quite easily with a variation in inflation pressure and other conditions.

Mismatched tire diameters (left to right) can have a very negative effect on handling. This is especially true of the rear tires which should always be within 10mm of each other. Tires can be stretched in diameter by inflating them to 40 psi or so and letting them set overnight. This is even more effective if the tire can be left in the sun for a period of time, then recheck when the tire is let back down to proper race pressure.

The Moving Target of Proper Pressures:

Ultimately, one of the difficulties in setting correct tire pressures lies in the condition of lower pressures producing more grip once the tire is up to proper operating temperature. However, higher pressures bring the tire up to operating temperature sooner, ultimately at the expense of grip later in the race (compared to a lower pressure at that same tread temperature).

Therefore, proper pressures are often based on how soon and how long optimum grip is needed. This principal is more relevant in lighter direct-drive or clutch karts. Heavier shifter karts tend to generate higher tire temperatures more rapidly due to their increased power and weight.

New Tire Break-In:

The final curing of the rubber on a racing tire takes place in the first laps taken with a new tire. Therefore, the proper procedure is to take two or three laps to gradually bring the tire up to temperature, then only one or two more laps at normal operating temperature. It is imperative that the tires be allowed to completely cool down before racing on the tires. Any other process risks the performance and longevity of the tires.

Setting Up for SL (Spec) Tires:

The first basic thing to realize about “SL” tires is that they give less grip. As a result, the wide rear stance of a kart that runs on “open” (soft) tires will not necessarily work. To start setting up on SL tires, set the kart up fairly wide and then after several laps, bring the rear track width in 1.0cm (.5cm per side). Keep repeating this procedure until the back of the kart stops sliding and starts to lift when cornering. If you move the rear track in to the point that the kart hops, you have gone a little too far. Make sure you run at least three to four laps to allow the harder SL tires to actually warm up.

Once you have the kart handling consistently in both directions and you find that you have the rear end of the kart handling well (but the front is pushing or understeering), the next step will be to widen the front track width. As track conditions improve and the grip levels come up, you can then move the front track back inward.

Troubleshooting Guide

Adjustments recommended for different handling problems. Always make only one change at a time.

The back end is loose at the entrance of the corner or there is too much front end bite.

- Move in one wheel spacer on both spindles
- Lower 1 psi in the rear tires
- Move weight away from the front of the kart
- Lower the front of the chassis
- Less caster (I/II or I/I)
- Check to make sure the toe is set to neutral with the driver seated and the kart on the ground
- Install a stiffer rear axle
- Install longer rear hubs
- Attach seat struts (4 total)
- Raise the rear ride height

The front end of the kart is "pushing out", understeering or the back end is tight at the corner entrance.

- Move out one wheel spacer on both spindles
- Add more caster (II/II or III/III)
- Raise the air pressure in the rear tires by 1 psi
- Add weight to the front of the kart
- Raise the front of the chassis
- More toe out

The kart is sliding on all four wheels too much or there is not enough side bite.

- Tighten the torsion bars
- Lower the hot tire pressures by 1 psi

The kart is not drifting enough on all four wheels or there is too much side bite.

- Loosen or remove the torsion bars
- Raise the hot tire pressures by 1 psi

The kart is loose on the exit of the corner.

- Move in the rear track closer to 54"
- Install longer wheel hubs on the rear axle
- Change to a stiffer axle
- Raise the air pressure in the rear tires by 1 psi
- Raise any ballast weight on the rear of the kart to a higher vertical position for more transfer
- Raise the rear ride height to the maximum if not already done
- Add seat struts (four)

Kart is tight at the exit of the corner or the front end is understeering at the exit of the corner.

- Put shorter wheel hubs on the axle
- Move in the rear track by up to ½”
- Raise the air pressure in the rear tires by 1 psi
- Install a softer axle
- Lower any ballast at the rear of the kart to a lower vertical position
- Remove one set of seat struts (leaving 1 on each side)
- Lower the rear ride height

Kart understeers or oversteers, but only in one direction.

- Check that kart corner weights are equal
- Check for a twisted, tweaked or bent chassis
- Check that settings are equal on both sides of the kart
- Check equal side to side tire pressures

The kart is “darty” on the straights and dives rapidly into the corners.

- Check the toe settings, you may have too much toe out.
- Front track is much too narrow, widen at least one spacer on each side

The kart is hopping at the rear in the corners.

- Put shorter wheel hubs on the axle
- Set the rear track width at or close to the maximum of 55”
- Install a softer axle
- Remove the seat struts
- Raise the air pressure in the rear tires by 1 psi
- Lower any ballast in the rear of the kart to a lower vertical position
- Lower the rear ride height (axle up)

The kart suffers from a “Push/Kick”.

- Move the seat forward
- Decrease the rear track width
- Increase the front track width
- Increase the rear tire pressures

Quick Troubleshooting Chart

- Remedies are listed in approximate order of relative effectiveness with most effective listed at the top.
- Many of the items below are of similar effectiveness to those adjacent in the list.

MOST EFFECTIVE	OVERSTEER	UNDERSTEER	PUSH/KICK	HOPPING	REMARKS
Seat Position	Move back	Move forward	Move Forward	Seat back lower	Very effective tuning tool
Axle	Stiffer	Softer	Softer	Softer	Don't narrow too much
Seat Struts	Add or tighten	Remove	Remove	Remove	
Rear Wheel Hubs	Longer	Shorter	Shorter	Shorter	
Rear Track Width	Decrease	Increase	Decrease	Increase	
Front Track Width	Decrease	Increase	Increase	Decrease	
Front Ride Height	Lower	Higher	Higher	Not effective	
Rear Ride Height	Higher	Lower	Lower	Lower	
Caster	Decrease	Increase	Not effective	Not effective	Effective on both ends of kart
LESS EFFECTIVE	**OVERSTEER**	**UNDERSTEER**	**PUSH/KICK**	**HOPPING**	**REMARKS**
Rear Tire Pressure	Decrease	Increase	Increase	Not effective	Tune for even tire wear, not fixing chassis
Front Tire Pressure	Increase	Decrease	Decrease	Not effective	Don't lower too much or lose sidewall stiffness
Rear Wheel Width	Increase	Decrease	Decrease	Not effective	
Front Wheel Width	Decrease	Increase	Increase	Not effective	
Toe	Not effective	Increase	Not effective	Not effective	
Camber	Less negative	More negative	Not effective	Not effective	
Side Pod Bars	Tighten	Tighten	Loosen	Loosen	Tightening stiffens chassis considerably
Torsion Bar	Tighten	Tighten	Loosen	Loosen	
Front Bumper	Loosen	Tighten	Tighten	Not effective	
Rear Bumper	Tighten	Loosen	Loosen	Loosen	

CRG/PTK/Mogo Axle Stiffness Comparison Chart

AXLE CODE	ALT. CODE	HARDNESS	THICKNESS (MM)	DIAMETER (MM)	REMARKS
K	KQ & KA	235-250		40	
MAF	M	195-210		40	
MB		180		40	
AZ	MZ2	180-190		40	
MZ	MOGO H	160-175		40	
ZZ	MOGO M	150-160		40	
MET30	MOGO S	130-140		40	Good general use
AZ4		110-115		40	
AZ5		100-110		40	
F		280-300		45	
K		235-250		45	
MZ		160-175		45	
ZZ		150-160		45	
MET30		130-140		45	
90		90		45	
T5		230	2.0	50	
T2		200	2.0	50	
M20	MOGO M20	170	2.0	50	
T4		130	2.0	50	
T1		120	2.5	50	
T6		100	2.0	50	
T3		90	2.0	50	
S25	MOGO S25	80	2.5	50	
S20	MOGO S20	60	2.0	50	

CRG Caster / Camber Chart

CASTER	CAMBER	UPPER	LOWER	REMARKS
Maximum	Central	III	III	Maximum Caster
More	More positive	II	III	
More	More negative	III	II	
Central	Max. negative	0	II	Maximum negative camber
Central	**Central**	**II**	**II**	**Factory neutral setting**
Central	Max. positive	II	0	Maximum positive camber
Less	More positive	II	I	
Less	More negative	I	II	
Minimum	Central	I	I	Minimum caster

Fixed Bottom Carrier:

- Position I on top carrier will give more negative camber and less caster.
- Position II gives less negative camber than adjustable carrier and no effect on caster.
- Position III will give more negative camber and more caster.

NOTE:

Adjusters must be installed in the following manner: Left side adjusters will be identical and numbered in a clockwise manner. Right side adjusters will be numbered in a counter-clockwise manner. With both tops and bottoms set (to inside) at “II”, top fronts on both sides will be “I” and the bottom fronts will be at “III”.