



r400



SETUP BOOK



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# INTRODUCTION

Setting up a racecar with fully-independent suspension, like your Serpent S400, 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.

This section describes the default settings for your Serpent S400.

## Setup Order

We have determined that you should set up your S400 in the order indicated in the table below. The order of the settings has been determined as the most logical to set up your S400 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>
<b>Caster</b>					
<b>Toe</b>			-/+	-/+	+
<b>Downstops</b>	-	-	-	+	+
<b>Shock Absorbers</b>					
<b>Track-Width</b>	+		+		+
<b>Ride Height</b>	+	-	+	-/+	+
<b>Camber</b>	+	-	-/+	-/+	+
<b>Anti-Roll Bars</b>		+			
<b>Suspension Tweak</b>	+	-/+	+		+

(+) Attach or use this component / apparatus

(-) DO NOT attach or use this component / apparatus

(-/+ ) Component / 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.



# BASIC SETUP

This section describes the default settings for the Serpent S400 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, 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.

## 1. 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

### 1.1 SETTING FRONT CASTER

To change front caster you must change the C-hubs to those of different caster values.

#### IMPORTANT!

You must use matched caster blocks (same caster angle) on both left and right sides of the car.

**Front Caster Default= 4°**

To change the front caster setting, replace the installed caster blocks with those of the proper caster angle.



2°



4°



6°



## 2. 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 toe value of  $0^{\circ}$ .
- 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).

### Setup Apparatus

Measure and adjust front and rear toe using a setup system on a flat reference surface

### IMPORTANT!

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

### 2.1 MEASURING TOE

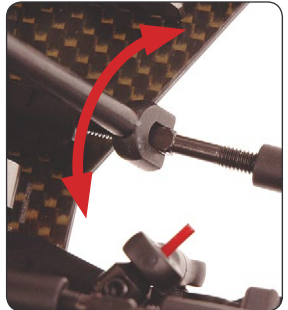
Measure front and rear toe using the setup system according to the instructions provided with the setup system.

### 2.2 SETTING FRONT TOE

**Front Toe Default Setting =  $-0.5^{\circ}$  (toe-out)**

Adjust the front toe-out value of each front wheel to  $-0.5^{\circ}$  (fronts of front wheels pointing outward) by adjusting the lengths of the front steering rods.

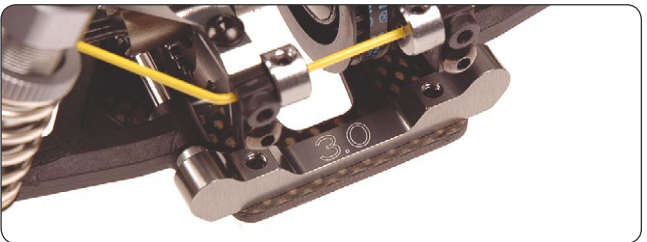
- To set less toe-out, **LENGTHEN** each steering rod equally.
- To set more toe-out, **SHORTEN** each steering rod equally.



### 2.3 SETTING REAR TOE

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

The rear toe is adjusted by using different suspension brackets at the front and back of the rear bulkheads. The default setup uses a  $0^{\circ}$  bracket at the front, and the  $3^{\circ}$  bracket at the back. (These two brackets are included in the kit.)



### 3. DOWNSTOPS

Downstops limit how far the suspension arms travel downward (which determines how far upward the chassis travels).

Downstops are a primary setup adjustment that affect other setup adjustments.

#### IMPORTANT!

Make sure you adjust downstops equally 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:** Disconnect one ball-joint from the front anti-roll bar

**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

#### 3.1 MEASURING DOWNSTOPS

Using the measuring gauge, measure the distance from the reference surface to the lowest point of the front/rear suspension arms.

- 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).



#### 3.2 SETTING FRONT DOWNSTOPS

**Front Downstop Default Setting = + 3mm**

Set the front downstops so the bottoms of the lower suspension arm are at +3mm on the gauge.

(Actual measurement = 3mm 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 suspension arm.



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

### **IMPORTANT!**

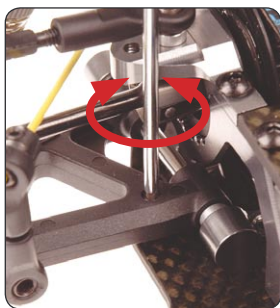
Make sure you adjust front downstops so they are equal on both left and right sides.

## **3.3 SETTING REAR DOWNSTOPS**

### **Rear Downstop Default Setting = 4mm**

Set the rear downstop screws so the bottoms of the rear suspension arms are at +4mm on the gauge. (Actual measurement = 4mm above top level of elevating blocks, or 4mm 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 **INTO** the rear suspension arm.
- To **decrease** the rear downstop value, **turn OUT** (CCW) the rear downstop setscrews **INTO** the rear suspension arm.

### **IMPORTANT!**

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

## **4. 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 S400 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 of the S400 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

#### 4.1 ADJUSTING SHOCK ABSORBER DAMPING

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

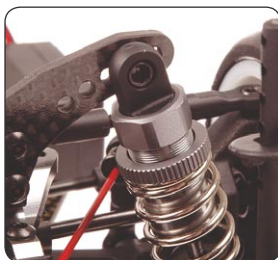
- To get **softer** damping, use a piston with **more holes** or use **thinner shock oil**.
- To get **harder** damping, use a piston with **less holes** or use **thicker shock oil**.

The standard setting for the S400 shocks is using a 3-hole piston and 500cst shock oil

#### 4.2 SETTING THE FRONT SHOCK ABSORBERS – UPPER MOUNTING POSITION

**Front Shock Default Upper Mounting Position = 2nd HOLE FROM TOP**

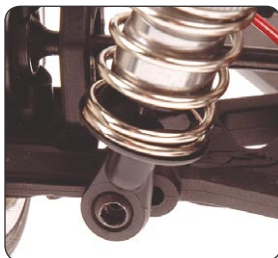
Attach the front shock upper pivotball to the 2nd hole from the top on the front shock tower.



#### 4.3 SETTING THE FRONT SHOCK ABSORBERS – LOWER MOUNTING POSITION

**Front Shock Default Lower Mounting Position = OUTER HOLE**

Attach the front shock lower pivotball to the outer hole on the front lower suspension arm.



#### 4.4 SETTING THE REAR SHOCK ABSORBERS – UPPER MOUNTING POSITION

**Rear Shock Default Upper Mounting Position = 2nd HOLE FROM TOP**

Attach the rear shock upper pivotball to the 2nd hole from the top on the rear shock tower.





## 4.5 SETTING THE REAR SHOCK ABSORBERS – LOWER MOUNTING POSITION

**Rear Shock Default Lower Mounting Position = MIDDLE HOLE**

Attach the rear shock lower pivotball to the middle hole on the rear lower suspension arm.



## 5. 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-widths are 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.

On a car with C-hub suspension the track-width is typically not adjustable. But by using different wheel-hexagons with different widths or by changing to different suspension brackets, the car's track-width will change as well.

When using the parts that come with the kit the S400 has a track width of slightly less than 190mm.

### 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 or a flat setup board which has graduated markings to measure track width.

## 5.1 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.

## 6. 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 or mount our set-up wheels

## Setup Apparatus

Measure ride height with the car resting on a flat reference surface (such as a flat setup board).

### 6.1 MEASURING RIDE HEIGHT

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



### 6.2 SETTING FRONT RIDE HEIGHT

**Front Ride Height Default Setting = 5mm**

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.

### 6.3 SETTING REAR RIDE HEIGHT

**Rear Ride Height Default Setting = 5mm**

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.

## IMPORTANT!

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

## 7. 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 ( $0^\circ$ ) 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

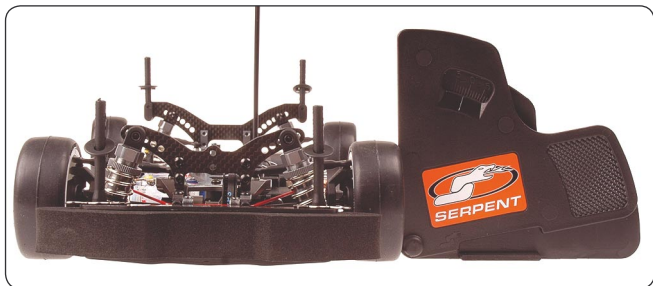
*Wheels on:*

Measure camber using Serpent's Camber Gauge #1460 and a flat reference surface (such as a flat setup board).

*Wheels off:*

Measure camber using a setup system and a flat reference surface.

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  $0.5^\circ$  from the reading you would get with a setup system.



### 7.1 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.

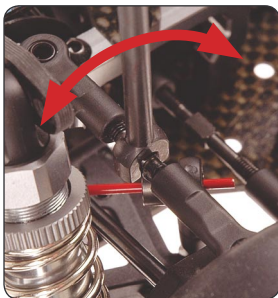
## 7.2 SETTING FRONT CAMBER

**Front Camber Default Setting =  $-2.0^{\circ}$**

Set the front camber to  $-2.0^{\circ}$  (top of front wheel leaning inward).

Adjust front camber using the upper camber link attached to the front C-hub.

- To get **more negative camber** (more slanted), **shorten** the front upper camber link.
- To get **less negative camber** (more upright), **lengthen** the front upper camber link.



### **IMPORTANT!**

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

## 7.3 SETTING REAR CAMBER

**Rear Camber Default Setting =  $-2.0^{\circ}$**

Set the rear camber to  $-2.0^{\circ}$  (top of rear wheel leaning inward).

Adjust rear camber using the upper camber link attached to 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!**

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

### **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.

## 8. ANTI-ROLL BARS

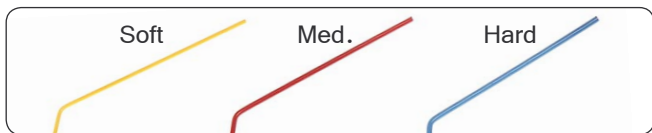
Anti-roll bars are used to adjust the car's side traction and alter chassis roll.

### **Initial Steps**

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

### **Setup Apparatus**

None

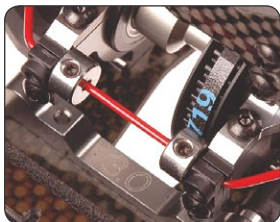


## 8.1 SETTING THE FRONT ANTI-ROLL BAR

**Default Front Anti-roll Bar= RED anti-roll bar**

Adjust the front anti-roll bar by replacing the anti-roll bar wire with another wire of different thickness.

- Thinner wire = softer front anti-roll bar
- Thicker wire = stiffer front anti-roll bar



## 8.2 SETTING THE REAR ANTI-ROLL BAR

**Default Rear Anti-roll Bar= YELLOW anti-roll bar**

Adjust the rear anti-roll bar by replacing the anti-roll bar wire with another wire of different thickness.

- Thinner wire = softer rear anti-roll bar
- Thicker wire = stiffer rear anti-roll bar



# 9. 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

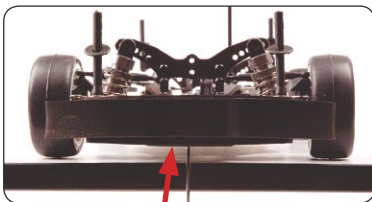
### CHECKING FOR REAR TWEAK

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

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

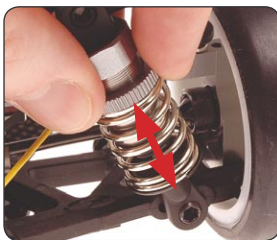
**9.2** Place a sharp tool underneath the front end of the chassis at its middle point, and lift the front end.

If one front wheel lifts before the other, the rear end of the car is tweaked and may be adjusted by rear spring preload.



**9.3** 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.



**9.4** 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 linkages until both front wheels lift at the same time.

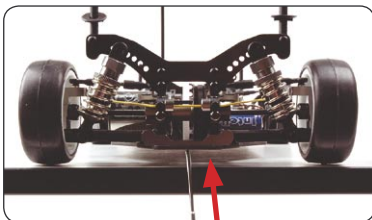
### CHECKING FOR FRONT TWEAK

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

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

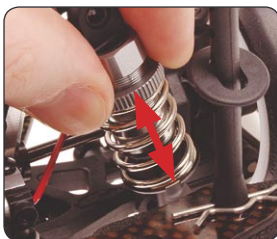
**9.6** Place a sharp tool underneath the rear end of the chassis at its middle point, and lift the rear end.

If one rear wheel lifts before the other, the front end of the car is tweaked and may be adjusted by front spring preload.



**9.7** 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.

**9.8** 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. Adjust the length of one or both front anti-roll bar linkages until both rear wheels lift at the same time.

## 10. Differential Adjustment

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.



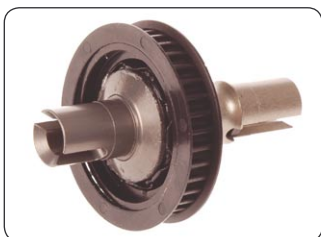
The S400 features a ball differential in the rear and a solid axle (spool) in the front. Optional available is a front differential as well as a one way axle.

### Setup Apparatus

Serpent diff-adjustment tool

The most important thing to adjust on a ball differential is the pressure that is applied to the internal diff balls. The pressure should be high enough to drive the car forward without letting the diff pulley slip between the diff plates. To check the diff tightness, place the diff tool into the slots in the two diff outdrives, and then try to turn the pulley. You should not be able to turn the pulley, or at the very least it should turn only when you apply extreme force.

- If the diff is too loose (pulley turns too easily), apply more diff preload by **tightening** (CW) the adjusting screw.
- If the diff is too tight, the balls and shims are more easily damaged. In that case you should reduce the diff preload by **loosening** the adjusting screw (CCW).



The logo 'S400' is rendered in a stylized, outlined font. The 'S' is a continuous, flowing shape. The '4' and '00' are more geometric. The entire logo is filled with a gradient from orange to yellow and has a white outline. Below the logo, there are several thin, curved lines in orange and white that sweep across the page.

S400

The word 'SERPENT' is written in a bold, italicized, sans-serif font. The letters are filled with a gradient from orange to yellow and have a white outline.

**SERPENT**

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