

SERPENT *seven20* 720

1/10TH SCALE 4WD COMPETITION CAR



SETUP BOOK

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INTRODUCTION

Setting up a racecar with fully independent suspension, like your Serpent 720, 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 Serpent 720.
- Section B: Advanced Setup - describes the effects of setup changes.

Setup Order

We have determined that you should set up your Serpent 720 in the order indicated in the table below. The order of the settings has been determined as the most logical to set up your Serpent 720 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 settings.

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

- (+) *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 downstops:

- Detach the shocks.
- Detach the anti-roll bars.
- Remove the wheels.
- Use a setup system (downstop blocks & gauge)
- Use a flat board.

SECTION A - BASIC SETUP

Section A: Basic Setup describes the default settings for the Serpent 720 and how to adjust those settings. 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 suspension arms travel downward (which determines how far upward the chassis travels). Make sure you adjust downstops so they are equal on both left and right sides of the car.

Initial Steps

A. Shocks: It is not absolutely necessary to remove the shocks, however you must be sure 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. Also ensure that there is not an excessive amount of preload on the shocks, or the downstop values may appear to be lower than actual.

B. Front anti-roll bar: Loosen the setscrew from the front anti-roll bar mounts and push the blades apart so they are not engaged.

C. Rear anti-roll bar: Disconnect one ball-joint from the rear anti-roll bar.

D. Wheels: Remove the wheels from the car.

Setup Apparatus

Check downstops using a downstop measuring set and flat reference surface such as those offered by HUDY.

A1.1 MEASURING DOWNSTOPS

Using the measuring gauge, measure the distance from the reference surface to the bottoms of the front steering blocks / rear hubs.



- Positive numbers on the gauge indicate the distance (in mm) **ABOVE** the top level of the elevating blocks (or, above the bottom of the chassis).
- Negative numbers on the gauge indicate the distance (in mm) **BELOW** the top level of the elevating blocks (or, below the bottom of the chassis).

A1.2 SETTING FRONT DOWNSTOPS

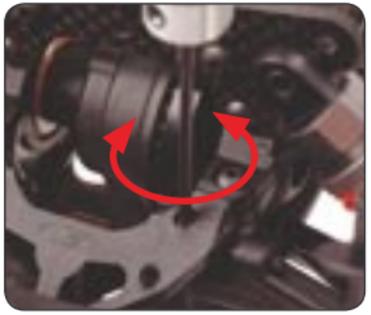
Front Downstop Default Setting = +1mm

Set the front downstops so the bottoms of the steering blocks are at +1mm on the gauge.

(Actual measurement = 1mm above top level of elevating blocks, or 1mm above the bottom of the chassis).

Adjust front downstops by turning the front downstop setscrews into or out of the front bulkheads.

- To **increase** the front downstop value, **turn IN** (CW) the front downstop setscrews **INTO** the front bulkhead.
- To **decrease** the front downstop value, **turn OUT** (CCW) the front downstop setscrews **OUT OF** the front bulkhead.



IMPORTANT!

Make sure you adjust front downstops so they are equal on both left and right sides.



A1.3 SETTING REAR DOWNSTOPS

Rear Downstop Default Setting = 7mm

Set the rear downstop screws so the bottoms of the rear hubs are at +7mm on the gauge. (Actual measurement = 7mm above top level of elevating blocks, or 7mm above the bottom of the chassis).

Adjust rear downstops by turning the rear downstop setscrews in or out of the rear lower arms.

- To **increase** the rear downstop value, **turn IN** (CW) the rear downstop setscrews so they protrude more below the arms.
- To **decrease** the rear downstop value, **turn OUT** (CCW) the rear downstop setscrews so they protrude less below the arms.

IMPORTANT!

Make sure you adjust rear downstops so they are equal on both left and right sides.

A2. SHOCK ABSORBERS

Shock absorbers, or shocks, are the suspension components that allow the wheels to keep as much contact as possible with the track surface. The Serpent 720 has fully-independent front and rear suspension, meaning that the suspension at each corner of the car (front left, front right, rear left, rear right) moves and may be adjusted independently of the others. As such, there is a shock absorber at each corner of the car.

Damping, mounting position, spring tension, and spring preload are all characteristics that determine how the shock performs. The shock absorbers on the 720 must be disassembled to change the shock oil and pistons in order to alter the damping.

Initial Steps

A. Shocks: To adjust shock damping, remove the shocks from the car by unscrewing the upper and lower shock pivotballs. You do not need to disconnect the shocks to adjust spring preload (for ride height adjustment).

Setup Apparatus

None

A2.1 ADJUSTING SHOCK ABSORBER DAMPING

Front and Rear Default Shock Oil = 35W

To adjust shock absorber damping, disassemble the shocks and change the pistons or shock oil.

- To get **softer** damping, use a piston with **more holes** or use **thinner shock oil**.
- To get **harder** damping, use a piston with **less holes** or use **thicker shock oil**.

IMPORTANT!

After reassembling the shocks, make sure you bleed the shock properly.

A2.2 SETTING THE FRONT SHOCK ABSORBERS – UPPER MOUNTING POSITION

Front Shock Default Upper Mounting Position = 2ND LOWEST HOLE

Attach the front shock upper pivotball to the **2nd lowest hole** on the front shock tower.



A2.3 SETTING THE FRONT SHOCK ABSORBERS – LOWER MOUNTING POSITION

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

A2.4 SETTING THE REAR SHOCK ABSORBERS – UPPER MOUNTING POSITION

Rear Shock Default Upper Mounting Position = 2ND LOWEST HOLE

Attach the rear shock upper pivotball to the **2nd lowest hole** on the rear shock tower.



A2.5 SETTING THE REAR SHOCK ABSORBERS – LOWER MOUNTING POSITION

There is only one shock mounting position 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 and rear track-width is adjusted symmetrically, meaning that the left and right wheels (at one end of the car) 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.



Setup Apparatus

Measure track-width with the car resting on a flat measuring surface, such as the HUDY Flat Setup Board which has graduated markings to measure track-width.

A3.1 MEASURING TRACK-WIDTH

Measure front track-width on the outside edges of the front wheels.
Measure rear track-width on the outside edges of the rear wheels.

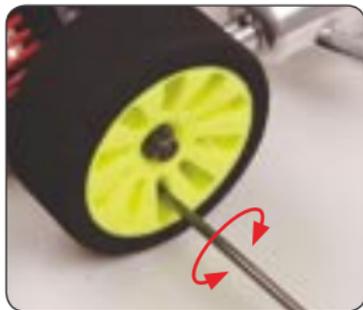
A3.2 SETTING FRONT TRACK-WIDTH

Front Track-width Default Setting = 199mm

Set the front track-width to **199mm**.
(The outer edge of each front wheel should be 99.5mm from the centerline of the chassis.)

Adjust front track-width using the pivotballs in the front steering blocks:

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



IMPORTANT!

Make equal adjustments on both left and right sides. Track-width must be symmetrical on both left and right sides of the car.

Changing front track-width will also affect the front toe setting.

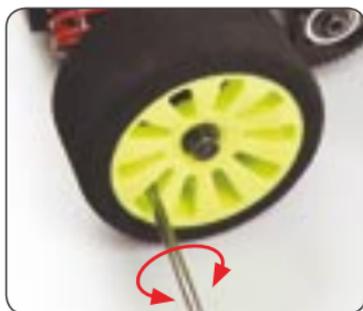
A3.3 SETTING REAR TRACK-WIDTH

Rear Track-width Default 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.)

Adjust rear track-width with the two lower pivotballs in the rear uprights, and also the rear upper camber link.

- To **increase** rear track-width, **turn OUT** both pivotballs equally, and lengthen the camber link.
- To **decrease** rear track-width, **turn IN** both pivotballs equally, and shorten the camber link.



IMPORTANT!

Make equal adjustments on both left and right sides. Track-width must be symmetrical on both left and right sides of the car.

A4. RIDE HEIGHT

Ride height is the distance between the bottom of the chassis and the reference surface on which the car is resting. 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 / 63mm rear.



Setup Apparatus

Measure ride height with the car resting on a flat reference surface (such as a Flat Setup Board offered by HUDY).

A4.1 MEASURING RIDE HEIGHT

Measure the ride height from the very end points at the front and rear of the car, using calipers or a ride height gauge (such as those offered by HUDY).

IMPORTANT!

Make equal adjustments on both left and right sides of the car.

A4.2 SETTING FRONT RIDE HEIGHT

Front Ride Height Default Setting = 6mm

Adjust front ride height by increasing or decreasing the preload on the front shock springs.

- **Increase** front ride height by **tightening** the spring preload collars on the front shocks (increasing the preload). This moves the collars **DOWN** the shock bodies.
- **Decrease** front ride height by **loosening** the spring preload collars on the front shocks (decreasing the preload). This moves the collars **UP** the shock bodies.

A4.2 SETTING REAR RIDE HEIGHT

Rear Ride Height Default Setting = 7mm

Adjust rear ride height by increasing or decreasing the preload on the rear shock springs.

- **Increase** rear ride height by **tightening** the spring preload collars on the rear shocks (increasing the preload). This moves the collars **DOWN** the shock bodies.
- **Decrease** rear ride height by **loosening** the spring preload collars on the rear shocks (decreasing the preload). This moves the collars **UP** the shock bodies.

A5. CAMBER

Camber is the angle of a wheel to the surface on which the car is resting (with wheels and shock absorbers mounted) when looked at from the front or rear of the car.

- Zero degrees (0°) of camber means the wheel is perpendicular to the reference surface.
- Negative camber means that the top of the wheel is leaning inward (toward the centerline of the car).

- Positive camber means that the top of the wheel is leaning outward (away from the centerline of the car).

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 setup system, remove the wheels and following the instructions included with the setup system. If measuring camber using a camber gauge, mount the wheels and set the car on a flat reference surface.

Setup Apparatus

Wheels on:

Measure camber using Serpent's Camber Gauge #1460 and a flat reference surface (such as a Flat Setup Board offered by HUDY).

Wheels off:

Measure camber using a setup system and a flat reference surface (such as those offered by HUDY).

There may be differences in measurements depending on whether you measure camber using a camber gauge or a setup system. The reason is that tires (especially the rear tires) have a tendency to lay flat on the reference 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 a setup system.



A5.1 MEASURING CAMBER

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

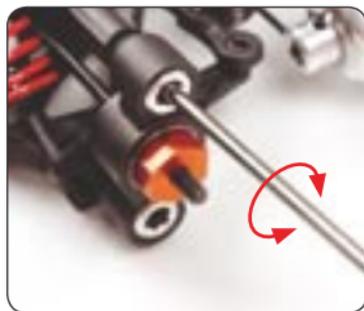
A5.2 SETTING FRONT CAMBER

Front Camber Default Setting = -2°

Set the front camber to -2° (top of front wheel leaning inward).

Adjust front camber using the upper pivotball in the front steering block.

- To get **more negative camber** (more inclined), **turn IN** the front upper pivotball.
- To get **less negative camber** (more upright), **turn OUT** the front upper pivotball.



IMPORTANT!

Make equal adjustments on both left and right sides of the car.

A5.3 SETTING REAR CAMBER

Rear Camber Default Setting = -3.0°

Set the rear camber to -3.0° (top of rear wheel leaning inward).

Adjust rear camber using the upper pivotball in the rear upright.

- To get **more negative camber** (more slanted), **SHORTEN** the rear upper camber link.
- To get **less negative camber** (more upright), **LENGTHEN** the rear upper camber link.



IMPORTANT!

After you set the camber, re-check 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 forward/rearward angle of the front steering block with respect to a line perpendicular to the ground.

Initial Steps

None

Setup Apparatus

None

A6.1 SETTING FRONT CASTER

Front Caster Default Gap = 3mm

(1+2mm spacers in front of upper arm, 4mm spacer behind)

Put the **1+2mm spacers** in front of the front upper arm, and the **4mm spacer** behind the front upper arm.



A7. TOE

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

- Wheels parallel with the centerline of the car have a 0° toe value.
- Wheels that are open toward the front have a negative toe value (toe-out).
- Wheels that are closed toward the front have a positive toe value (toe-in).

Initial Steps

A. Shocks: Connect the front and rear shocks.

B. Wheels: Remove all wheels from the car.

Setup Apparatus

Measure and adjust front and rear toe using a setup system on a flat reference surface (such as those offered by HUDY).

IMPORTANT!

Make equal adjustments on both left and right sides of the car.



A7.1 MEASURING TOE

Measure front and rear toe using the setup system according to the instructions provided with the setup system.

A7.2 SETTING FRONT TOE

Front Toe Default Setting = -1.0° (toe-out)

Adjust the front toe-out value of each front wheel to **-1.0°** (fronts of front wheels pointing outward) by adjusting the lengths of the front steering rods.

- To set **less toe-out**, **LENGTHEN** each steering rod equally.
- To set **more toe-out**, **SHORTEN** each steering rod equally.



A7.3 SETTING REAR TOE

Rear Toe Default Setting = $+3.0^\circ$ (toe-in)

Adjust the rear toe-in value of each rear wheel to **$+3.0^\circ$** (fronts of rear wheels pointing inward) by adjusting the two (2) lower pivotballs in the rear uprights in equal but opposite directions.

- To set **more** rear toe-in, **turn IN** the front lower pivotball, and **turn OUT** the rear lower pivotball.
- To set **less** rear toe-in, **turn OUT** the front lower pivotball, and **turn IN** the rear lower pivotball.



IMPORTANT!

Ensure you adjust the rear lower pivotballs in equal but opposite directions, or you will change the camber setting.

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.

Setup Apparatus

None

A8.1 SETTING THE FRONT ANTI-ROLL BAR

Front Anti-roll Bar Default Setting = HORIZONTAL (softest)

Adjust the front anti-roll bar by turning both blades to an equal angle.

- To set the front anti-roll bar to the **softest** setting, turn the blade so the flat part is **horizontal**.
- To set the front anti-roll bar to the **Stiffest** setting, turn the blade so the flat part is **vertical**.



IMPORTANT!

Ensure that both blades of the front anti-roll bar are set equally.

A8.2 SETTING THE REAR ANTI-ROLL BAR

Rear Anti-roll Bar Default Setting = linkage upper position (end of bar), linkage lower position (inner holes on suspension arms)

Adjust the rear anti-roll bar by moving the linkage upper pivotball on the bar, or moving the linkage lower pivotball to a different position (on suspension arms):

- To set the rear anti-roll bar to a **softer** setting, move the linkage upper pivotball **outward** towards the end of the bar and/or move the linkage lower pivotball to the **inner** hole on the suspension arm.
- To set the rear anti-roll bar to a **stiffer** setting, move the linkage upper pivotball **inward** from the end of the bar, and/or move the linkage lower pivotball to the **outer** hole on the suspension arm.



IMPORTANT!

Make equal adjustments on both sides of the rear anti-roll bar.

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 all other suspension settings.

Initial Steps

A. Shocks: Connect the front and rear shocks.

B. Anti-roll bars: Disconnect the front and rear anti-roll bars (initially).

C. Wheels/Tires: Mount a set of wheels/tires. Ensure that each set of left/right tires is the same size.

Setup Apparatus

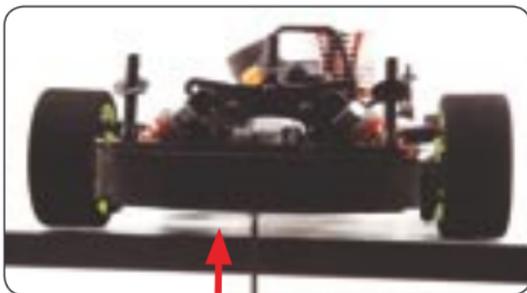
Measure tweak with the car sitting on a flat reference surface (such as a Flat Setup Board offered by HUDY).

CHECKING FOR REAR TWEAK

Determine if the REAR of the car is tweaked by checking at the FRONT of the car.

A9.1 Lift and drop the front end and rear end of the car a few cm's to let the suspension settle.

A9.2 Place a sharp tool underneath the front end of the chassis at its middle point, and lift the front end.
If one front wheel lifts before the other, the rear end of the car is tweaked and may be adjusted by rear spring preload.



A9.3 Adjust the preload on the rear springs until both front wheels lift at the same time.

Increase the preload on the rear spring diagonally across from the front wheel that lifted first, and decrease the preload on the rear spring diagonally across from the front wheel that lifted last. Adjust both rear springs in equal but opposite directions, otherwise you will change the rear ride height.



Example: If the front right wheel lifts first, increase the preload on the rear left spring, and decrease the preload on the rear right spring by an equal but opposite amount.

A9.4 Reconnect the rear anti-roll bar, and check for rear tweak again by lifting the front end of the car.

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.

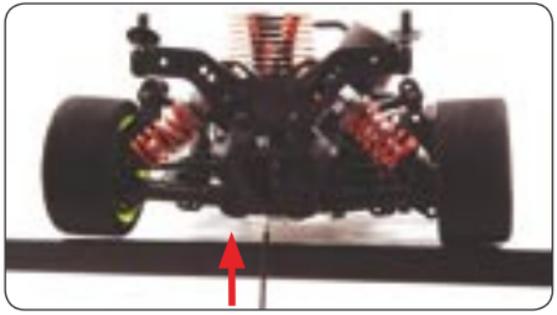


CHECKING FOR FRONT TWEAK

Determine if the FRONT of the car is tweaked by checking at the REAR of the car.

A9.5 Lift and drop the front end and rear end of the car a few cm's to let the suspension settle.

A9.6 Place a sharp tool underneath the rear end of the chassis at its middle point, and lift the rear end. If one rear wheel lifts before the other, the front end of the car is tweaked and may be adjusted by front spring preload.



A9.7 Adjust the preload on the front springs until both rear wheels lift at the same time.

Increase the preload on the front spring diagonally across from the rear wheel that lifted first, and decrease the preload on the front spring diagonally across from the rear wheel that lifted last. Adjust both front springs in equal but opposite directions, otherwise you will change the front ride height.



Example: If the rear right wheel lifts first, increase the preload on the front left spring, and decrease the preload on the front right spring by an equal but opposite amount.

A9.8 Reconnect the front anti-roll bar, and check for front tweak again by lifting the rear end of the car.

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. Re-tighten the screw to secure the adjusting cam.



SECTION B - ADVANCED SETUP

Section B: Advanced Setup describes the effects of changing settings on your Serpent 720.

Throughout this section, 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

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 to prepare it and optimize the setup should give better results and more satisfaction.

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 for 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 collision.

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

TERMINOLOGY

The terms "understeer" and "oversteer" appear throughout this manual. These terms describe a particular handling characteristic of the car.

Understeer

Also known as "push."

A car understeers when the front wheels do not grip enough and the rear tires grip too much. This results in a front end that slides too much rather than turning. A car that understeers is easier to drive, but it is slower than a car that oversteers slightly.

Oversteer

Also known as "loose."

A car oversteers when the front wheels grip too much and the rear tires do not grip enough. This results in a rear end that slides too much. Excessive oversteer causes the rear tires to "break loose" allowing the car to spin out.

WEIGHT TRANSFER

Weight transfer is the key to car handling. Consider that a car has a certain amount of "weight" on various parts of the car and this weight is distributed by a certain amount into each wheel. When the car corners, weight is transferred to the outside tires, when it accelerates weight is transferred to the rear, and when it brakes weight is transferred to the front. By transferring weight to one side of the car (left or right) or one end of the car (front or rear), the tires on that side (or at that end) will be forced onto the racing surface more, resulting in more grip or traction.

The amount of weight transfer is affected by the car's center-of-gravity (CG), the distribution of the weight by the car's setup, and by the way that you drive. Before you start adjusting your car setup to maximize the car's performance and ease of handling, you should ensure that the car is in good mechanical shape with no broken, binding, or loose parts, and that the car has proper weight balance left/right.

WEIGHT BALANCE

You should always try to adjust the weight on your car so it is equal left-to-right; this will help to ensure proper, consistent handling. You can use balancing tools to check the weight distribution of your car, and ensure that your ready-to-race car does not list to one side.

CENTER-OF-GRAVITY (CG)

The center-of-gravity (CG) of the car is the point on the car (in 3-dimensional space) around which the car would be in total balance, if you could support it at that very point. Center-of-gravity is affected by the physical weight of the car, and the placement of all components on the car. If the car is not equally balanced left/right, the car's CG will not be centered. This will cause the car to handle differently when it turns one direction as opposed to the other direction.

Center-of-gravity is also the point at which all centrifugal and other forces of inertia are applied while the car is in motion.

- When the car corners, centrifugal force causes weight to be transferred to the outside wheels.
- When the car accelerates, the force pushes backward on the car's CG causing weight to be transferred to the rear wheels.
- When the car brakes, the force pushes forward on the car's CG causing the weight to be transferred to the front wheels.

It is always best to make the car's CG as low as possible to minimize the negative effects of weight transfer.

WEIGHT TRANSFER AND CAR SETUP

Car setup is always a matter of compromise, and every aspect of car setup affects the way that weight transfers on the car. There is no one magical setup change that will solve all the car's handling problems. Car setup is a complex interaction of the various components that make up the car, and all of these aspects of setup will affect one another.

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. In general, a higher roll center on one end of the car creates more weight transfer at

that end. The amount that a chassis rolls depends on the position of the roll axis relative to the car's center-of-gravity (CG). A lower roll center generally creates more grip due to the reduction in weight transfer. A lower roll center also creates less sideways tire scrub.

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.

ROLL CENTER BASICS

Here are some basic facts about center-of-gravity (CG) and roll center (RC):

- Center-of-gravity (CG) is the point on the car on which all forces are directed.
- Roll center (RC) is the point around which the car rolls.
- Each end of the car (front and rear) has its own roll center.
- RC and CG are (ideally) in the middle (left-right middle) of the car.
- RC is usually below the CG in cars.

ROLL CENTER IN ACTION

When the car is cornering, centrifugal force is applied to the car's CG which pushes the car to the outside of the corner. This causes the CG to rotate around the RC to the outside of the corner. Since the RC is below the CG, this causes the car to roll to the OUTSIDE of the corner.

- When the RC is far away from CG (lower RC), when the car corners the CG has more leverage on the RC, so the car will roll more. In that case, the anti-roll bars and springs would have more effect on the car's handling.
- When the RC is closer to CG (higher RC), when the car corners the CG has less leverage on the RC, so the car will roll less. In that case, the anti-roll bars and springs would have less effect on the car's handling.
- If the RC is in the same position as the CG, when the car corners the CG has no leverage on the RC, so the car would not roll at all. In that case, the anti-roll bars and springs would have no effect on the car's handling.

EFFECTS OF ROLL CENTER ADJUSTMENT

Front Roll Center

(Mostly affects on-throttle steering during mid-corner and corner exit)

Lower

- Increases on-throttle steering
- Decreases car's responsiveness
- Decreases weight transfer at front of car, therefore increases grip
- Increases chassis roll
- Better on smooth, high-traction tracks with long fast corners

Higher

- Decreases on-throttle steering
- Increases car's responsiveness
- Increases weight transfer at front of car, therefore decreases grip
- Decreases chassis roll
- Use in high-grip conditions to avoid traction rolling
- Better on tracks with quick direction changes (chicanes)

Rear Roll Center

(Affects on- and off-throttle situations in all cornering stages)

Lower

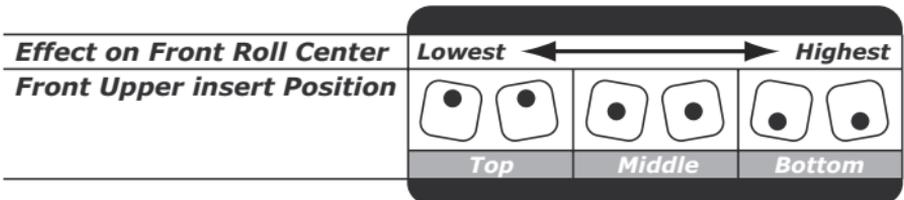
- Increases on-throttle grip
- Decreases weight transfer at rear of car, therefore increases grip
- Increases grip, decreases rear tire wear
- Increases chassis roll
- Use to avoid traction rolling at corner entry (increases rear grip)
- Better on low-traction tracks

Higher

- Decreases on-throttle steering
- Increases weight transfer at front of car, therefore decreases grip
- Increases car's responsiveness
- Decreases chassis roll
- Use in high-grip conditions to avoid traction rolling in mid-corner and corner exit
- Better on tracks with quick direction changes (chicanes)

ADJUSTING FRONT ROLL CENTER

Adjust the front roll center by changing the orientation of the front upper pivot pin inserts.



IMPORTANT!

It is very important that you have the same settings on the left and right sides of the car.

Also, each matched pair of inserts (at ends of a pin) must have the same position.

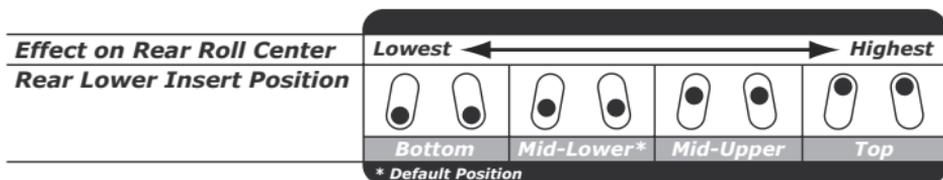
ADJUSTING REAR ROLL CENTER

Rear roll center on the Serpent 720 can be adjusted in two manners:

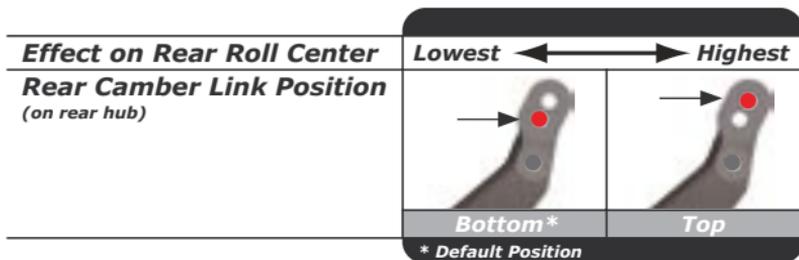
- **LARGE ADJUSTMENTS:** Change the position of the rear lower pivot pin inserts.
- **FINE TUNING:** Change the position of the rear camber link on the rear hub.



LARGE ADJUSTMENTS



FINE TUNING



IMPORTANT!

Changing rear roll center settings impacts several other settings such as downstop and ride height.

After changing rear roll center, re-check your other settings.

IMPORTANT!

It is very important that you have the same settings on the left and right sides of the car.

Also, each matching pair of inserts (at ends of a pin) must have the same position.

B2. DOWNSTOPS



Downstops limit how far the suspension arms travel downward, which determines how far upward the chassis rises. This affects the car's handling (due to effects on camber and roll-center) and the ability of the tires to "follow" the track. The effects may change with the type of track and/or amount of grip available.

More suspension travel (lower downstop value) makes the car more responsive but less stable; it is also typically better on a bumpy tracks or tracks with slow corners. Less suspension travel (higher downstop value) makes the car more stable and is typically better on smoother tracks.

IMPORTANT!

It is very important to have the same downstop settings on the left and right sides of the car.

EFFECTS OF DOWNSTOP ADJUSTMENT

Front Downstops

Higher

- Decreases front chassis upward travel on-throttle
- Increases high-speed steering
- Increases "initial" on-throttle understeer
- Better on smooth tracks

Lower

- Increases upward chassis travel on-throttle
- Decreases high-speed steering
- Decreases "initial" on-throttle understeer
- Better on bumpy tracks

Rear Downstops

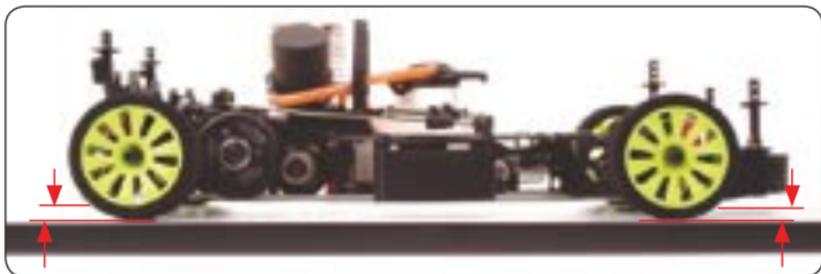
Higher

- Decreases rear chassis upward travel off-throttle or under braking
- Increases stability under braking
- Better on smooth tracks

Lower

- Increases rear chassis upward travel off-throttle or under braking
- Increases steering in slow corners
- Better on bumpy tracks

B3. RIDE HEIGHT



Ride height is the height of the chassis in relation to the surface it is resting on, with the car ready to run. Ride height affects the car's grip since it alters the car's center-of-gravity (CG) and roll center (RC). Because of changes in suspension geometry and 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.

RIDE HEIGHT AND TIRES

The car's ride height decreases as the foam tires wear down to smaller diameters. The foam tires may wear at different rates front-to-back, and left-to-right, which may eventually result in an uneven ride height at all four corners and an incorrect overdrive ratio. You should try to select tire hardness to achieve even tire wear for longer races.

EFFECTS OF RIDE HEIGHT ADJUSTMENT

Lower Ride Height

- Increases overall grip
- Better on smooth tracks

Higher Ride Height

- Decreases overall grip
- Better on bumpy tracks (prevents bottoming)

B4. SHOCK ABSORBERS

Shock absorbers are a key component to setting up your Serpent 720. There are various aspects of shock absorbers that can be adjusted: spring tension, preload, position, and damping.

SPRING RATE

Spring rate determines how much the spring resists compression, which is commonly referred to as the "hardness" of the spring. Different spring rates determine how much of the car's weight is transferred to the wheel relative to the other shocks. Spring rate also influences the speed at which a shock rebounds after compression. Spring rate selection depends on whether the track is fast or slow, or has high or low grip.

Spring rate is determined by the characteristics of the spring itself, and NOT by the amount of preload placed on the spring by the preload collars. Characteristics such as wire material, wire thickness, and other factors determine spring rate. Spring rate is usually rated in a "spring weight" number that indicates how much weight (or force) is required to compress the spring by a specific amount. A spring with a higher "spring weight" number (such as a 5N/mm) is considered "harder" since it will be more difficult to compress than a spring with a lower "spring weight" number (such as a 3N/mm spring).

Serpent shock springs are color-coded so that all springs of a specific "spring weight" have the same external colour. Note that spring colours are NOT standardized; a Serpent red spring will not have the same spring rate as a red spring from another manufacturer.

Softest						Hardest
Orange	White	Yellow	Red	Blue	Purple	Grey
#909414	#909415	#909416	#909417	#909418	#909419	#909420

Effects of Spring Rate

Softer Springs

- Makes the car feel as if it has increased 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, and will allow more chassis roll

Harder Springs

- Increases the car's responsiveness
- Increases the car's reaction to steering inputs
- Harder springs are suited for tight, high-traction tracks that aren't too bumpy
- Usually when you use harder springs you lose a small amount of steering, and reduce chassis roll

Softer Front Springs

- Increases steering, especially mid-corner and at corner exit
- Front springs that are too soft can make the car understeer under braking

Harder Front Springs

- Increases mid-corner and corner-exit understeer
- Increases steering under braking
- Increases the car's responsiveness, but makes it more "nervous"

Softer Rear Springs

- Increases rear side traction in mid-corner, through bumpy sections, and while accelerating(forward traction)

Harder Rear Springs

- Decreases rear traction, but increases steering mid-corner and at corner exit. This is especially apparent in long, high-speed corners.

SPRING PRELOAD

Spring preload is used primarily for adjusting ride height, and is not used for altering camber or other suspension settings or characteristics. Spring preload may also be used to adjust the tweak in the car. For more information, see the section for setting ride height and adjusting suspension tweak.

Adjusting Spring Preload

Adjust the alu. spring collar so you get the desired ride-height when the car is fully equipped, ready-to-run.

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

Adjusting spring preload does not alter spring tension. To change spring tension, switch to a softer or harder spring.

SHOCK POSITION

The upper and lower shock mounting positions determine how much leverage the lower suspension arm has on the shock during compression, and how progressive the suspension is.



Effects of Shock Position Adjustment

Shocks More Inclined

- Makes the spring and damping softer
- Makes the car more progressive, giving a smoother feel and more lateral grip (side-bite)

Shocks More Upright

- Makes the spring and damping harder
- Makes the car have a more direct feel, but less lateral grip

SHOCK DAMPING

Shock damping manages the resistance of the shock to movement, as the internal shock piston moves through the shock oil when the shock compresses and rebounds.



Damping mainly has an effect on how the car behaves on bumps and how it reacts initially to steering, braking, and acceleration. 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. Without damping, the shock springs would cause the shock to "pogo" or "bounce" (compressing and rebounding) until it stabilized.

When the shock is compressing or rebounding, the shock oil resists the movement of the piston through it. The amount of resistance is affected by several factors:

- Viscosity (thickness) of the shock oil
- Restriction of oil flow through the piston (affected by the number of holes in the piston)
- Velocity (speed) of the piston

Damping is affected by both shock oil and shock piston settings; getting the optimum shock damping typically requires a lot of "hands on" experience.



Shock Damping - Shock Oil

Shock oil is rated with a "viscosity" number that indicates the thickness of the oil, which determines how much the oil resists flowing and how much it resists the shock piston moving through it. Shock oil with a higher viscosity (for example, 40W oil) is thicker than shock oil with a lower viscosity (for example, 20W oil).

We recommend using only highest-grade Serpent Silicone Shock Oil, which is available in numerous viscosities. Serpent Silicone Shock Oil is specially formulated to be temperature-resistant and low-foaming for use in Serpent shocks.

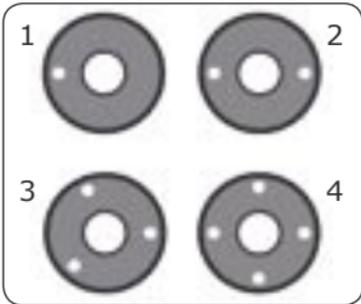
To be able to compare your setup with other Serpent drivers, we advise using only Serpent Silicone Shock Oil.

Thinnest
➔
 Thickest

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

Shock Damping - Shock Pistons

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.



A piston with fewer holes moves more slowly through shock oil compared to a piston with more holes (which moves faster). Therefore a piston with fewer holes gives harder damping, and a shock piston with more holes gives softer damping. The shocks in the Serpent 720 have non-adjustable pistons, however you may disassemble the shock to change the piston to another with fewer or more holes.

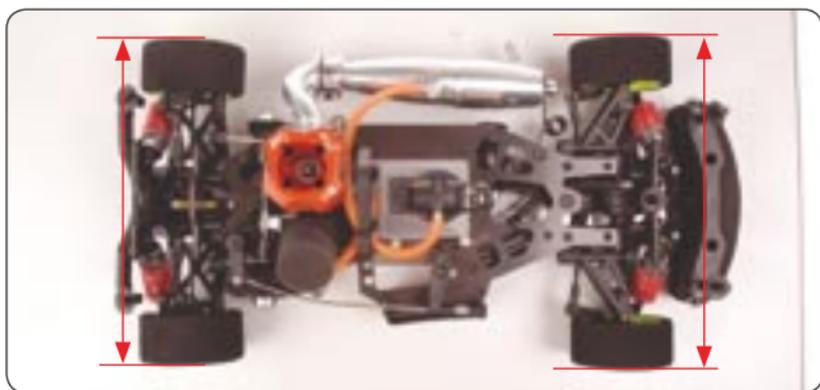
Effects of Shock Damping

The effects of damping are often difficult to distinguish since there is an adjustment where grip is optimum. When you get away from the optimum damping setting, either softer or harder, the car will always lose grip.

The table below describes the handling effects by changing damping on one end of the car; the starting point is always the ideal "optimum."

	Adjusting with...		Effect
	Shock Oil	# Piston Holes	
Front Shocks			
Softer Damping	Thinner	More holes	<ul style="list-style-type: none"> • Slower steering response • Decreases initial steering at corner entry • Increases oversteer at corner exit/under acceleration
Harder Damping	Thicker	Fewer holes	<ul style="list-style-type: none"> • Faster steering response • Increases initial steering at corner entry • Increases understeer at corner exit/under acceleration
Rear Shocks			
Softer Damping	Thinner	More holes	<ul style="list-style-type: none"> • Slower steering response • Decreases rear grip at corner exit/under acceleration • Increases rear grip under braking
Harder Damping	Thicker	Fewer holes	<ul style="list-style-type: none"> • Faster steering response • Increases rear grip under acceleration • Decreases rear grip under braking

B5. TRACK-WIDTH



Track-width is the distance between the outside edges of the wheels at one end of the car. Track-width affects the car's handling and steering response. It is important that front or rear track-width is adjusted symmetrically, meaning that the left and right wheels at one end of the car are the same distance from the centerline of the chassis.

It is not recommended to alter the car's track-width from the default setting.

EFFECTS OF TRACK-WIDTH ADJUSTMENT

Front Track-width

Wider

- Decreases front grip
- Increases understeer
- Slower steering response
- Use to avoid traction rolling

Narrower

- Increases front grip
- Decreases understeer
- Faster steering response

Rear Track-width

Wider

- Increases rear grip at corner entry
- Increases high-speed on-throttle steering
- Use to avoid traction rolling

Narrower

- Increases grip at corner exit
- Increases high-speed understeer
- Increases front grip in hairpin turns



B6. CAMBER & CAMBER RISE

CAMBER

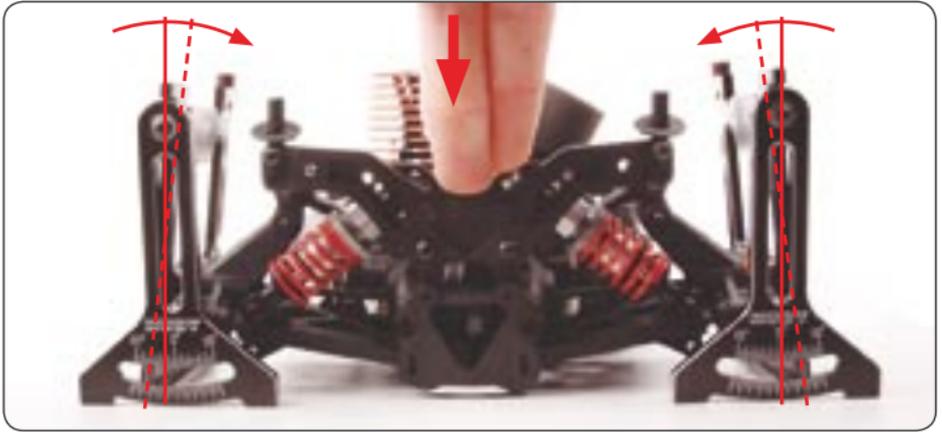
Camber affects the car's traction. Generally more negative (inward) camber results in increased grip since the side-traction of the wheel increases.

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 caster angles (more inclined) require less negative camber, while lower caster angles (more upright) require more negative camber.

REAR CAMBER RISE

Also referred to as "camber change," this setting affects how much the rear camber angle changes during suspension compression and chassis roll. Rear camber rise can be adjusted on the Serpent 720 by changing the location of the rear camber link inner mounting position, and altering the length of the rear camber link.



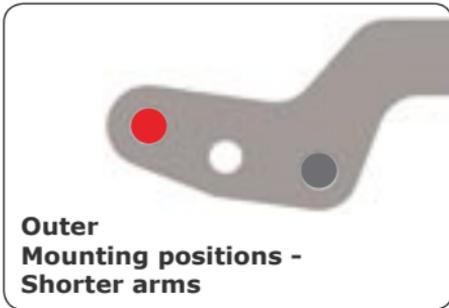
Adjusting Rear Camber Rise

To **increase** rear camber rise, do the following:

- Relocate the inner mounting points of the rear upper camber links to the **OUTER** positions.
- **Shorten** the length of the rear upper camber links.

To **decrease** rear camber rise, do the following:

- Relocate the inner mounting points of the rear upper camber links to the **INNER** positions.
- **Lengthen** the length of the rear upper camber links.



Effects of Rear Camber Rise Adjustment

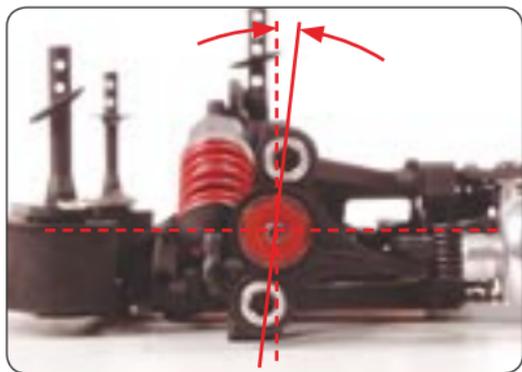
*Outer Position
Shorter Arm*

- Increases camber change under suspension compression and chassis roll

*Inner Position
Longer Arm*

- Decreases camber change under suspension compression and chassis roll

B7. CASTER



Caster describes the forward/backward 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 set. Generally, a lower caster angle (more upright) is better on slippery, inconsistent, and rough surfaces, and a higher caster angle (more inclined) is better on smooth, high-traction surfaces.

Camber vs. Caster

Camber is all about contact patch - keeping as much tire on the ground as possible. Camber and caster are related in that caster gives an amount of EFFECTIVE CAMBER change when the front wheels are turned.

A higher caster angle (more inclined) has the effect of progressively leaning the front tires into the direction of the corner as the wheels are turned. The higher (more inclined) the caster angle, the greater the effective camber change when the wheels are turned. This happens because the tops of the wheels BOTH TILT towards the inside of the corner. With the proper amount of caster this can increase steering, but if too much the tire only runs on the inside edge and loses its contact patch and grip.

Compare that with static camber angle of the wheels, which is adjusted with the car resting on a flat surface and the wheels pointed straight ahead. Static camber adjustments primarily affect the outside wheels, since these are the wheels that bear the majority of the load during cornering. The amount of front static camber required to maintain maximum tire contact largely depends on the amount of caster used. A higher caster angle (more inclined) requires less static camber, while a lower caster angle (more upright) requires more static camber. Check how the tires wear when you change caster and re-adjust static camber if necessary until you get the desired (flat) wear on the tire.

Another effect of caster is that it tilts the chassis when the front wheels are turned. The higher the caster angle (more inclined), the more the inside wheel lifts the inside of the chassis from the ground when the wheels are turned into the corner. This tilts the chassis down to the outside, distributing more weight to the outside rear wheel.

EFFECTS OF CASTER ADJUSTMENT

Lower Caster Angle (more upright)

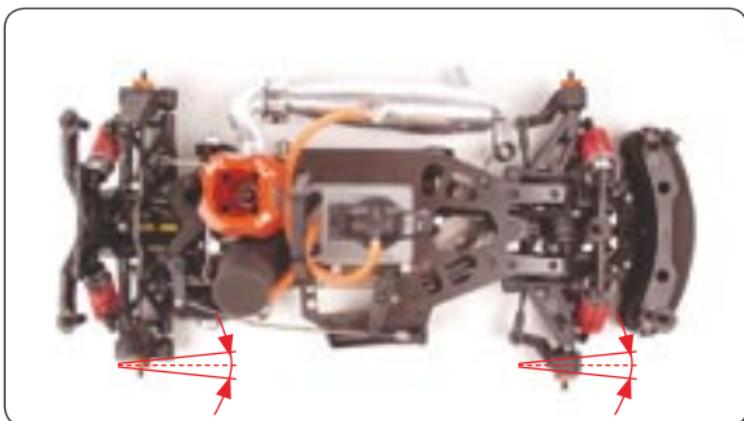
- Decreases straight-line stability
- Increases steering at corner entry
- Decreases steering at mid-corner and corner exit

Higher Caster Angle (more inclined)

- Increases straight-line stability
- Decreases steering at corner entry
- Increases steering at mid-corner and corner exit

Note that depending on the track surface and tire hardness, these effects may be different in that you may always have more steering with more caster. This is especially true for high-traction tracks and/or soft tires.

B8. TOE



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

- Wheels parallel with the centerline of the car have a 0° toe angle.
- Wheels are open toward the front have a negative toe angle (toe-out).
- Wheels that are closed toward the front have a positive toe angle (toe-in).

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

Front wheels may be set to toe-in, neutral, or toe-out.

Rear wheels should always have toe-in; they should never have toe-out.

EFFECTS OF TOE ADJUSTMENT

Front Toe

Increased (more toe-in)

- Increases understeer (decreases oversteer)
- Decreases steering at corner entry
- Increases "nervousness"
- Makes car more difficult to drive

Decreased (more toe-out)

- Decreases understeer (increases oversteer)
- Increases steering at corner entry
- Increases straight-line stability
- Makes car easier to drive

Rear Toe-In

Increased (more toe-in)

- Increases understeer
- Increases on-power stability at corner exit and braking at corner entry
- Less chance of losing rear traction
- Increases straight-line stability

Decreased (less toe-in)

- Decreases on-power stability at corner exit and braking
- More chance of losing rear traction

B9. ANTI-ROLL BARS

Anti-roll bars are used to distribute the car's side (lateral) grip. Anti-roll bars resist chassis roll and by doing so transfer wheel load from the inside wheel to the outside wheel; the harder the anti-roll bar, the more wheel load is transferred. However, as the outside wheel is not able to convert 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 axle at the other end of the car; increasing the hardness of an anti-roll bar on one particular axle (front or rear) decreases the side grip of that axle and increases the side grip of the axle at the other end of the car.

The overall grip 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 a car. Note that chassis stiffness plays a very important role in the effectiveness of anti-roll bars, and a stiffer chassis makes the car more responsive to anti-roll bar changes.

FRONT ANTI-ROLL BAR

The front anti-roll bar affects mainly off-power steering at corner entry.

Effects of Front Anti-roll Bar Adjustment

Softer

- Increases chassis roll
- Increases front grip (decreases rear grip)
- Decreases off-power steering at corner entry
- Slower steering response

Stiffer

- Decreases chassis roll
- Decreases front grip (increases rear grip)
- Increases off-power steering at corner entry
- Quicker steering response



REAR ANTI-ROLL BAR

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

Effects of Rear Anti-roll Bar Adjustment

Softer

- Increases chassis roll
- Increases rear grip (decreases front grip)
- Decreases on-power steering

Stiffer

- Decreases chassis roll
- Decreases rear grip (increases front grip)
- Increases on-power steering
- Quicker steering response in high-speed chicanes



B10. CENTAX-3 CLUTCH

The Centax-3 clutch included with the Serpent 720 may be used to tune the performance of the car. It is important to note that there are many factors that may affect engine and clutch performance. Factors such as proper engine tuning, proper clutch assembly, clutch gap, clutch endplay can all affect clutch performance.

BUILDING AND MAINTAINING THE CENTAX-3 CLUTCH

When building a Centax-3 clutch, it is very important to shim it properly for proper operation and long life. An improperly built Centax-3 clutch may cause excessive slip, too early or too late engagement, engine bogging, and premature thrustbearing failure.

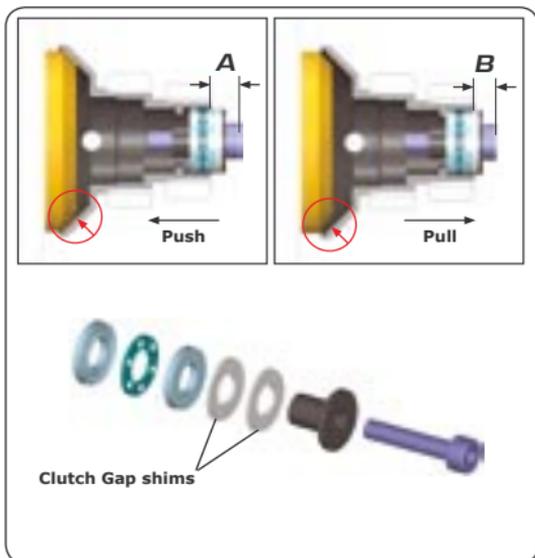
Greasing & Oiling

The thrustbearing in the Centax-3 clutch should be re-greased at least once every 30 minutes, or more often if you run on dirty tracks or your car goes off the track often. We recommend using a thick, high-tack grease such as graphite grease. The ball-bearings in the Centax-3 clutch should be oiled regularly with a good, light bearing oil. The ball-bearings are subjected to high heat for extended periods, and have a tendency to get "rusty" after a short time (which may lead to failure if not oiled).

Thrustbearing Installation

The thrustbearing has two rings - one with a large inner diameter, and one with a small inner diameter. The ring with large inner diameter **MUST** go towards the flywheel.

BUILDING AND SHIMMING THE CENTAX-3 CLUTCH – CLUTCH GAP



There are two ways to shim the Centax-3 clutch: clutch gap and end play. Each of these is adjusted independently of the other.

Clutch gap is the amount that the clutch shoe moves before it contacts the clutch housing. This affects the **WAY** that the clutch engages more than **WHEN** it engages.

Clutch gap is the **FIRST** thing you should adjust on the Centax-3 clutch, and it is done with the bearings **NOT** installed. For information on setting the clutch gap, see the Serpent 720 Instruction Manual.

In the images shown here, clutch gap is the difference between values A and B. You adjust clutch gap by placing shims (medium size) on the thrustbearing holder in front of the thrustbearing assembly.

Effects of Clutch Gap Adjustment

Larger Clutch Gap

- Harder engagement
- More sudden acceleration
- Better on a wider track or high-traction a track
- Puts excess stress on the clutch components, especially the thrustbearing

Smaller Clutch Gap

- Softer engagement
- Smoother acceleration
- Better on a tighter track or a track with low traction
- May result in engine bogging and premature clutch shoe wear

BUILDING AND SHIMMING THE CENTAX-3 CLUTCH – END PLAY



Clutch housing end play is the amount that the clutch housing moves along the crankshaft.

Adjust the end play to a minimal amount (0.05~0.15mm) so that there is only a slight amount of movement detectable. The clutch housing should rotate freely.

End play is adjusted AFTER clutch gap, and is done with the clutch fully assembled with all bearings. For information on adjusting the end play, see the Serpent 720 Instruction Manual.

You adjust end play by placing shims (small size) over the end of the crankshaft, in front of the flywheel nut.

Effects of Excessive End Play

When the clutch is disengaged, the thrustbearing plates are further apart. When the clutch engages, the thrustbearing plates travel further before they are 'sandwiched' together. By traveling further, more force is built up so when the clutch engages, the thrustbearing has more force suddenly applied to it.

Too much endplay will cause premature thrustbearing wear and eventual failure.

CLUTCH SHOES

Serpent offers different clutch shoes for the Centax-3 clutch to change the characteristics of the clutch and also wear and durability.

Effects of Different Clutch Shoes

#802508 Centax-3 Clutch Shoe XP (black)

- Softer material
- Higher initial bite, but more slippage
- More wear

#802509 Centax-3 Clutch Shoe Yellow

- Harder material
- Less clutch slippage
- Less wear



CLUTCH SPRING PRELOAD

Clutch spring preload affects the point at which the clutch engages, and is altered by tightening or loosening the spring preload collar. This is done with the engine stopped, and without disassembling the clutch.

Effects of Clutch Spring Preload Adjustment

Lighter Spring Preload

- Earlier engagement
- Better on slippery tracks

Heavier Spring Preload

- Later engagement
- Better on smooth, high-traction tracks



B11. 2-SPEED TRANSMISSION

The 2-speed transmission included with the Serpent 720 may be adjusted for shift point and shift smoothness.



TRANSMISSION ADJUSTMENT - SHIFT POINT

The shift point determines when the transmission shifts into 2nd gear, and is set by the two shift-point screws on the sides of the 2-speed shoes. It is VERY important to set both shift-point screws equally for proper shifting operation.

Adjustment of the shift point is done with the engine stopped, and may be done without disassembling the transmission.

TRANSMISSION ADJUSTMENT - SHOE GAP

The shoe gap determines how smoothly the transmission shifts into 2nd gear, and is set by the two small shoe-gap screws in the center of the 2-speed shoes.

Adjustment of the shoe gap is done with the engine stopped, and may be done without disassembling the transmission.

Check and adjust the shoe gap periodically to compensate for wear. Always adjust the shoe gap to minimum, without the shoes touching the cage.



B12. FRONT AND REAR AXLES

The Serpent 720 has several options for front and rear axles. The choice of front and rear axles depends on track conditions. The Serpent 720 is designed to quickly change these axles with minimal effort or disassembly.

Front axles

- Gear differential (standard)
- Adjustable ball differential
- One-way axle
- Solid axle (locked one-way axle)

Rear axles

- Gear differential (standard)
- Adjustable ball differential

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

B13. DIFFERENTIALS

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.



The Serpent 720 uses gear differentials as standard, but can use optional ball differentials.

B14. FRONT AND REAR GEAR DIFFERENTIALS



The gear differentials included as standard in the Serpent 720 give smooth differential action and high durability. Also, due to their geared design, there is none of the gear slippage that is associated with ball differentials.

Gear differentials are easy to adjust in that there is only one tuning factor — the weight of the oil used. This makes it very easy to share setups with others using a gear differential.

ADJUSTING FRONT AND REAR GEAR DIFFERENTIALS

Gear differential action is adjusted by filling the gear differential with differential oil of a specific viscosity.

Differential oil is rated with a "viscosity" number that indicates the thickness of the oil, which determines how much the oil resists flowing. Differential oil with a higher viscosity (for example, 40,000cst oil) is thicker than differential oil with a lower viscosity (for example, 20,000cst oil).

We recommend using only highest-grade Serpent Silicone Diff Oil, which is available in numerous viscosities. Serpent Silicone Diff Oil is specially formulated to be temperature-resistant and low-foaming for use in Serpent gear differentials. To be able to compare your gear differential setup with other Serpent drivers, we advise using only Serpent Silicone Diff Oil.



Thinnest



Thickest

1,000cst	(#160001)
3,000cst	(#160003)
5,000cst	(#160005)
7,000cst	(#160007)
10,000cst	(#160010)
20,000cst	(#160020)
30,000cst	(#160030)
40,000cst	(#160040)
50,000cst	(#160050)
60,000cst	(#160060)

- To make a gear differential **LIGHTER**, fill it with **thinner** oil.
- To make a gear differential **HEAVIER**, fill it with **thicker** oil.

EFFECTS OF FRONT GEAR DIFFERENTIAL ADJUSTMENT

Lighter Front Differential

(thinner oil)

- Decreases understeer
- Decreases stability under braking and acceleration
- Increases chance of traction roll

Heavier Front Differential

(thicker oil)

- Increases understeer
- Increases stability under braking and acceleration
- Reduces chance of traction roll

EFFECTS OF REAR GEAR DIFFERENTIAL ADJUSTMENT

Lighter Rear Differential

(thinner oil)

- Decreases on-throttle steering
- Less acceleration if the grip is there
- Less predictable car (cars with very "loose" diffs have a tendency to understeer heavily under throttle and turn-in oversteer as soon as you lift)
- Less on-throttle oversteer (snap-oversteer)
- Less turn-in understeer
- Less stable under braking

Heavier Rear Differential (thicker oil)

- Increases on-throttle steering
- Better acceleration if the grip is there
- More predictable car (cars with very "loose" diffs have a tendency to understeer heavily under throttle and turn-in oversteer as soon as you lift)
- More on-throttle oversteer (snap-oversteer)
- More turn-in understeer
- More stable under braking

B15. FRONT BALL DIFFERENTIAL (Optional)

The optional front ball differential (#802370) differential action can be adjusted externally with a single screw, enabling quick changes to the steering characteristic and overall behavior of the car.



Using the front differential combines some of the braking advantages of a solid front axle while allowing inner/outer wheel speed difference. This last adjustment depends on how much friction is applied with the external friction collar.

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 a rear differential.

The advantage of using a front ball differential is that it can be quickly adjusted to adapt the Serpent 720 to varied track conditions, using a single screw. Drawbacks include the possibility of diff slippage if the internal adjustment screw is not sufficiently tight, and also that running an excessively loose diff action (when slippage is tight) will result in front end looseness if one wheel starts spinning.

ADJUSTING THE FRONT BALL DIFFERENTIAL

Gear slippage is set independently of differential action. When building the front ball differential, tighten the internal adjustment screw to minimize or eliminate slippage under power. The internal adjustment screw squeezes the diff plates against the diff balls, putting lateral force on them. Make sure the differential does not slip under power, since this will cause power loss and excessive wear. However, do not tighten the differential too much as it will damage the diff balls and plates.

Differential action is set via an external adjustment screw in the external friction collar. Use the diff friction collar to adjust the amount of friction. Tighten the adjustment screw to tighten the diff; loosen the adjustment screw to loosen the diff.

EFFECTS OF FRONT BALL DIFFERENTIAL ADJUSTMENT

Looser Front Diff Action (looser friction collar)

- Increases steering
- Decreases stability under braking but better turn-in
- Understeer on-power at corner exit

Tighter Front Diff Action
(tighter friction collar)

- Decreases steering
- Increases stability under braking but less turn-in
- Better on-power at corner exit

B16. REAR BALL DIFFERENTIAL (Optional)

The optional rear ball differential (#802380) shares the same construction and adjustability as the front ball differential (#802370). Differential action can be adjusted externally with a single screw.



The rear differential can be combined with all types of front axles. The advantage of the rear ball differential is that it can be quickly adjusted to adapt the Serpent 720 to varied track conditions, using a single screw. Drawbacks include the possibility of diff slippage if the internal adjustment screw is not sufficiently tight, and also that running an excessively loose diff action (when slippage is tight) will result in rear end looseness if one wheel starts spinning.

ADJUSTING THE REAR BALL DIFFERENTIAL

Gear slippage is set independently of differential action. When building the rear ball differential, tighten the internal adjustment screw to minimize or eliminate slippage under power. The internal adjustment screw squeezes the diff plates against the diff balls, putting lateral force on them. Make sure the differential does not slip under power, since this will cause power loss and excessive wear. However, do not tighten the differential too much as it will damage the diff balls and plates.

Differential action is set via an external adjustment screw in the external friction collar. Use the diff friction collar to adjust the amount of friction. Tighten the adjustment screw to tighten the diff; loosen the adjustment screw to loosen the diff.

EFFECTS OF REAR BALL DIFFERENTIAL ADJUSTMENT

Looser Rear Diff Action
(looser friction collar)

- Increases stability at mid-corner and corner exit
- Increases on-throttle understeer
- Better on low-traction surfaces

Tighter Rear Diff Action
(tighter friction collar)

- Car understeers slightly at corner entry, but makes the car more difficult to control at corner exit (power slides)
- Increases on-throttle steering
- Better on high-traction surfaces

B17. FRONT ONE-WAY AXLE (Optional)

The Front One-way Axle (#802245) 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 standard rear gear differential or the adjustable rear ball differential.

B18. FRONT SOLID AXLE (Optional)

The optional front one-way axle can be very quickly converted into a solid front axle by using the Front Shaft Locking Set (#802252). This set includes two steel pins and a bushing. To lock the front one-way axle, insert the two steel pins through the front axle and both drive adapters, and slide the aluminum bushing over the pins to secure them.

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.

QUICK REFERENCE

The Quick Reference table on the next page 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.

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