SERPENT

710

1:10 SCALE 200mm 4WD GAS ON-ROAD

Setup Book

CONTENTS

INTRODUCTION

Setting up a racecar with fully independent suspension, like your Serpent 710, is necessary to make the car perform well. We have developed these straightforward procedures to help you set up your car properly and easily. Always follow these procedures step-by-step, in the order presented, and always make sure that you make equal adjustments on both left and right sides of the car.

These setup guidelines are divided into two major sections.
• **Section A: Basic Setup -** describes default settings for your 710.
• **Section B: Advanced Setup -** describes the effects of setup changes.

Setup Order
We have determined that you should set up your 710 in the order indicated in the table below. The order of the settings has been determined as the most logical to set up your 710 properly and easily. Also, certain settings must be made before others, as changing one setting will impact another setting.

The table below gives you a breakdown of what components need to be attached on the car, and what you will need to measure the setting.

	Shocks	Anti-roll bars	Wheels	Set-up System	Flat Board
Downstops	-	-	-	+	
Shock Absorbers					
Track-Width	+		+		+
Ride Height	+	-/+	+	-/+	+
Camber	+	-	+	-/+	+
Caster					
Toe	+		+		
Anti-Roll Bars		+			
Suspension Tweak	+	+	+		+
Rear Differential					

(+) attach or use this component or apparatus
(-) DO NOT attach or use this component or apparatus.
(-/+) component or apparatus may or may not be attached or used.

For example, to set the car's camber:
- attach the shocks
- detach the anti-roll bars
- attach the wheels
- use a flat board

SECTION A - BASIC SETUP

This section describes the default settings for the 710. We strongly recommend you thoroughly read this section so you understand how the settings are adjusted.

The setup described here is a good starting point. After rebuilding the chassis, or in case you become lost with your setup, always return to the setup described here.

If you choose to adjust the settings to better suit different track conditions, see "Section B: Advanced Setup." Make small adjustments, one at a time, and see if you find any improvement in handling with each adjustment. We advise you to keep track of your setup changes, and record which setups work best at different racetracks under various conditions.

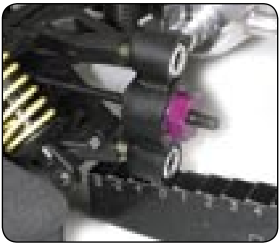
A1. DOWNSTOPS

Downstops limit how far the wishbones travel downward (which determines how far upwards the chassis travels). Make sure you adjust downstops so they are equal on both left and right sides.

Initial steps
A Shocks: It is not necessary to remove the shocks, however you must be sure that they are long enough not to limit the suspension travel. Be sure the suspension is reaching the downstop limits before the shocks are fully extended.
B Front anti-roll bar: Loosen the setscrew from the front anti-roll bar mounts and push the blades apart so that they are not touching.
C Rear anti-roll bar: Disconnect one ball-joint from the rear anti-roll bar.
D Wheels: Remove the wheels from the car.

Set-up apparatus
Check downstops with the chassis elevated above a reference surface. A special, flat reference board is available from HUDY (#108200 Flat Set-up Board). We also advise you to use the downstop measuring set from HUDY.

Measuring downstops
Using the measuring gauge, measure the distance from the reference surface to the bottoms of the front steering blocks / rear uprights. Positive numbers indicate the distance (in mm) ABOVE the level of the elevating blocks (or, above the bottom of the chassis). Negative numbers indicate the distance (in mm) BELOW the level of the elevating blocks (or, below the bottom of the chassis).



A1.1 Setting front downstops

Front downstop setting = 0mm
Set the front downstops so that the bottoms of the steering blocks are at 0mm on the gauge. (Actual measurement = 0mm above level of elevating blocks, or level with the bottom of the chassis).

Adjust front downstops by turning the front downstop setscrews in or out. Turn the front setscrews IN to increase the front downstop value. Turn the front setscrews OUT to decrease the front downstop value. Make sure you adjust front downstops so they are equal on both left and right sides.

A1.2 Setting rear downstops
Rear downstop setting = 7mm
Set the rear downstop screws so that the bottoms of the rear uprights are at 7mm on the gauge. (Actual measurement = 7mm above level of elevating blocks, or above the bottom of the chassis).

Adjust rear downstops by turning the rear downstop screws in or out. Turn the rear setscrews IN to increase the rear downstop value. Turn the rear setscrews OUT to decrease the rear downstop value. Make sure you adjust rear downstops so they are equal on both left and right sides.

A2. SHOCK ABSORBERS

Shocks, or shock absorbers, are a part of the suspension that allow the wheels to keep as much contact with the running surface as possible. The 710 features unique 4-step externally-adjustable racing shocks that do not require you to change pistons or change shock oil to alter the damping. Damping, mounting position, spring tension, and spring preload are all characteristics that determine how the shock performs.

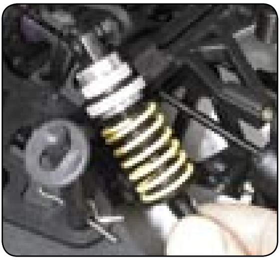
Initial steps
A Shocks: To adjust shock damping, remove the lower shock ball-joint from the lower suspension arm. You do not need to disconnect the shocks to adjust spring preload.

Set-up apparatus
None

Adjusting the shock absorbers
Pull out the piston rod and turn it slightly until it locks in the shock body. Turning the piston rod fully CW aligns 2 piston holes (hardest setting); turning the piston rod fully CCW aligns 5 piston holes (softest setting). There are four positions (2-3-4-5 holes aligned), each of which can be felt by a slight “click” when you turn the piston rod.

A2.1 Setting the front shock absorbers - damping

Front shock damping setting= 3 holes open
Adjust the front shocks to 3 holes open.
Turn completely CW, then turn 1 click CCW.



A2.2 Setting the rear shock absorbers - damping

Rear shock damping setting= 3 holes open
Adjust the rear shocks to 3 holes open.
Turn completely CW, then turn 1 click CCW.

A2.3 Setting the front shock absorbers – upper mounting position

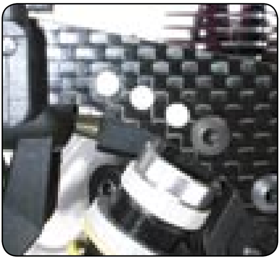
Front shock upper mounting position = second hole
Attach the front shock upper mount to the hole that is 1 hole above the bottom hole on the front shock tower.

A2.4 Setting the front shock absorbers – lower mounting position

There is only one shock mounting position on the front lower arm.

A2.5 Setting the rear shock absorbers – upper mounting position

Rear shock upper mounting position = bottom hole
Attach the rear shock upper mount to the bottom hole on the rear shock tower.



A2.6 Setting the rear shock absorbers – lower mounting position

Rear shock lower mounting position = outer hole
Attach the rear shock lower mount to the outer hole on the rear lower arm.

A3. TRACK-WIDTH

Track-width is the distance between the outside edges of the wheels, front or rear. It is important that front or rear track-width is adjusted symmetrically, meaning that the left and right wheels must be the same distance from the centerline of the chassis.

Initial steps
A Shocks: Attach front and rear shocks.
B Wheels: Mount all four wheels on the car.

Set-up apparatus
Place the car on a flat measuring surface. We recommend using a HUDY Set-Up Flat Board, which has graduated markings to measure track-width.

Measuring track-width
Measure front track-width on the outside edges of the front wheels. It is important that front track-width is adjusted symmetrically, meaning that the left and right wheels must be the same distance from the centerline of the chassis.

Measure rear track-width on the outside edges of the rear wheels. As with front track-width, it is important that rear track-width is adjusted symmetrically, meaning that the left and right wheels must be the same distance from the centerline of the chassis.

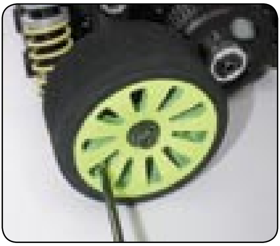
A3.1 Setting front track-width
Front track-width setting = 200mm
Set the front track-width to 200mm; the outer edge of each front wheel should be 100mm from the centerline of the chassis.

To increase front track-width, turn OUT both upper and lower pivotballs equally. To decrease front track-width, turn IN both pivotballs equally.

Note that changing front track-width will also affect the front toe-in setting.

A3.2 Setting rear track-width
Rear track-width setting = 200mm
Set the rear track-width to 200mm; the outer edge of each rear wheel should be 100mm from the centerline of the chassis.

To increase rear track-width, turn OUT the rear upper pivotball AND both rear lower pivotballs. To decrease rear track-width, turn IN the rear upper pivotball AND both rear lower pivotballs; do this equally for both right and left sides.



A4. RIDE HEIGHT

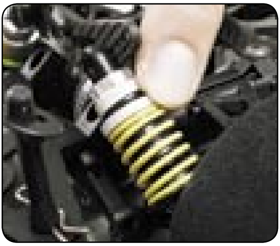
Ride height is the distance between the bottom of the chassis and the reference surface on which the car is sitting. Adjust ride height with the car ready-to-run but without the body.

Initial steps
A Shocks: Connect front and rear shocks.
B Anti-roll bars: Disconnect front and rear anti-roll bars.
C Wheels: Mount a set of wheels/tires with diameters of 62mm front / 62mm rear.

Set-up apparatus
Measure ride height with the car sitting on a flat reference surface (such as a HUDY setup board).

Measuring ride height
Measure the ride height using a HUDY ride height gauge or calipers from the very end points at the front and rear of the car.

A4.1 Setting front ride height
Front ride height setting = 6mm
Set the front ride height to 6mm.



Increase the front ride height by tightening the shock preload collars on the front shocks. This moves the collars DOWN the shock body.
Decrease the front ride height by loosening the shock preload collars on the front shocks. This moves the collars UP the shock body.

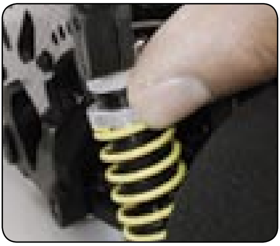
Make sure you change the shock preload on both front shocks equally.

A4.2 Setting rear ride height
Rear ride height setting = 6mm
Set the rear ride height to 6mm.

Increase the rear ride height by tightening the shock preload collars on the rear shocks. This moves the collars DOWN the shock body.

Decrease the rear ride height by loosening the shock preload collars on the rear shocks. This moves the collars UP the shock body.

Make sure you change the shock preload on both rear shocks equally.



A5. CAMBER

Camber is the angle of a wheel to the surface on which the car is resting (with wheels and shock absorbers mounted). Zero degrees (0°) of camber means that the wheel is perpendicular to the reference surface. Negative camber means that the top of the wheel is leaning inwards towards the centerline of the car. Positive camber means that the top of the wheel is leaning outwards from the centerline of the car.
Camber affects the car's traction.

Initial steps
A Shocks: Connect front and rear shocks.
B Anti-roll bars: Disconnect front and rear anti-roll bars.
C Wheels: If measuring camber using a set-up system, remove the wheels. If measuring camber with the car sitting on a flat surface, mount the wheels.

Set-up apparatus
Measure the camber using Serpents camber gauge #1460.

Note: *You can measure camber using the HUDY Set-Up System (on a flat reference surface), but you may get slightly different camber readings than those from using Serpent camber gauge. The reason is that tires (especially the rear tires) have a tendency to lay flat on the surface. If this happens (that is, if the tires are not pre-coned), the camber readings may differ as much as 0.5° from the reading you would get with the HUDY Set-Up System.*

Measuring camber
Measure the camber using the Serpent camber gauge. Before measuring camber, lift and drop the end of the car (front or rear) a few cm's to let the suspension settle.

A5.1 Setting front camber
Front camber setting = -1.5°
Set the front camber to –1.5° (tops of front wheels leaning inwards).

Adjust front camber by turning the front upper pivotball in or out. To get more negative camber, turn the front upper pivotball IN. To get less negative camber, turn the front upper pivotball OUT.

A5.2 Setting rear camber
Rear camber setting = -3.0°
Set the rear camber to –3.0° (tops of rear wheels leaning inwards).

Adjust rear camber by turning the rear upper pivotball in or out. To get more negative camber, turn the rear upper pivotball IN. To get less negative camber, turn the rear upper pivotball OUT.

STOP!
After you set the camber, recheck the ride height settings. Camber and ride height settings affect each other, so be sure to check each one when you adjust the other.

A6. CASTER

Caster is the angle of an imaginary line between the top pivotball and the bottom pivotball of the front steering block, with respect to a line perpendicular to the ground.

Initial steps
None

Set-up apparatus
None

A6.1 Setting front caster
Set the front caster gap to 3mm (2+1mm spacers in front of the upper wishbone, 4mm spacer behind).

A7. TOE

Toe is the angle of the wheels when looked at from above the car.

When the wheels are parallel with the centerline of the car, toe is 0°. When the wheels are open towards the front, this is called toe-out (negative value). When the wheels are closed towards the front, this is called toe-in (positive value).

Initial steps
A Shocks: Connect the front and rear shocks.
B Wheels: Mount all 4 wheels on the car.

Set-up apparatus
Place the car flat on the rear shock tower and measure the rear toe using Serpents camber gauge #1460.

A7.1 Setting front toe
Front toe setting = -1.0° (toe-out)
Set the front toe to -1.0° (fronts of front wheels pointing slightly outwards).

Adjust front toe using the track-rods that connect the servo-saver to the steering blocks. Make the track-rods LONGER to give more toe-in (less toe-out). Make the track-rods SHORTER to give less toe-in (more toe-out).

A7.2 Setting rear toe
Rear toe setting = +2.0° (toe-in)
Set the rear toe to +2.0° (fronts of rear wheels pointing inwards).

Adjust rear toe using the rear lower pivotballs. To get more rear toe-in, turn IN the front lower pivotball and turn OUT the rear lower pivotball equally. To get less rear toe-in, turn OUT the front lower pivotball and turn IN the rear lower pivotball equally.

Make sure you adjust the pivotballs equally (in opposite directions) or you will change the wheel's camber.

A8. ANTI-ROLL BARS

Anti-roll bars are used to adjust the car's side traction and alter chassis roll.

Initial steps
A Anti-roll bars: Connect the front and rear anti-roll bars.

Set-up apparatus
None

A8.1 Setting the front anti-roll bar
Front anti-roll bar setting = horizontal (softest)
Set the front anti-roll bar to the horizontal (softest) position.

Adjust the front anti-roll bar by turning both blades to an equal angle. When the flat of the blade is horizontal, this is the softest position. When the flat of the blade is vertical, this is the stiffest position.

A8.2 Setting the rear anti-roll bar
Rear anti-roll bar linkage lower mounting position = outer hole
Attach each rear anti-roll bar linkage to the outer mounting hole on the rear lower arm.

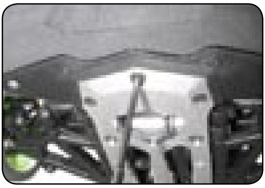
A9. SUSPENSION TWEAK

A "tweaked" car is an unbalanced car, and has a tendency to pull to one side under acceleration or braking. Tweak is caused by an uneven wheel-load on one particular axle. You should check for suspension tweak after you have set up the suspension settings.

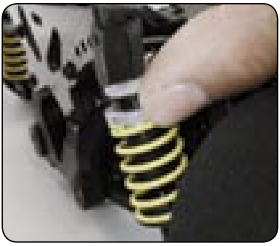
Initial steps
A Shocks: Connect the front and rear shocks.
B Anti-roll bars: Disconnect the front and rear anti-roll bars.
C Wheels/Tires: Mount a set of wheels/tires. Ensure that each set of tires is the same size left and right.

Set-up apparatus
Measure tweak with the car sitting on a flat reference surface (such as a HUDY setup board).

Check for tweak from the front of the car
A9.1 Lift and drop the front end of the car a few cm's to let the suspension settle. Place a sharp tool underneath the chassis at its middle point, and lift the front end. If one front wheel lifts before the other, the rear of the car is tweaked.



A9.2 Adjust the preload on the rear springs until both front wheels lift at the same time.

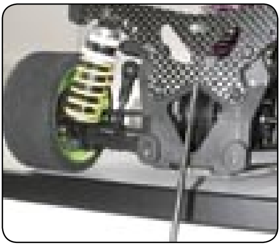


Increase the preload on the rear wheel diagonally across from the front wheel that lifts earlier, and decrease the preload on the rear wheel diagonally across from the front wheel that lifts last. Adjust both rear springs equally but in opposite amounts, otherwise you will change the rear ride height.

Example: If the front right wheel lifts earlier, increase the preload on the rear left spring, and decrease the preload on the rear right spring.

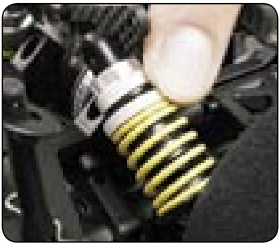
A9.3 Reconnect the rear anti-roll bar, and check for tweak again by lifting the front end of the car.

For example, if one front wheel lifts before the other, the rear anti-roll bar is tweaked. Adjust the length of one or both rear anti-roll bar pushrods until both front wheels lift at the same time.



Check for tweak from the rear of the car

A9.4 Lift and drop the rear end of the car a few cm's to let the suspension settle. Place a sharp tool underneath the chassis at its middle point, and lift the rear end. If one rear wheel lifts before the other, the front of the car is tweaked.



A9.5 Adjust the preload on the front springs until both rear wheels lift at the same time.

Increase the preload on the front wheel diagonally across from the rear wheel that lifts earlier, and decrease the preload on the front wheel diagonally across from the rear wheel that lifts last. Adjust both front springs equally but in opposite amounts, otherwise you will change the front ride height.

Example: If the rear right wheel lifts earlier, increase the preload on the front left spring, and decrease the preload on the front right spring.

A9.6 Reconnect the front anti-roll bar, and check for tweak again by lifting the rear end of the car.
For example, if one rear wheel lifts before the other, the front anti-roll

bar is tweaked. Loosen the screw on the left front anti-roll bar mount. Adjust the eccentric cam until both rear wheels lift from the ground at the same time. Tighten the screw to secure the adjusting cam.

A10. REAR DIFFERENTIAL

The rear differential can be used to fine-tune the rear traction of the 710. A looser rear diff gives more rear traction, while a tighter rear diff gives less rear traction. You can also adjust the slippage (preload) of the rear diff pulley.

Set the initial diff preload before installing the rear differential in the car. For more information, see Section 2.0: Differential Assembly in the 710 Instruction Manual.

Initial steps
None

Set-up apparatus
None

A10.1 Setting differential preload
Check the diff preload setting periodically by placing the car on the track, and blocking the front of the car with your foot while opening the throttle. The diff pulley should not slip at all. If the pulley slips, you need to tighten the diff preload to prevent slippage.

To tighten the diff preload, disassemble the rear suspension until the two drive shafts can be removed. Undo the locking setscrew, tighten the diff preload screw, and then tighten the locking setscrew again. Reassemble the rear suspension and check the diff preload setting.

A10.2 Setting differential action
Adjust the diff friction collar to adjust the differential action. Tighten the adjustment screw to increase the spin-resistance of the differential; loosen the adjustment screw to reduce the spin-resistance of the differential. The tighter the diff collar, the more the differential resists the difference in speed between the inner and outer wheel. Generally, the more grip a track has, the tighter the diff collar should be.

SECTION B - ADVANCED SETUP

This section describes the effects of changing settings on your Serpent 710.

Car setup is a complex matter, as all adjustments interact. Fine-tuning the setup will make the car faster and often easier to drive near its performance limit. This means that all the effort you put into your car in preparing it and optimizing the setup will pay off in better results and more satisfaction. The 710 was designed to have a large 'sweet spot' meaning that the car will still be very easy to drive even if the setup is not exactly 'spot on.' Changing the setup of your 710 in one particular area will not make a dramatic negative change in the behavior of the car.

Chassis stiffness (especially torsional) is an important factor when setting up your 710. A stiff chassis helps to eliminate chassis flexing and twisting, which would otherwise introduce another factor that is not easy to measure or adjust. The 710 is equipped with side stiffeners around the engine section to reinforce chassis stiffness.

If you choose to adjust the settings to better suit different track conditions, make small adjustments, one at a time, and see if you find any improvement in handling with each adjustment. We advise you to keep track of your setup changes, and record which setups work best at different racetracks under various conditions.

Remember that for the car to work and respond to setup changes properly, it must be in good mechanical shape. Check the well functioning of critical areas such as the free movement of the suspension, smoothness of shock absorbers, and lubrication and wear of transmission parts after each run, and especially after a crash.

After rebuilding the chassis, or in case you become lost with your setup, always return to the setup described in Section A: Basic Setup.

In Advanced Setup we refer to handling effects of the car in the corner. We distinguish three corner sections and three throttle/brake positions as follows:

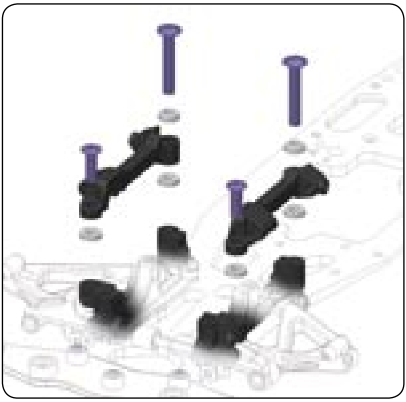
- corner entry
- mid-corner
- corner exit

- braking
- off-throttle
- on-throttle

B1. ROLL CENTER

A "roll center" is a theoretical point around which the chassis rolls, and is determined by the design of the suspension. Front and rear suspensions normally have different roll centers. The "roll axis" is the imaginary line between the front and rear roll centers. The amount that a chassis rolls in a corner depends on the position of the roll axis relative to the car's center of gravity (CG). The closer the roll axis is to the center of gravity (i.e., a higher roll center or a lower center of gravity), the less the chassis will roll and the less camber change there will be as a result of chassis roll. A lower roll center will generally produce more grip.

Roll-centers have an immediate effect on a car's handling, whereas anti-roll bars, shocks and springs require the car to roll before they produce an effect.



Front Roll Center
Front roll center has most effect on on-throttle steering during mid-corner and corner exit.

Lowered front roll center (raising the upper arm mounts - flattening the arms)

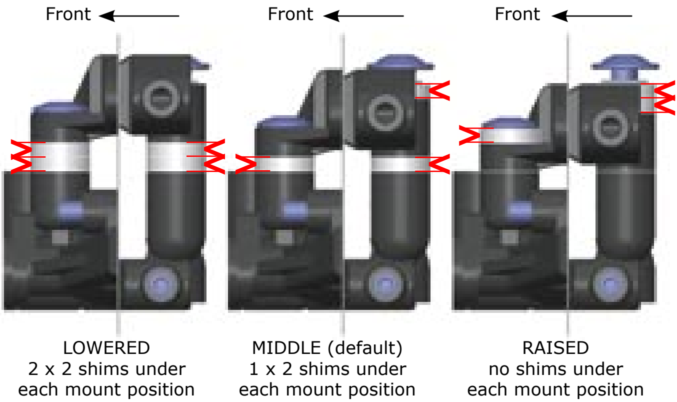
- more on-throttle steering
- car is less responsive
- better on smooth, high grip tracks with long fast corners

Raised front roll center (lowering the upper arm mounts - angling the arms)

- less on-throttle steering
- car is more responsive
- use in high grip conditions to avoid traction rolling
- use on tracks with quick direction changes (chicanes)

Adjust the front roll center by changing the location of the shims under and above the front upper arm mounts. To lower the front roll center, put shims under the upper arm mount. To raise the front roll center, remove shims from under the upper arm mount. Default (middle) position is one 2mm shim under each mount position.

There are three front roll center positions: lowered - middle - raised.



Rear Roll Center

Rear roll center affects on- and off-throttle situations in all cornering stages.

Lowering rear roll center

- more on-throttle grip
- less grip under braking
- use to avoid traction rolling at corner entry (increases rear grip)
- use under low traction conditions
- increases traction, reduces rear tire wear

Raising rear roll center

- use to avoid traction rolling mid-corner and corner exit
- reduces rear traction

Upper Arm Length	***Longer upper arm***			
Effect on Roll Center	***Lower*** →			***Higher***
Upper Insert position	UTI	UBI	UTI	UBI
Lower Insert position	LB	LB	LT	LT

Upper Arm Length	***Shorter upper arm***			
Effect on Roll Center	***Lower*** →			***Higher***
Upper Insert position	UTO	UBO	UTO	UBO
Lower Insert position	LB	LB	LT	LT

U = Upper Insert, L = Lower Insert,
T = Top, B = Bottom, O = Outer, I = Inner

Adjust the rear roll center by changing the orientation of the rear pivot pin inserts. Note that when setting the upper inserts to positions UTO and UBO, you have to shorten the upper arms by turning in the upper pivot ball; this gives more camber change under suspension compression and chassis roll.

IMPORTANT! Changing roll-center settings impacts camber and downstop settings. When changing the lower rear roll center inserts please note that the default setting of the rear toe-in linkage also changes. See page 25 for further details.

B2. DOWNSTOPS

Downstops limit how far the suspension arms travel downward, which determines how far upwards the chassis rises. This affects the car's handling, as it directly impacts the weight transfer of the chassis. The effect may change with the type of track and/or amount of grip available.

In general, more suspension travel (lower downstop value) makes the car more responsive but less stable; it is also typically better on a bumpy track or on a track with slow corners. Less suspension travel (higher downstop value) makes the car more stable; it is typically better on a smooth track.

Reduced downstops (higher downstop value)

- decreases upward chassis travel
- car more stable under braking
- better on smooth tracks

Increased downstops (lower downstop value)

- increases upward chassis travel
- car more responsive but less stable
- better on bumpy tracks

IMPORTANT! Adjust the downstops so the left and right sides are equal.

B3. SHOCK ABSORBERS

Shock absorbers are a key component to setting up your 710. There are various aspects of shock absorbers that can be adjusted: spring choice, spring preload, shock position & orientation, and damping.

Springs

The shock springs support the weight of the car, and different spring tensions determine how much of the car's weight is transferred to the wheel relative to the other shocks. Spring tension also influences the speed at which a shock rebounds after compression.

Spring selection depends on whether the track is fast or slow, or has high or low grip.

- *Stiffer springs:* Makes the car more responsive. The car reacts faster to steering inputs. Stiff springs are suited for tight, high-traction tracks that aren't too bumpy. Usually when you stiffen all of the springs, you lose a small amount of steering, and reduce chassis roll.

• *Softer springs:* Makes the car feel as if it has a little more traction in low grip conditions. Better for bumpy and very large and open tracks. Springs that are too soft make the car feel sluggish and slow, allowing more chassis roll.

• *Stiffer front springs:* Makes the car more stable, but with less front traction and less steering. It will be harder to get the car to turn, and turning radius increases. The car will have much less steering at corner exit. Very stiff springs are preferred on very high-grip tracks, or if the track itself feels tacky or sticky.

• *Softer front springs:* Makes the car have more steering, especially mid-corner and at corner exit. Front springs that are too soft can make the car oversteer (lose rear grip).

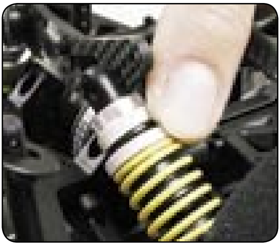
• *Stiffer rear springs:* Makes the car have less rear traction, but more steering mid-corner and at corner exit. This is especially apparent in long, high-speed corners.

• *Softer rear springs:* Makes the car have more rear side traction mid corner, through bumpy sections, and while accelerating (forward traction).

Serpent Spring Tensions

Softest → ***Hardest***

ORANGE	***WHITE***	***YELLOW***	***RED***	***BLUE***
Soft ***(#909414)***	***Med-soft*** ***(#909415)***	***Medium*** ***(#909416)***	***Med-Hard*** ***(#909417)***	***Hard*** ***(#909418)***



Spring Preload

Spring preload should only be used to alter ride height. For more information, see the setup section for setting ride height.

Adjust the alu. spring collar on the shocks so that the springs are only slightly compressed when the car is fully equipped, ready-to-run. To change the characteristic of the springs, change to a softer or harder spring rather than loosening or tightening the springs as this only changes the ride height.

Hint: File a small notch on the top of each spring collar so you can tell when you have adjusted it one full rotation.

Shock Position

The upper and lower shock mounting positions determine how much leverage the lower suspension arm has on the shock when compressing it, and how progressive the suspension is. Different shock position settings change how the shock reacts to compression.

• *Shocks more inclined:* Makes the spring and damping softer. Makes the car more progressive, giving a smoother feel and more lateral grip (side-bite). When all four shocks are inclined it makes the car very easy to drive, and it feels like the car has more grip, but it is not always fastest.
• *Shocks more vertical:* Makes the spring and damping harder. Makes the car have a more direct feel, but less lateral grip.
• *Front shocks more inclined than rear shocks:* Makes the steering feel very smooth and there will be slightly more mid-corner steering. Mounting the rear shocks very upright can result in the rear feeling unpredictable and more nervous in corners.
• *Rear shocks more inclined than front shocks:* Makes the car feel aggressive turning into a corner, but most of the time the car will have slightly less steering. The car will have abundant lateral grip in the rear, so turning radius won't be very tight.

Shock Damping
Setting the right damping is always a compromise and requires a lot of "hands on" experience.

Damping only comes into play when the suspension is moving (either vertical wheel or chassis movement or due to chassis roll), and loses its effect when the suspension has reached a stable position. When the shock is compressing or decompressing (rebounding), the shock absorber oil resists this movement. How much it resists depends on the thickness of the oil, how much the flow is restricted (affected by the number of holes in the shock piston), and the velocity of the piston. No damping means that the spring rate determines how long it takes for the spring to compress and the suspension to reach a stable position.

Shock Oil

• *Thicker oil:* Slower shock action, more immediate chassis weight transfer from side-to-side or front-to-rear. In general this means that the will respond quicker and is less likely to become unsettled with sharp direction changes such as in chicanes.

• *Thinner oil:* Faster shock action, faster chassis weight transfer. Faster shock action means the suspension can work faster to keep the tire in contact with the surface quicker, resulting in more traction. However, the chassis is more susceptible to chassis roll and becoming unsettled in sharp direction changes such as in chicanes

Thinnest → ***Thickest***

20W	25W	30W	35W	40W	45W	50W
(#1670)	(#1674)	(#1671)	(#1675)	(#1672)	(#1676)	(#1673)

Thicker shock oil usually requires the use of heavier springs to compensate for the heavy damping action. Likewise, thinner oil usually requires lighter springs.

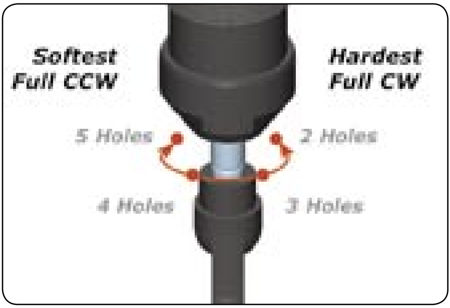
We recommend using only highest-grade Serpent Silicone Shock Oil, which is available in numerous weights. This shock oil is specially formulated to be temperature resistant and low-foaming for use in the special adjustable Serpent shocks. To be able to compare your setup with other racers it is advised to use only Serpent Silicone shock oil.

Damping and Shock Pistons
Shock damping manages the resistance of the shock as the piston moves up and down through the oil in the shock body.

- *Soft damping:* Produces the most grip (both front and rear) through chassis roll, but also decreases cornering speed.
- *Hard damping:* Allows the car to break traction more easily, but with less chassis roll and higher cornering speed.

Shock pistons affect shock damping by affecting how easily the piston travels through the shock oil when the shock is compressing or decompressing (rebounding). The piston has holes through which shock oil flows as the piston travels up and down inside the shock body. The number of holes helps control how quickly the shock compresses or decompresses.

- *Less piston holes open:* Harder damping, reacts like using thicker shock oil.
- *More piston holes open:* Softer damping, reacts like using thinner shock oil.



Serpent shocks can be assembled with non-adjustable or adjustable pistons. The non-adjustable pistons use a 1-piece piston with 2, 3, or 4 holes in it. The Serpent adjustable pistons use a unique 2-piece piston assembly that can be easily adjusted to align 2, 3, 4, or 5 holes.

- *More holes in piston:* More oil can pass through the piston as the piston moves. This means less resistance to shock movement, less damping, and faster shock movement.
- *Fewer holes in piston:* Less oil can pass through the piston as the piston moves. This means more resistance to shock movement, more damping, and slower shock movement.

Damping Adjustment
The Serpent adjustable shocks have four settings (2, 3, 4, or 5 holes aligned), each of which can be felt by a slight "click" when you turn the shock rod.

Disconnect the lower shock mount from the arm. Fully extend the shock rod and turn it slightly to lock the piston in the shock body.

- *Harder setting:* Turn the shock rod CW to align less holes
- *Softer setting:* Turn the shock rod CCW to align more holes

- *Hardest setting:* Turn the shock rod fully CW to align 2 piston holes
- *Softest setting:* Turn the shock rod fully CCW to align 5 piston holes

B4. TRACK-WIDTH

Track-width affects the car's handling and steering response. Front track width can be adjusted between 198—200mm. Rear track width can be adjusted between 196—200mm.

Wider front track-width
- decreases front grip
- increases understeer
- slower steering response
- use to avoid traction rolling

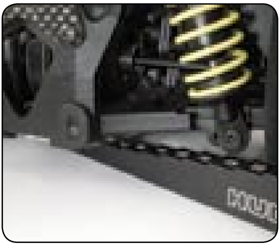
Narrower front track-width
- increases front grip
- decreases understeer
- faster steering response

Wider rear track-width
- increases rear grip
- use if car is traction rolling

Note that track width is normally set to 200mm and not changed for setup reasons

B5. RIDE HEIGHT

Ride height is the height of the chassis in relation to the surface it is sitting on, with the car ready to run. Ride height affects the car's traction since it alters the car's center of gravity and roll center. Because of changes in suspension geometryand ground clearance, there are negative consequences to altering ride height too much.



Measure and adjust ride height with the car ready-to-run but without the body. Use the shock preload collars to raise and lower the ride height.

Decreasing ride height (lowering the car)
- increases overall grip
- better on smooth tracks

Increasing ride height (raising the car)
- reduces overall grip
- better on bumpy tracks (prevents bottoming)

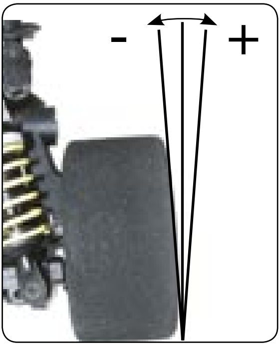
Ride Height and Tires
Ride height is measured with the wheels on the car, and the car ready-to-run. When using rubber tires, your ride height settings should stay consistent, since rubber tires do not wear down appreciably during use, which results in a fairly constant ride height. However, if using foam tires, the car's ride height decreases as the foam tires wear down to smaller diameters.

Tires may wear at different rates front-to-back, and left-to-right, which may eventually result in a car with uneven ride height at all four corners. You should periodically true your foam tires and readjust your settings accordingly.

Ride Height and Suspension Settings
Suspension settings are unaffected by the wheels/tires you put on the car, only the ride height is affected. When you use a set-up system (such as the Hudy Set-Up System) to set your suspension settings, the suspension settings do not change when you put different wheels on the car. With the car sitting on the ground, it may appear that certain settings are different, but this may be due to uneven tires, or tires with different diameters. However, the settings you set using a set-up system are the true suspension settings.

B6. CAMBER

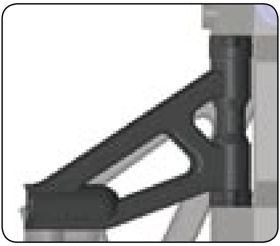
Camber affects the car's traction. Generally more negative (inward) camber means increased grip since the side-traction of the wheel increases.



Adjust front camber so that the front tires wear flat, Adjust rear camber so that the rear tires wear slightly conical to the inside.

The amount of front camber required to maintain the maximum contact patch largely depends on the amount of caster. Higher degrees of caster require little or no camber, while lower degrees of caster require more negative camber.

B7. CASTER



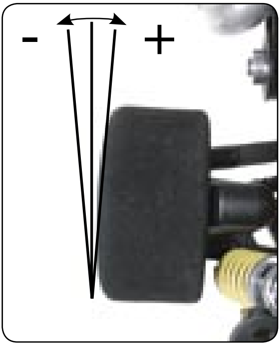
Caster describes the angle of the front steering block with respect to a line perpendicular to the ground. Caster angle affects on- and off-power steering, as it tilts the chassis more or less depending on how much caster is applied.

Less caster (more vertical)
- less caster spacers in front of front upper wishbone
- decreases straight-line stability

More caster (more inclined)
- more caster spacers in front of front upper wishbone
- increases on-power steering at mid-corner and corner exit
- increases straight-line stability
- makes the car more stable through bumpy track conditions

B8. TOE

Toe is the angle of the wheels when looked at from above the car. When the wheels are parallel with the centerline of the car, toe is 0° (neutral). When the wheels are open towards the front, this is called toe-out (negative value). When the wheels are closed towards the front, this is called toe-in (positive value).



Toe is used to stabalize the car at the expense of traction, as it introduces friction and therefore some slip in the tires.

Front wheels should be set to neutral or toe-out. Rear wheels should have toe-in.

Increasing front toe (more front toe-in)
- makes car easier to drive

Decreasing front toe (more front toe-out)
- decreases understeer
- increases steering at corner entry
- faster steering response
- less stable under acceleration
- makes car more difficult to drive

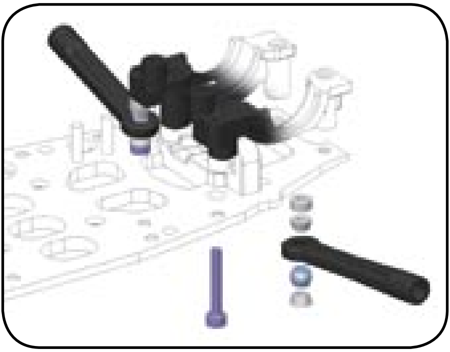
Increasing rear toe (more rear toe-in)
- increases understeer
- more stable exiting on-power at corner exit and braking
- less chance of losing rear traction
- decreases top speed

Decreasing rear toe (less rear toe-in)

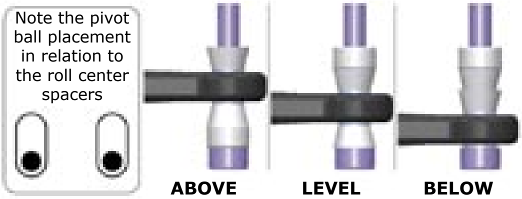
- less stable at on-power corner exit and braking
- more chance of losing rear traction
- increases top speed

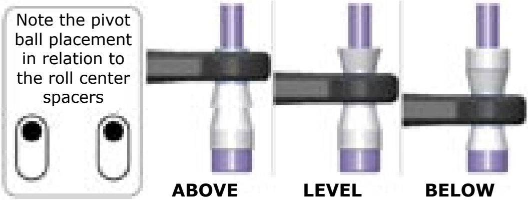
Dynamic Rear Steering

The orientation of the rear toe-in linkage (front part of rear lower wishbone) affects rear toe-in under braking, acceleration and cornering.



Adjust the rear toe-in linkage by changing the position of the thick spacer where the linkage connects to the rear block. This places the inner pivot point of the track-rod arm below, level with, or above the inner pivot point of the fixed rear lower arm.





IMPORTANT! Left and right rear toe-in linkages must be set equally.

Pivot ball ABOVE rear toe-in linkage:

- outside rear wheel toes-out when cornering
- improved high speed steering
- improved braking stability
- less stable under acceleration

Pivot ball LEVEL WITH rear toe-in linkage:

- no dynamic rear toe effect, works like normal suspension

Pivot ball BELOW rear toe-in linkage:

- outside rear wheel toes-in when cornering
- improved traction in slow corners
- less stable under braking

B9. UPSTOPS

Upstops are used to prevent the front of the chassis from bottoming out on the pavement under braking.

Upstop settings are directly impacted by ride height. As the tires wear (foam tires in particular) the ride height decreases, and the front upstop setting must be increased to prevent chassis bottoming.

Higher upstop setting

- more space beneath chassis
- less chance of chassis bottoming under braking
- use with softer shock settings

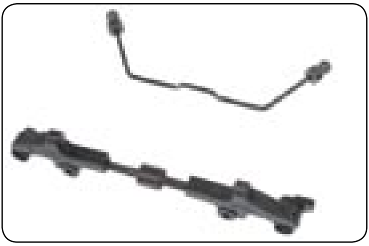
Lower upstop setting

- less space beneath chassis
- more chance of chassis bottoming under braking
- use with stiffer shock settings

IMPORTANT! Upstop screws must be set equally on left and right sides, otherwise the car may suffer from massive tweak under braking.

B10. ANTI-ROLL BARS

Anti-roll bars are used to adjust the car's side (lateral) traction. Anti-roll bars resist chassis roll and by doing so transfer wheel load from the inside wheel to the outside wheel. The stiffer the anti-roll bar, the more load is transferred from the inside wheel to the outside wheel. However, as the outside wheel is not able to convert all the extra wheel load



into extra grip, the sum of the grip of both wheels is actually reduced. This changes the balance of the car to the other axle.

Increasing the stiffness of an anti-roll bar on one particular axle decreases the side traction of that axle and increases the side traction of the other axle.

Keep in mind that the overall traction of a car cannot be changed, but it can be balanced by distributing wheel loads. Anti-roll bars are a very useful tool to change the balance of the car.

Chassis stiffness plays a very important role in the effectiveness of anti-roll bars. A stiffer chassis makes the car more responsive to anti-roll bar changes. For this reason, all Serpent cars use chassis side-plates to bridge the car's front section with the rear section.

Front Anti-Roll Bar

The front anti-roll bar affects mainly off-power steering at corner entry. To make the front anti-roll bar stiffer, rotate the blades to a more vertical position. To make the front anti-roll bar softer, rotate the blades to a more horizontal position.

Stiffer front anti-roll bar (blade more vertical):

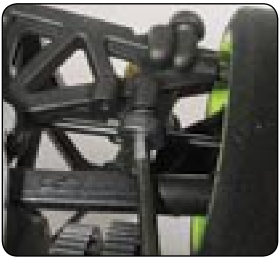
- less chassis roll
- decreases front traction
- increases rear traction
- reduces off-power steering at corner entry (increases understeer)
- quicker steering response

Softer front anti-roll bar (blade more horizontal):

- more chassis roll
- increases front traction
- decreases rear traction
- increases off-power steering (may cause oversteer)

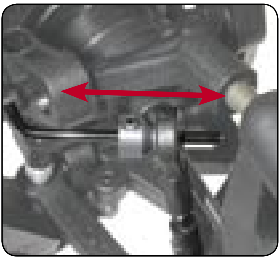
Rear Anti-Roll Bar

The rear anti-roll bar affects mainly on-power steering and stability in mid-corner and at corner exit.



The rear anti-roll bar is adjusted in two ways. There are two positions on the lower arms where the linkages connect; the inside position is the softer setting, and the outside point is the stiffer setting.

Rear anti-roll bar stiffness is also affected by the position of the pivot ball on the anti-roll bar itself. Placing the pivot ball towards the end of the anti-roll bar gives a softer setting.



Stiffer rear anti-roll bar (linkage outer mounting hole):

- less chassis roll
- decreases rear traction
- increases front traction
- increases on-power steering (may cause oversteer)
- quicker steering response in high speed chicanes

Softer rear anti-roll bar (linkage inner mounting hole):

- more chassis roll
- increases rear traction
- decreases front traction
- decreases on-power steering (increases understeer)

B11. FRONT and REAR AXLES

The 710 has several options for front and rear axles. The choice of front and rear axles depends on track conditions. The 710 is designed to quickly change these axles with the least effort.

Front axles

- one-way front axle (standard)
- solid front axle (locked one-way axle)
- adjustable front ball differential (optional)

Rear axles

- adjustable rear ball differential (standard)
- solid rear axle (optional)

You may use any combination of front and rear axles, but some work better together than others

B12. FRONT ONE-WAY AXLE

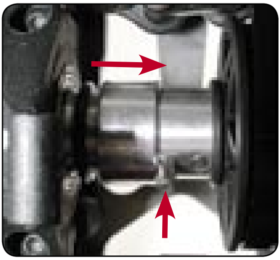
The front one-way axle behaves like a differential off-power at corner entry and in mid-corner, and like a solid front axle on-power at corner exit. It allows the inner and outer wheels to rotate at different speeds under off-power conditions at corner entry and sometimes mid-corner. Under on-power conditions at mid-corner and corner exit, the one-way front axle locks up and acts like a solid front axle, introducing some on-power understeer.

With the front one-way axle there is no braking of the front wheels since the front wheels disengage under braking.

The front one-way axle allows you to use slightly bigger rear tires than front tires, and to have the rear wheels overdrive the front wheels. In that situation, when the rear wheels lose traction the front wheels engage and start helping to generate forward traction.

The front one-way axle can be used with either the adjustable rear differential or the solid rear axle.

B13. SOLID FRONT AXLE (Optional)



The 710 front one-way axle can be very quickly converted into a solid front axle by inserting two steel pins through the front axle and both drive adapters. An alu. bushing holds the pins in place.

The biggest advantage of the solid front axle is that the car brakes using all four wheels, allowing for much later braking than with rear wheel brakes only (when using a front one-way axle). This may require you to adapt your driving style. Using the solid front axle can be beneficial in low-grip conditions and especially wet or damp conditions. The drawbacks to using a front solid axle are less off-power steering, and the car becomes more sensitive to tire diameter differences. Overall, using the solid front axle makes the car quite easy to drive.

The solid front axle is used mostly used with the adjustable rear differential.

B14. FRONT BALL DIFFERENTIAL (Optional)

Differentials allow the wheels at opposite ends of the same axle to rotate at different speeds. Why is this important? When a car turns in a circle, the outer wheel has a larger diameter circle to follow than the inner wheel, so it needs to rotate faster to keep up. If the differential is too tight, the result is that the wheels “fight” each other for the proper rotation speed; the result is a loss of traction. Generally, the more grip a track has, the tighter the diff action should be.

For optimal performance, when building the ball differential, without the diff friction collar applied the diff should be as free as possible, of course with no (minimal) slippage on the balls. Use the diff friction collar to adjust the amount of friction you want. Make sure the diff does not slip under power; this causes power loss and excessive wear of the diff.

The front differential shares the same design as the rear differential, and can be adjusted externally with a single screw. This enables very quick changes to the steering characteristic and overall behavior of the car.

Using the front differential combines some of the braking advantages of the solid front axle while allowing inner-outer wheel speed difference. The last adjustment depends on how much friction is applied on the diff friction collar.

Adjust the diff friction collar to adjust the differential action. Tighten the adjustment screw to tighten the diff; loosen the adjustment screw to loosen the diff.

The front differential is most commonly used in low grip conditions. It can improve on-power corner entry as well as braking.

The front differential is most commonly used with the rear differential.

Tighter front diff action

- Less Steering
- More stable under braking but less turn in
- Better on power out of a corner

Looser front diff action

- More Steering
- Less stable under braking but better turn in
- Understeer on power out of the corner

B15. REAR DIFFERENTIAL

The rear differential shares the same design as the front differential. It is designed to allow separate adjustment of pulley slip and differential action. The differential action is easily adjusted with a single external screw.

Adjust the diff friction collar to adjust the differential action. Tighten the adjustment screw to tighten the diff; loosen the adjustment screw to loosen the diff.

Tighter rear diff action

- car understeers slightly at corner entry, but makes the car more difficult to control at corner exit (powerslides)
- increased on-throttle steering
- better on high-traction surfaces

Looser rear diff action

- more stability mid corner and corner exit
- understeer on-throttle
- better on low-traction surfaces

The rear differential can be combined with all front axle types. The advantage of the rear differential is that you can quickly adjust it to adapt your 710 to track conditions, using a single screw. Drawbacks of the rear differential are that the weight and inertia are considerably higher than the solid axle, and more maintenance is required.

B16. REAR SOLID AXLE (Optional)

The solid rear axle is typically used when track grip is very high. It is most commonly used with the front one-way axle.

QUICK REFERENCE

The Quick Reference table is a simple to use setup guide. With the car's handling characteristics listed on the left of the table the suggestions for solutions are presented in order of importance and also shows whether the adjustment should be a positive or negative change.

HOW TO USE

Identify the problem
After driving your car and getting a feel for how it's handling bring it in and decide where you feel the car could improve.

Using the table
The table is separated into 5 main areas that represent the cars main handling characteristics. Understeer, Oversteer and traction roll are further separated to identify exactly where the problem occurs and even further still to know if it is occurring On or Off throttle.

Pinpoint the Solution
• Select a characteristic that best describes your cars handling problem (for example oversteer).

• Then identify in which stage of the corners that the oversteer is occuring (for example corner entry).

• Further identify the problem by figuring out the throttle setting when the problem occurs (for example, on or off throttle).

• The number corresponds to the adjustment that will have the most benefit (lower numbers should be tackled first). In this case we are recommended to try Tires and/or the Anti-Roll bars (front & rear).

• The table then tells you what adjustment to make and whether the adjustment is to be made on the front or the rear of the car. As you can see the Tires fall under the Front section whilst the anti-roll bars fall under both the Front and Rear section.

• The colour of the box represents whether it is a positive or negative change to the selected area of adjustment. The tires are Red (a positive change) so we need to make them harder. The front anti-roll bar is Red (a positive change), so we should make it stiffer, whilst the rear anti-roll bar is Green (a negative change) so we need to make it softer.

Testing the solution
It is recommended that you try one adjustment at a time and test the new setting. If it has not had the expected result you can either try the rest of the changes or increase the amount of change. If you feel you would like to try something different simply move on to the next level of possible adjustments.

Note that setup is always a compromise and changing one setting affects the handling of another part of the car. It is therefore important to only make small changes at a time.

Key Guide

- (Red) Harder / Increase / Higher / Lengthen / Do not Use
- (Green) Softer / Decrease / Lower / Shorten / Use
- **1** Order of importance

				FRONT														REAR													
		Off-Throttle	On-Throttle	Downstops	Camber	Caster	Ride Height	Toe-out	Roll Center	Anti-Roll bar	Tires	Shock Springs	Shock Damping	Shock Position	One-way Front axle	Locked Front axle	Front Differential	Downstops	Camber	Ride Height	Toe-in	Dynamic rear steering	Roll Center	Anti-roll bar	Tires	Shock Springs	Shock Damping	Shock Position	Rear Differential	Solid Rear axle	Gurney strip
How to get rid of **UNDERSTEER**	**Corner Entry**	■		5	6	4	5	5	3	1	1	3	3	4	5	5	6	3	6	5	2	3	2	1	3	3	3	4	4	3	3
			■	2	6	3	5	8	2	1	3	4	3	4	5	5	6	7	5	5	2	3	2	1	1	3	3	4	4	3	3
	Mid Corner	■		5	6	4	5	8	3	1	1	3	5	4	5	5	6	7	6	5	2	3	2	1	3	3	5	4	4	5	3
			■	2	6	3	5	8	2	1	3	4	5	4	5	5	6	8	5	5	2	3	2	1	1	3	5	4	4	3	3
	Corner Exit		■	2	6	3	5	7	2	1	3	4	3	4	5	5	6	8	5	5	1	3	2	1	1	4	2	3	4	3	3
	Braking	■		6	6	4	5	7	4	2	4	4	5	4	3	3	4	3	4	5	1	3	2	1	1	3	3	3			3
How to get rid of **OVERSTEER**	**Corner Entry**	■		5	6	4	5	5	3	1	1	3	3	4	5	5	6	3	6	5	2	3	2	1	3	3	3	4	4	3	3
			■	2	6	3	5	8	2	1	3	4	3	4	5	5	6	7	5	5	2	3	2	1	1	3	3	4	4	3	3
	Mid Corner	■		5	6	4	5	8	3	1	1	3	5	4	5	5	6	7	6	5	2	3	2	1	3	3	5	4	4	5	3
			■	2	6	3	5	8	2	1	3	4	5	4	5	5	6	8	5	5	2	3	2	1	1	3	5	4	4	3	3
	Corner Exit		■	2	6	3	5	7	2	1	3	4	3	4	5	5	6	8	5	5	1	3	2	1	1	4	2	3	4	3	3
	Braking	■		6	6	4	5	7	4	2	4	4	5	4	3	3	4	3	4	5	1	3	2	1	1	3	3	3			3
How to get rid of **TRACTION ROLL**	**Corner Entry**	■			8	2	1		2	1	1	2	3	4	4	4	5	3	6	1	2	3	2	1	1	3	4	5	2	2	3
			■	6	8	2	1		2	1	1	3	4	5	4	4	5	5	6	1	2	3	2	1	1	2	3	4	2	2	3
	Mid Corner		■	6	8	2	1		2	1	1	2	5	5	4	4	5	5	6	1	2	3	2	1	1	2	5	5	5	5	3
	Corner Exit		■	6	8	2	1		2	1	1	3	4	5	4	4	5		6	1	2	3	2	1	1	2	3	4	2	2	3
	Braking	■			8	2	1		2	1	1	2	3	4	4	4	5	3	6	1	2	3	2	1	1	3	4	5	2	2	3
STRAIGHT LINE STABILITY To make Better				7	5	3	7	4	7	5	3	8	4	8	8	8	8		5	6	1		7	7	3	8	4	8	6	6	2
STEERING RESPONSE To make Faster					6	4	4	5	1	2	4	2	1	4						4	7		2	3	4	4	3	4			4

DEFAULT SETUP SHEET

Suspension Geometry Front

Downstops	0mm
Set-up ride height	6mm
Camber Left	-1.5
Camber Right	-1.5
Track-Width	200mm
Toe-in	-1.0
Caster setting (mm in front)	3mm
Roll center (mm below below pivot point)	2mm
Upstop	2mm

Suspension Geometry Rear

Downstops	7mm
Set-up ride height	6mm
Camber Left	-3.0
Camber Right	-3.0
Track-Width	200mm
Toe-in	+2.0
Roll center position upper	Bottom inner
Roll center position lower	Bottom
DRS arm position	Level

Shock Absorbers Front

Springs	Yellow
Oil	30W
Holes	3
Cylinder type	Composite
Shock tower position	2nd

Shock Absorbers Rear

Springs	Yellow
Oil	30W
Holes	3
Cylinder type	Composite
Shock tower position	1st
Wishbone mounting position	Outside

Anti-roll bar front

Thickness	N/A
Position	Flat

Anti-roll bar rear

Thickness	N/A
Position of top pivot point (mm from end of bar)	0mm
Position on lower arm	Outside

Tires Front

Make	Ellegi
Hardness Left	40°
Hardness Right	40°
Diameter	62mm

Tires Rear

Make	Ellegi
Hardness Left	40°
Hardness Right	40°
Diameter	62mm

Transmission

Pinion 1st	17T
Pinion 2nd	22T
Gear 1st	60T
Gear 2nd	56T
Pulley rear axle	45T
Pulley layshaft middle	24T
Pulley layshaft side	22T
Pulley middle shaft side	22T
Pulley middle shaft center	19T
Pulley front axle	35T

Front axle

Type	One-way

Rear axle

Type	Ball Differential
Diff setting	Medium

Aerodynamics

Body	Volvo
Wing	#170103
Gurney strip	1mm

Engine and pipe

Engine	NovaMega
Version	#2106
Head shims	0.3mm
Glowplug	6TF
Pipe	#2171
Header	#2174
Length	N/A
Fuel	N/A

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PERFORMANCE THROUGH EVOLUTION

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