XRAY T3

1/10 LUXURY TOURING CAR

25x USA NATIONAL CHAMPION

12x CAR OF THE YEAR

US SNOWBIRD Nationals WINNER '04-'05-'06-'07-'08-'09

IIC INTERNATIONAL INDOOR CHAMPION 05'-06'-07'-08'-09'

car action Reader's Choice Award

5x junior EUROPEAN CHAMPION

200+ NATIONAL CHAMPION TITLES

SET-UP BOOK

XRAY

CONTENTS

SETUP THEORY

Setting up a racecar with fully independent suspension, like your XRAY T3, 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.

The Set-Up Theory section describes the effects of changing settings on your T3 racing car. We refer to handling effects of the car in the corner, and we distinguish three corner sections and three throttle/brake positions as follows:

• corner entry	• braking
• mid-corner	• off-throttle
• corner exit	• 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 in preparing it and optimizing the setup will pay off in better results and more satisfaction.

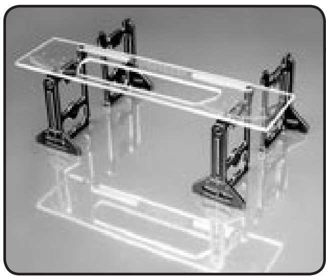
Chassis stiffness (especially torsional) is an important factor when setting up your car. A stiff chassis helps to eliminate chassis flexing and twisting, which would otherwise introduce another factor that is not easy to measure or adjust. However, chassis stiffness is also a setup tool. By altering chassis stiffness by changing the main chassis plate, top deck, chassis stiffeners, or other components, you can make a "softer" or "stiffer" car that may be more or less suited for racing or your driving style. T3 features the world's first exclusive XRAY Multi-Flex Technology™ (XRAY patent) that enables you to adjust the car's stiffness.

If you choose to adjust your car set-up 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 set-up changes, and record which set-ups work best at different racetracks under various conditions. You can upload all your T3 set-up settings to the XRAY's On-line Virtual Set-up Sheet Database at www.teamxray.com and can access your personal settings from anywhere. You can also benefit from all the set-up sheet knowledge and download the set-up sheets from XRAY factory team drivers.

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

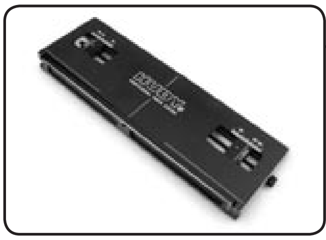
After rebuilding the chassis, or in case you become lost with your set-up, always return to the last set-up you have recorded, or use one of the set-ups posted for your car.

When setting up your T3 car, we strongly recommend using the Hudy All-In-One Set-Up Solution #108255, which includes all the required and neccessary set-up tools and equipment.



109305 UNIVERSAL EXCLUSIVE ALU. SET-UP SYSTEM FOR TOURING CARS

- CNC-machined alu. and acrylic components
- fully ball-bearing equipped
- precision engraving
- directly measures camber, camber rise, caster, toe, steering throw symmetry
- easy one-screw assembly/disassembly

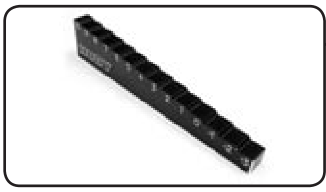


PROFESSIONAL TWEAK STATION FOR 1/10 TOURING CARS

- best-in-class integrated solution for quick and easy track & tweak adjustment
- innovative, easy-to-use, high-tech design
- fully ball-bearing equipped for smoothness and high precision
- ultra-sensitive balance platform gives highly-accurate readings, allowing you to easily and quickly read and interpret tweak
- rugged CNC-machined aluminum construction, fully assembled

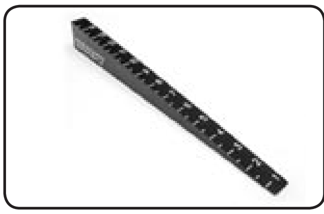
107702 DROOP GAUGE SUPPORT BLOCKS

- CNC-machined high-grade aluminum
- precision engraving
- supports chassis when checking downstops
- used with 107712 Droop Gauge



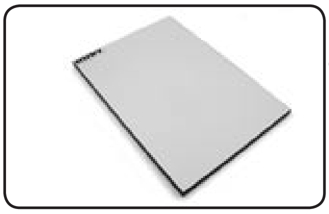
107712 DROOP GAUGE

- CNC-machined high-grade aluminum
- precision engraving
- measures downstops when used with107702 Droop Gauge Support Blocks



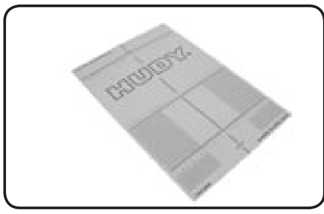
107715 RIDE HEIGHT GAUGE

- CNC-machined high-grade aluminum
- precision engraving
- measures ride height



108201 SET-UP BOARD

- suitable for 1/10 R/C touring cars
- exceptionally flat, warp-resistant surface
- very small, compact size
- provides perfectly flat reference surface for chassis set-up



108211 SET-UP BOARD DECAL

- self-adhesive set-up decal for 108201 Set-Up Board
- accurate, clear markings with 1mm grid for adjustment of 1/10 touring cars
- tough, smooth, liquid-resistant plastic surface

SET-UP ORDER

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

The table below gives you a breakdown of what components need to be attached on the car, and what you will need to measure the setting. When setting up your T3 car, use the components of the Hudy All-In-One Set-Up Solution as follows.

	CAR			SET-UP COMPONENTS				
	Shocks	**Anti-Roll Bars**	**Wheels**	**Set-Up Stands**	**Droop Gauges**	**Ride Height Gauge**	**Toe Gauge**	**Tweak Station**
Downstops	detach	detach	remove	not used	use	not used	not used	not used
Ride Height	attach	attach	attach	not used	not used	use	not used	not used
Droop	attach	attach	attach	not used	not used	not used	not used	not used
Track-width	attach	doesn't matter	remove	use	not used	not used	not used	use
Camber & Camber Rise	attach	detach	remove	use	not used	not used	not used	not used
Caster	attach	doesn't matter	remove	use	not used	not used	not used	not used
Toe	attach	doesn't matter	remove	use	not used	not used	use	not used
Steering Throw Symmetry	attach	doesn't matter	remove	use	not used	not used	use	not used
Tweak	attach	use/don't use	remove	use	not used	not used	not used	use

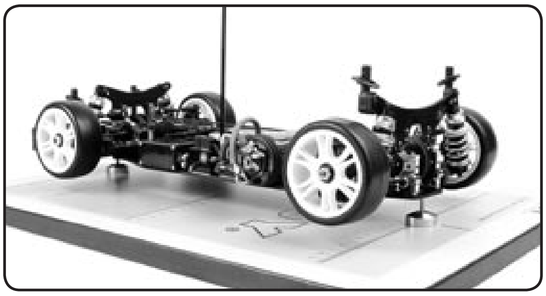
TERMINOLOGY

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 set-up to maximize the car’s performance and ease of handling, you should ensure the following:

- Car is in good mechanical shape with no broken, binding, or loose parts.
- Car has proper weight balance front/rear and 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.

We recommend using #107880 HUDY Chassis Balancing Tool. You would then place the chassis on the points of the stands so that the stand are along the car’s centerline at the front and rear. If the car lists to one side (for example, to the left), add weight to the other side (say, to the right) until the car stays level when left untouched.

CENTER-OF-GRAVITY

The center-of-gravity (CG) of the car is the point on the car (in 3 dimensional space) around which the car moves, and the point at which all force is applied while the car is in motion.

- When the car goes around a corner, centrifugal force pushes the car to the outside of the turn, and that force pushes on the car’s CG causing the car to tilt or roll to the outside. This transfers weight to the outside wheels of the car.
- When the car accelerates, the force pushes backward on the car’s CG, causing the car to tilt backward. This transfers weight from the front wheels to the rear wheels.
- When the car brakes, the force pushes forward on the car’s CG, causing the car to tilt forward. This transfers weight from the rear wheels to the front wheels.

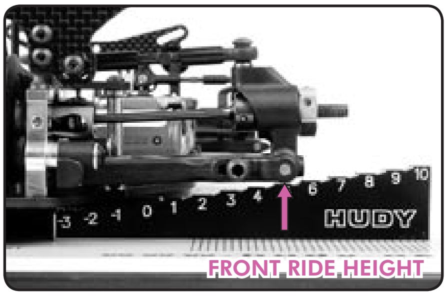
Center-of-gravity is affected by the physical weight of the car, and the placement of all components on the car. If the car is not equally balanced front/rear and left/right, the car’s CG will not be centered. This will cause the car to handle differently when it turns one direction as opposed to the other direction.

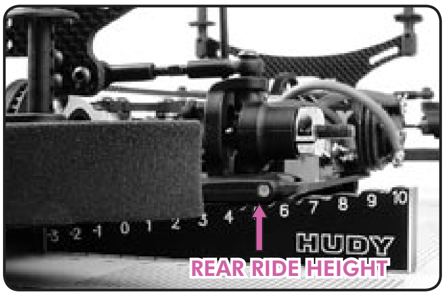
It is always best to make the car’s CG as low as possible to minimize the negative effects of weight transfer. Do this by placing all components down as low as possible on the car’s chassis, and reduce the weight that is up high.

WEIGHT TRANSFER AND CAR SET-UP

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

DOWNSTOPS - THEORY





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.

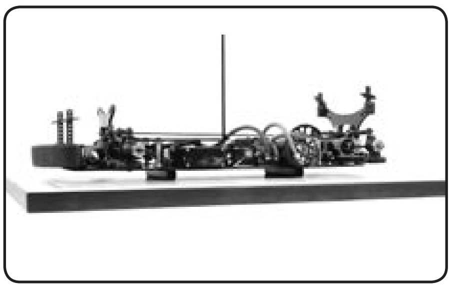
It is very important to have the same downstop settings on the left and right sides of the car.

DOWNSTOPS - EFFECTS OF ADJUSTMENT

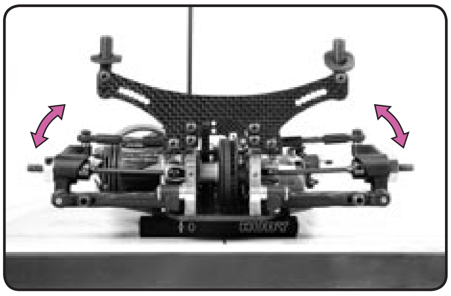
Front Downstops	
Higher front downstop value	• Decreases front chassis upward travel on-throttle. • Increases high-speed steering. • Increases "initial" on-throttle understeer. • Better on smooth tracks.
Lower front downstop value	• Increases upward chassis travel on-throttle. • Decreases high-speed steering. • Decreases "initial" on-throttle understeer. • Better on bumpy tracks.
Rear Downstops	
Higher rear downstop value	• Decreases rear chassis upward travel off-throttle or under braking. • Increases stability under braking. • Better on smooth tracks.
Lower rear downstop value	• Increases rear chassis upward travel off-throttle or under braking. • Increases steering in slow corners. • Better on bumpy tracks.

DOWNSTOPS - MEASURING

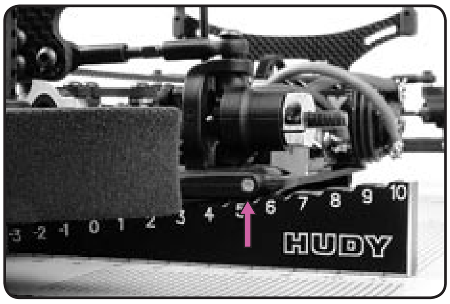
INITIAL STEPS	SET-UP COMPONENTS:
Prepare the car as follows:	**Use the following set-up components:**
• Shocks: Detach the shocks. • Anti-roll bars: Detach the anti-roll bars. • Wheels: Remove the wheels.	• Droop Gauge Support Blocks • Droop Gauge



1. Place the droop gauge support blocks on the set-up board, and then place the chassis on the support blocks.
   Make sure the chassis is solidly mounted on the support blocks so it does not move.

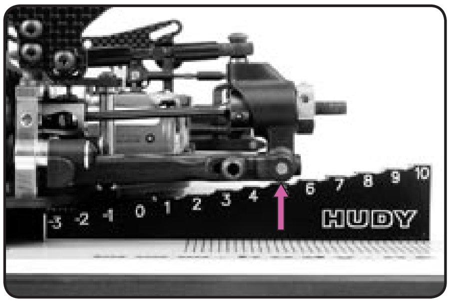


2. Lift and drop the suspension arms so that they settle in their lowest positions.



3. Using the droop gauge, measure the downstop value.

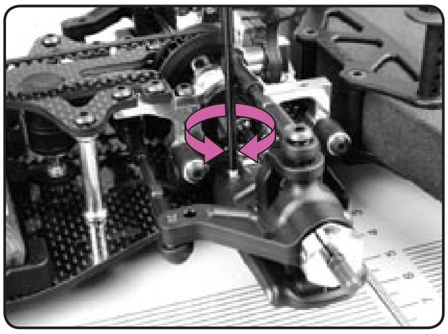
FRONT DOWNSTOPS
Measure at the bottom of the front arms. Do NOT measure under the front C-hub.



REAR DOWNSTOPS
Measure at the bottom of the rear arms. Do NOT measure under the rear uprights.

Positive numbers indicate the distance (in mm) ABOVE the level of the support blocks (or, above the bottom of the chassis).
Negative numbers indicate the distance (in mm) BELOW the level of the support blocks (or, below the bottom of the chassis).

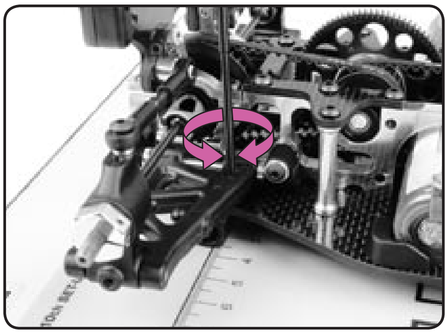
DOWNSTOPS - ADJUSTING



FRONT DOWNSTOPS

Increase
Turn IN (CW) the front downstop screw so the front lower arm raises up slightly.

Decrease
Turn OUT (CCW) the front downstop screw so the front lower arm drops slightly.

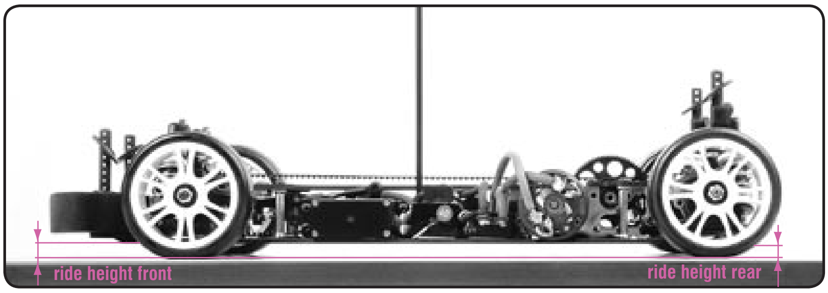


REAR DOWNSTOPS

Increase
Turn IN (or CW) the rear downstop screw so the rear lower arm raises up slightly.

Decrease
Turn OUT (or CCW) the rear downstop screw so the rear lower arm drops slightly.

RIDE HEIGHT - THEORY



Ride height is the height of the chassis in relation to the surface it is sitting on, with the car ready to run. Ride height affects the car's traction since it alters the car's center of gravity and roll center. Because of changes in suspension 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 - EFFECTS OF ADJUSTMENT

Decreasing ride height (lowering the car)	• Increases overall grip. • Better on smooth tracks.
Increasing ride height (raising the car)	• Decreases overall grip. • Better on bumpy tracks (prevents bottoming).

RIDE HEIGHT AND TIRES

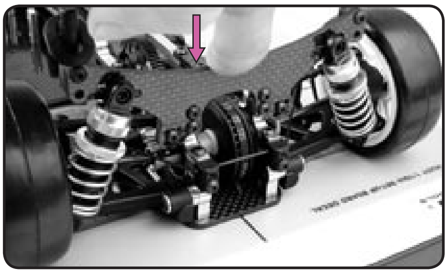
Ride height is measured with the wheels on the car, and the car ready-to-run. When using rubber tires, your ride height settings should stay consistent, since rubber tires do not wear down appreciably during use, which results in a fairly constant ride height. However, if using foam tires, the car's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

RIDE HEIGHT AND SUSPENSION SETTINGS

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

RIDE HEIGHT - MEASURING

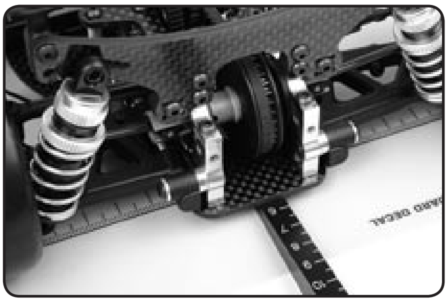
INITIAL STEPS	SET-UP COMPONENTS
Prepare the car as follows:	**Use the following set-up components:**
• Shocks: Attach the front and rear shocks • Anti-roll bars: Attach front and rear anti-roll bars • Wheels: Attach the wheels. Both left and right wheels at the front or rear should be the same diameter	• Ride Height Gauge



1. Place the car on the set-up board.

2. Push down and release the front and rear of the car so that the suspension settles.

3. Measure the ride height using the ride height gauge at the front and rear of the car at the lowest points of the chassis.



RIDE HEIGHT - ADJUSTING

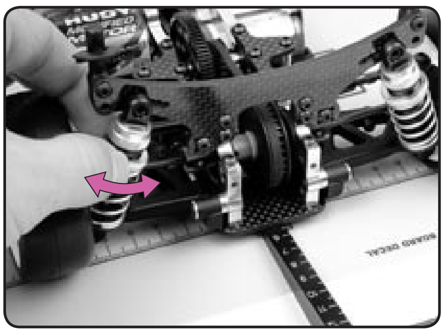
Adjust ride height using spring preload only.
DO NOT adjust ride height using downstop screws.

PRELOAD SETTING	THREADED PRELOAD COLLAR
Increase	TIGHTEN collar so it moves DOWN the shock body.
Decrease	LOOSEN collar so it moves UP the shock body.

FRONT RIDE HEIGHT

Increase (Raise)
INCREASE preload on both FRONT springs EQUALLY.

Decrease (Lower)
DECREASE preload on both FRONT springs EQUALLY.



REAR RIDE HEIGHT

Increase (Raise)
INCREASE preload on both REAR springs EQUALLY.

Decrease (Lower)
DECREASE preload on both REAR springs EQUALLY.

DROOP - THEORY

Droop refers to the amount that the chassis travels downward after the car is dropped and the wheels touch the ground; it is also the amount that the chassis travels upward before the wheels lift from the ground. Droop is a very powerful way to adjust your car's handling, as it adjusts the weight transfer of the car.

Droop is affected by both downstop setting and ride height adjustments. When you adjust ride height, you must also adjust downstops to maintain the same droop setting. This is particularly important when running a car with foam tires, since foam tires get smaller when run, requiring you to increase ride height periodically. Increasing ride height by itself will reduce droop value unless you compensate by changing the downstop setting.

FRONT DROOP	
Less front droop (higher front downstop value)	• Decreases front chassis upward travel on-throttle. • Increases high-speed steering. • Increases "initial" on-throttle understeer. • Better on smooth tracks.
More front droop (lower front downstop value)	• Increases upward chassis travel on-throttle. • Decreases high-speed steering. • Decreases "initial" on-throttle understeer. • Better on bumpy tracks.
REAR DROOP	
Less rear droop (higher rear downstop value)	• Decreases rear chassis upward travel off-throttle or under braking. • Increases stability under braking. • Better on smooth tracks.
More rear droop (lower rear downstop value)	• Increases rear chassis upward travel off-throttle or under braking. • Increases steering in slow corners. • Better on bumpy tracks.

DROOP AND RIDE HEIGHT

When you use rubber tires on your car, you can set a particular downstop value to get a particular droop value, and then forget about it. Rubber tires do not wear appreciably during use, so the droop value should not change.

However, when you use foam tires on the car, things become a bit more complicated. You will have to constantly adjust ride height and downstop settings to maintain a particular droop value.

CONSIDER THE FOLLOWING SITUATION:
You have foam tires of a particular diameter. You have adjusted your downstop settings and your ride height settings. There is mm of front droop and 1mm of rear droop.

After you race the car for a short time the foam tires wear down to a smaller diameter, which decreases the ride height. So you now adjust the shock spring preload to increase the ride height to a proper value again.

Increasing the ride height causes the chassis to raise up slightly, which decreases the amount of space between the downstop screws and the chassis. The result is that the droop values are now reduced, so the car will handle differently.

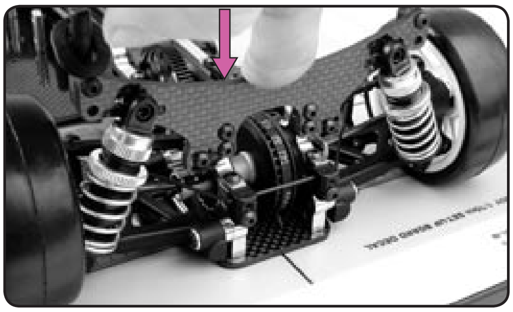
(In extreme cases when you have to increase the ride height a lot, the droop may completely disappear as you increase shock spring preload. If you increase the spring preload so much that you remove all droop, the ride height will not increase no matter how much preload you set since the downstop screws are tight against the chassis and do not permit the chassis to rise).

In this situation, to maintain a certain amount of droop you need to loosen the downstop screws slightly as you increase the ride height. You must alternate between adjusting ride height and downstop settings to maintain a particular droop value. This must be done equally on left and right sides of the car.

DROOP - MEASURING

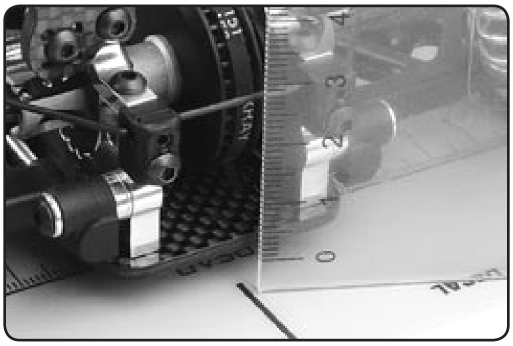
You measure droop with the car ready-to-run.

INITIAL STEPS	SET-UP COMPONENTS:
Prepare the car as follows:	**Use the following set-up components:**
• Shocks: Attach the front and rear shocks. • Anti-roll bars: Attach front and rear anti-roll bars. • Wheels: Attach the wheels. Both left and right wheels at the front or rear should be the same diameter.	• Small ruler

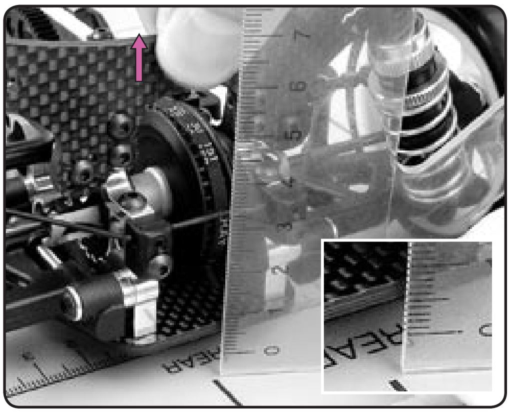


1. Place the car on the set-up board.

2. Push down and release the front and rear of the car so that the suspension settles.

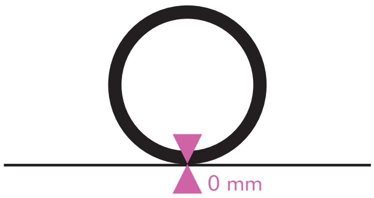


3. Place the ruler vertically beside the chassis, so that you can see how much distance there is between the flat surface and the bottom of the chassis.



4. Keeping the ruler in place, slowly lift the chassis at its centerline. The chassis rises slightly until the wheels just lift from the set-up board.

5. On the ruler, note the distance to the chassis bottom. The amount that the chassis rose before the wheels lifted is the droop value. Repeat steps 3-5 for the other end of the car.

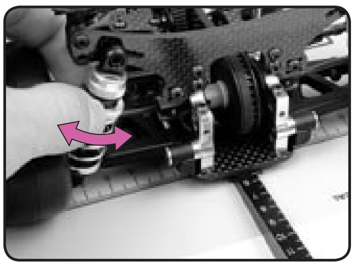


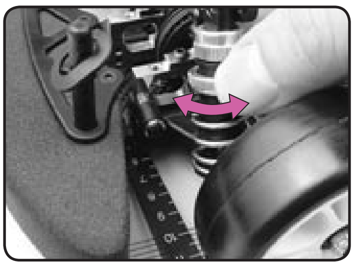
DROOP - ADJUSTING

When you adjust ride height you affect the droop setting. Compensate changes in ride height by making adjustments to downstops. For more information, see “Ride Height” and “Downstops.”

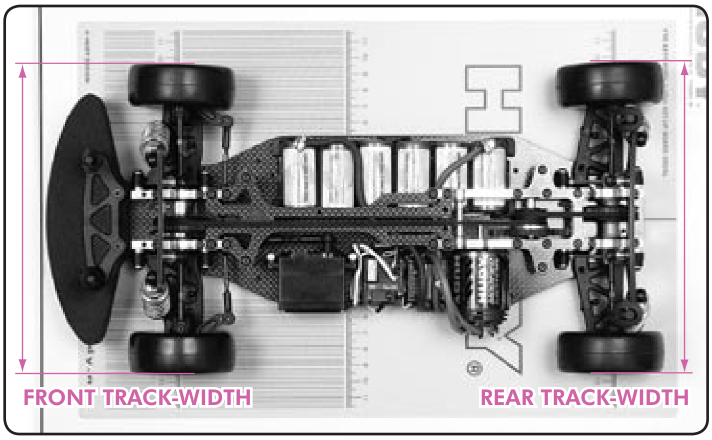
- A higher downstop setting creates a smaller gap between the downstop setscrew and the chassis at rest. This smaller gap reduces the amount that the chassis rises before the wheels lift from the ground. The result is a smaller droop value.
- A lower downstop setting creates a larger gap between the downstop setscrew and the chassis at rest. This larger gap increases the amount that the chassis rises before the wheels lift from the ground. The result is a larger droop value.

When you do this to RIDE HEIGHT	Do this to DOWNSTOP	Comments
Increase	Decrease	Increasing ride height will decrease the droop value. To compensate, decrease the downstop setting.
Decrease	Increase	Decreasing ride height will increase the droop value. To compensate, increase the downstop setting.





TRACK-WIDTH - THEORY



Track-width is the distance between the outside edges of the wheels, front or rear, and it 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 must be the same distance from the centerline of the chassis.

Making the track-width narrower can be compensated with adding shims on the wheel axles to make the offset larger.

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.

TRACK WIDTH - MEASURING

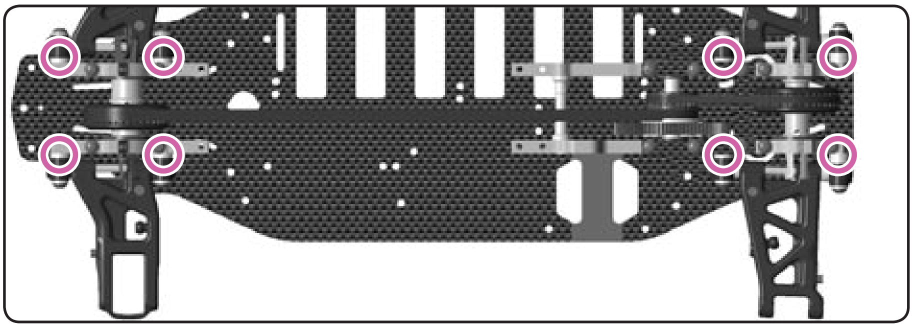
The amounts of shims used in the T3 suspension will determine the track-width settings.

	1.5mm shim (left & right sides)	NO shims used
FRONT TRACK WIDTH	186mm	183mm
REAR TRACK WIDTH	189mm	186mm

TRACK WIDTH - ADJUSTING

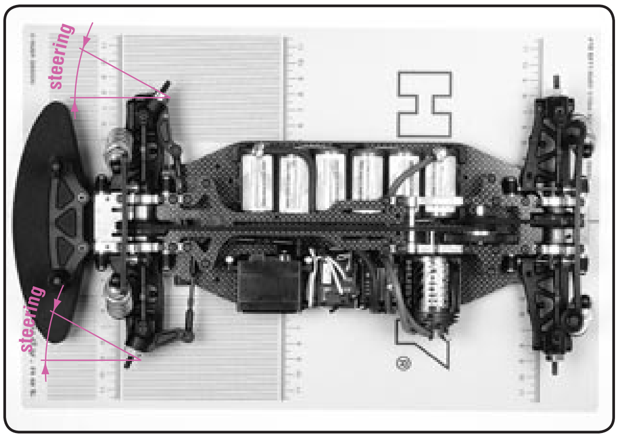
Normally you cannot adjust the track-width of a car with C-hub suspension due to the design of the suspension system. However, the T3 suspension system allows you to easily adjust the track width by adding/removing shims between the suspension holders and the bulkheads.
Make sure to use the same amount and thickness of shims on both left and right sides.

Increase Track-width (WIDER)	More/thicker shims
Decrease Track-width (NARROWER)	Less/thinner shims



NOTE: CHANGING FRONT TRACK-WIDTH SETTING WILL ALSO AFFECT THE FRONT TOE AND CAMBER SETTING.

STEERING THROW SYMMETRY - THEORY



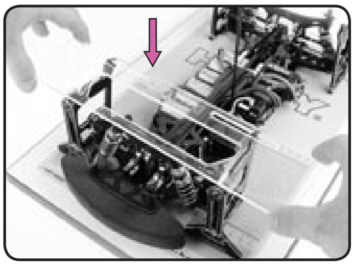
Although most cars' front suspension geometry is designed such that the turning radius of the car is the same from left to right, sometimes this isn't the case. You can use the toe gauge plate to make sure that the steering turns as sharply to the left as it does to the right.

If it is not the case and if your radio has EPA (End Point Adjustments), adjust the EPA on your transmitter in order to achieve steering throw symmetry. The wheels should turn equally in both directions for balanced handling.

For detailed information on adjusting end point adjustment, refer to the instruction manual for your transmitter.

STEERING THROW SYMMETRY - MEASURING & ADJUSTING

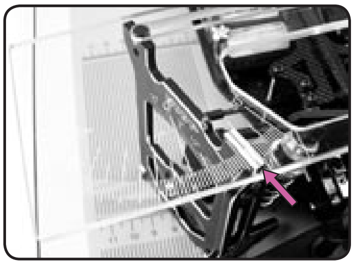
INITIAL STEPS	SET-UP COMPONENTS
Prepare the car as follows:	Use the following set-up components:
• Shocks: Attach the front and rear shocks. • Wheels: Remove the wheels. • Motor: Remove the pinion gear. • Electronics: Connect the radio electronics so the steering is active when you turn on the car	• assembled set-up stands • toe gauge



1. Turn on the transmitter.
2. Turn on the receiver. The steering should respond to the transmitter.
3. Assemble the set-up stands.
4. Mount the set-up stands on the axles.
5. Place the car on the set-up board.

6. Set the toe gauge atop the front set-up stands.

   The pins at the top of the front stands fit in the machined slots in the toe gauge.



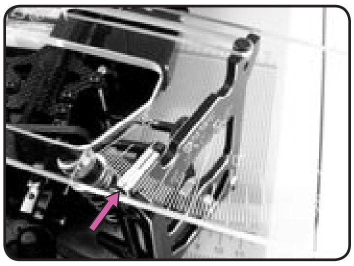
7. Push the toe gauge to the right until the pin on the top edge of the left set-up stand hits the edge of the slot in the toe gauge.

   Then slide the toe gauge to the left until it stops against the pin on the right front stand.

8. Adjust the transmitter steering trim until you get the same toe value on both front wheels.

9. Turn the steering to the left, and push the toe gauge against the pin on the right front stand.

   Note the amount that the wheel turns to the left (in degrees) on the toe gauge.



10. Turn the steering to the right, and push the toe gauge against the pin on the left front stand.

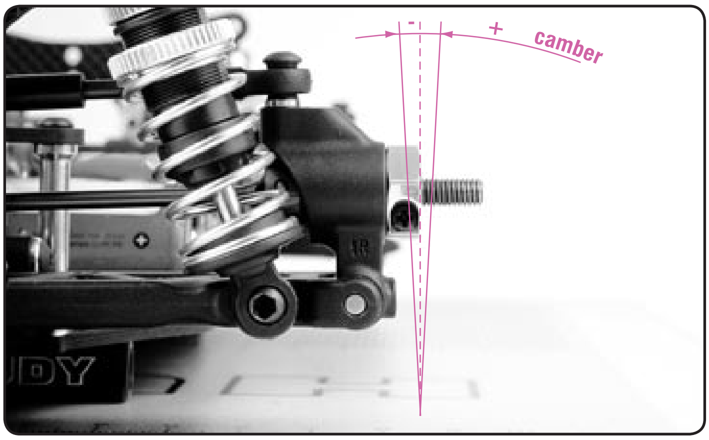
    Note the amount that the wheel turns to the right (in degrees) on the toe gauge.

11. Compare the amounts that the steering turns left and right. They should be the same.

    If they are different, adjust the left or right EPA (end point adjustment) settings on your transmitter until the left and right steering amounts are the same.

12. Turn off your receiver, then turn off your transmitter.

CAMBER - THEORY

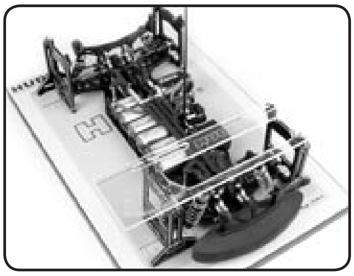


Camber is the angle of a wheel to the surface on which the car is resting (with wheels and shock absorbers mounted). Zero degrees (0°) of camber means that the wheel is perpendicular to the reference surface. Negative camber means that the top of the wheel is leaning inwards towards the centerline of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

Camber affects the car's traction. Generally more negative (inward) camber means increased grip since the side-traction of the wheel increases. Adjust front camber so that the front tires wear flat. Adjust rear camber so that the rear tires wear slightly conical to the inside.
The amount of front camber required to maintain the maximum contact patch also 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.

CAMBER - MEASURING

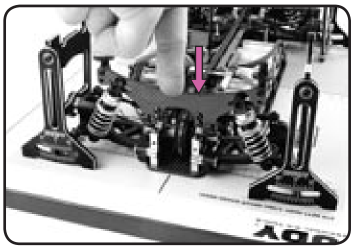
INITIAL STEPS	SET-UP COMPONENTS:
Prepare the car as follows:	Use the following set-up components:
• Shocks: Attach the front and rear shocks. • Anti-roll bars: Detach front and rear anti-roll bars. • Wheels: Remove the wheels.	• assembled set-up stands



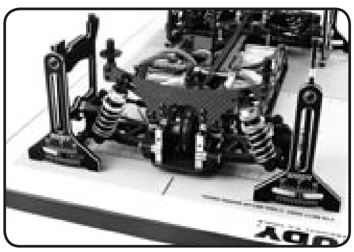
1. Assemble the set-up stands.

2. Mount the set-up stands on the axles.

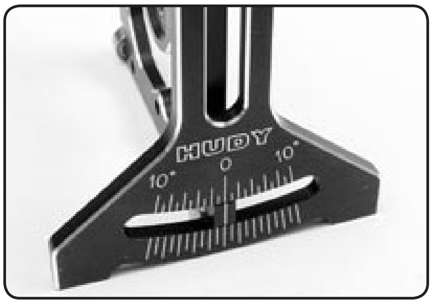
3. Place the car on the set-up board.



4. Push down and release the front and rear of the car so that the suspension settles.

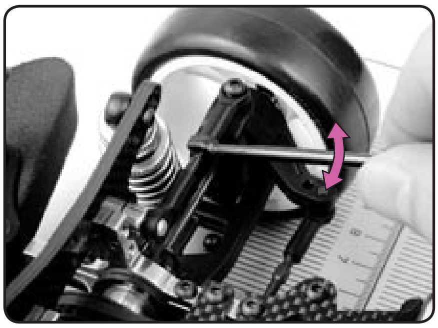


5. Read the camber setting from the camber gauge of each of the four set-up stands.



Each graduated mark indicates a 1° camber value. You should be able to set camber with a resolution of 0.5°

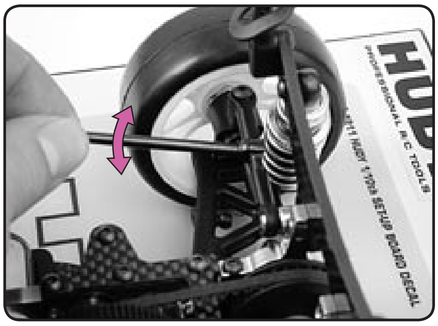
CAMBER - ADJUSTING



FRONT CAMBER

Increase (more –ve)
SHORTEN the front upper camber link.

Decrease (less –ve)
LENGTHEN the front upper camber link.



REAR CAMBER

Increase (more –ve)
SHORTEN the rear upper camber link.

Decrease (less –ve)

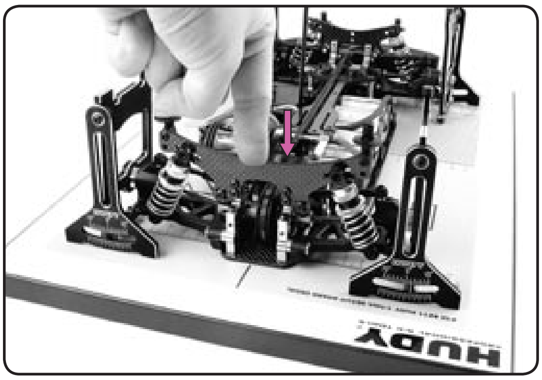
LENGTHEN the rear upper camber link.

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

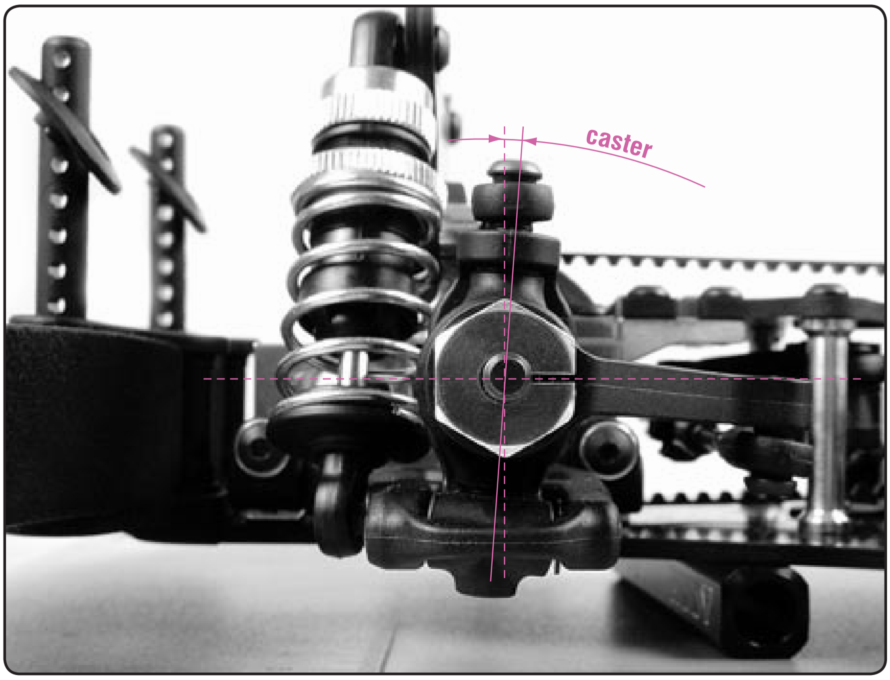
CAMBER RISE

Also referred to as “camber intake,” this measurement quantifies how much the camber changes on the car when the suspension is compressed. Usually, a shorter upper link will result in a large camber rise, while equal length upper and lower links (or suspension arms) help keep the camber rise minimal.

To measure camber rise, set the car at normal ride height and then measure the camber on the camber gauges. Next, push on the suspension, and measure the camber again. The difference between those two camber angles represents the camber rise. It can usually be adjusted by changing the upper link/arm mount location on the shock tower.



CASTER - THEORY



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 wheel.

EFFECTS OF CASTER ADJUSTMENT

LESS CASTER ANGLE (more vertical)	• Decreases straight-line stability. • Increases steering at corner entry. • Decreases steering at mid-corner and corner exit.
MORE CASTER ANGLE (more inclined)	• Increases straight-line stability. • Decreases steering at corner entry. • Increases steering at mid-corner and corner exit.

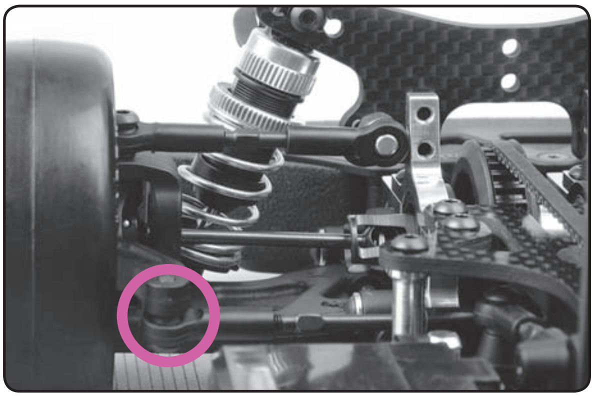
Note that depending on the track surface and tire hardness, these effects may be different in that you may always have more steering with more caster. This is especially true for high-traction tracks and/or soft tires.

30 2361	C-HUB BLOCK, RIGHT - 2° DEG.
30 2362	C-HUB BLOCK, LEFT - 2° DEG.
30 2363	C-HUB BLOCK, RIGHT - 4° DEG.
30 2364	C-HUB BLOCK, LEFT - 4° DEG.
30 2365	C-HUB BLOCK, RIGHT - 6° DEG.
30 2366	C-HUB BLOCK, LEFT - 6° DEG.

CASTER - ADJUSTING

To change the front caster on the T3, you must change to C-hubs of different caster values. Note that left and right sides should have the same caster value.

BUMP STEER



Bump steer is an undesirable handling effect that occurs when a car's front toe angle changes as its suspension compresses or rebounds, from the position that was pre-set using a setup station.

To reduce or eliminate bump steer, the angle of the steering rods must be changed. This is easily accomplished by using shims between the outer steering rod ends and the steering blocks.

Bump steer is a suspension tuning option commonly used in off-road RC racing to change steering characteristics over rough and loose terrain. However, we strongly recommend eliminating bump steer in touring car suspensions.

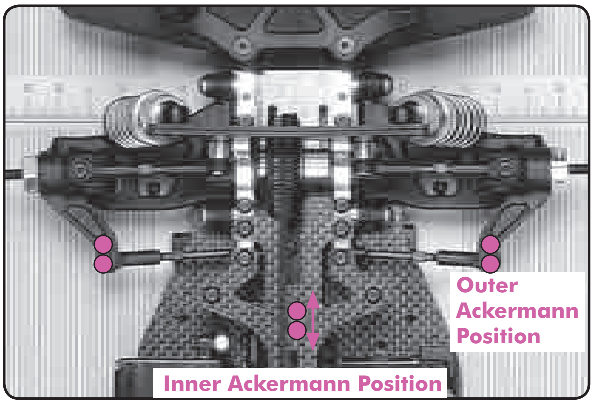
Here is a simple process to figure out if a car has bump steer and how to minimize or eliminate it:

1. Make sure the car is fully set up, has been de-tweaked, and is "race ready". Remove the tires and body.
2. Put the car on the set-up station.
3. Press down and quickly release the front shock tower to get the suspension to settle.
4. Use the set-up stands and the toe-gauge to measure the front toe angle at rest.
5. Press down on the front shock tower until the front of the chassis is approximately 1-2mm above the board. Hold the chassis in place.
6. Use the set-up stands and toe-gauge to measure the front toe angle under compression, and see if the front toe angle has changed.
7. If the front toe angle changes when the front suspension is compressed, do the following:

   - Add or remove shims underneath the outer steering rod end (in 1mm increments) in 1mm increments
   - Repeat steps 5-6 until the front toe is the same with the suspension at rest or compressed.

A barely noticeable change is acceptable, but you may need to use 0.5mm shims to completely eliminate the angle change.

ACKERMANN



Ackermann controls the difference in steering arcs between the front inside and outside wheels. The inside wheel always has a tighter arc in any corner. The amount of grip provided by the tires, in relation to the steering arc and speed of the car, create an amount of measurement called a "slip angle" for each wheel. For some tires you need a greater difference in slip angles between the inner and outer wheel and for some you need less. The size and geometry of the servo saver on XRAY cars forces the inside wheel to increase its turning angle at a greater rate than the outside wheel, as the servo turns either way from center. The rate of the increase, called Ackerman effect, can be changed by the angle of the steering rods connecting the servo saver to the steering blocks. The straighter the rods are in relation to each other, the more Ackerman effect will be applied to the inside wheel.

Slip angles work differently on each wheel when the car is slowing down & pitching forward, than when the throttle is applied & the tires are pulling the car forward. The goal in tuning ackerman is to get the car to keep a consistent steering arc after going from off-power to on-power, while not allowing the front inside wheel to be turned too much and drag through the corners instead of rolling through them. If the car steers well off-power but pushes on-power, then use more Ackermann effect and decrease your transmitter EPA/dual rate. If the car steers well on-power and pushes off-power, or if you can hear the front inside wheel chattering at mid-corner, then use less Ackermann effect and increase your transmitter EPA/dual rate.

The angle of the steering rods can be changed by moving the steering rods inner mount position on the servo saver, or outer mount position on the steering blocks.

1. Inner Ackermann Position (servo saver) – Changing the forward/rearward position of the servo saver has the greatest Ackermann effect

Position #1 (forward) – less Ackermann effect (steering rods more angled)
Position #2 (rearward) – the greatest Ackermann effect (steering rods straighter)

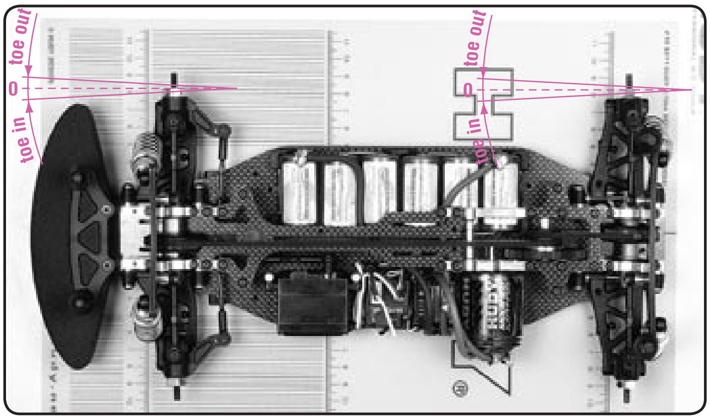
2. Outer Ackermann Position (steering blocks) – Changing positions on the steering blocks is used to fine tune the Ackermann effect

Position #1 (forward) – more Ackermann effect (steering rods straighter)
Position #2 (rearward) – less Ackermann effect (steering rods more angled)

NOTE: It is recommended to use more Ackermann effect in low-to-medium grip conditions and less Ackermann effect in medium-to-high grip conditions.

TOE

TOE - THEORY



Toe is the angle of the wheels when looked at from above the car. Toe is used to stabilize the car at the expense of traction, as it introduces friction and therefore some slip in the tires.

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

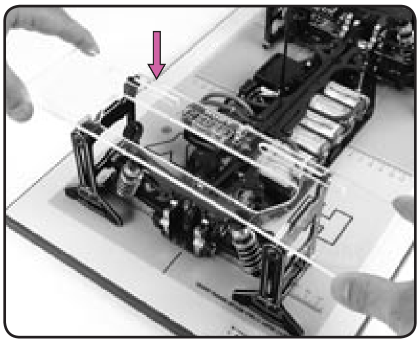
The front wheels can have either toe-in or toe-out. The rear wheels should always have toe-in; they should never have toe-out.

We recommend that you first adjust the rear toe, if your car allows it, then put the car on the track and adjust the steering trim so that the car tracks straight. Then you can proceed to the front toe adjustment back in the pits. Rear toe-in is a primary adjustment, and will dictate the symmetry of the handling of the car. It is critical that you adjust rear toe-in perfectly symmetrical from left to right.

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	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.

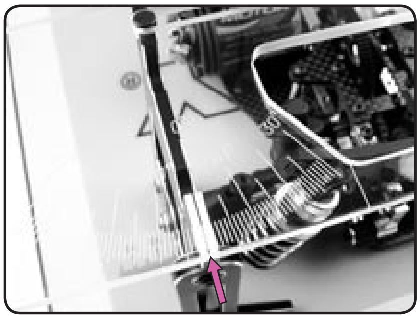
TOE - MEASURING

INITIAL STEPS	SET-UP COMPONENTS:
Prepare the car as follows:	Use the following set-up components:
• Shocks: Attach the front and rear shocks. • Wheels: Remove the wheels.	• assembled set-up stands • toe gauge



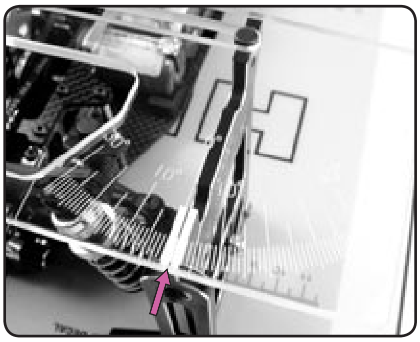
1. Assemble the set-up stands.
2. Mount the set-up stands on the axles.
3. Place the car on the set-up board.
4. To adjust rear toe, set the toe gauge atop the rear set-up stands.

   The pins at the top of the stands fit in the machined slots in the toe gauge.



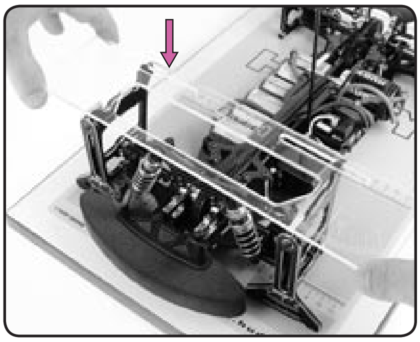
5. To read the toe value of the left rear wheel, push the toe gauge to the right until the pin on the top edge of the left set-up stand hits the edge of the slot in the toe gauge.

   Now read the toe value on the toe gauge. The black line on the top edge of the stand points to a toe value engraved in the toe gauge. Each graduated mark indicates a 1° toe value. You should be able to set toe with a resolution of 0.5°



To read the toe value of the right rear wheel, push the toe gauge to the left until the pin on the top edge of the right set-up stand hits the edge of the slot in the toe gauge. Read the measurement.

When using the acrylic toe gauge, the toe gauge does not fit over the pins on the set-up stands so that the toe gauge is in one position. The toe gauge is designed to slide over the pins from one side to the other, depending on which wheel you are measuring (left or right). Follow the instructions carefully.

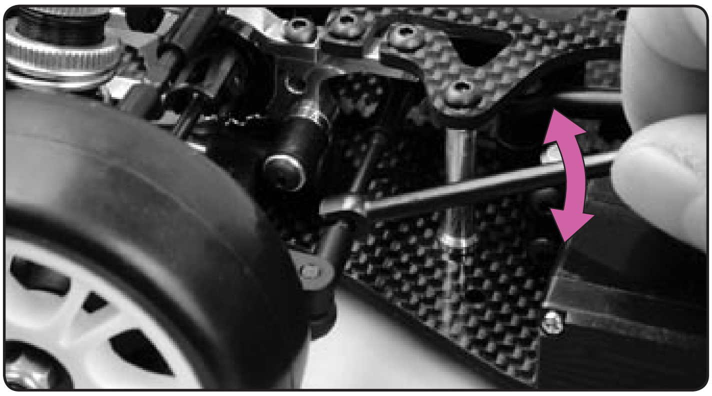


6. To adjust front toe, set the toe gauge atop the front set-up stands and then repeat the procedure.

   We recommend you adjust front toe after the rear toe and steering trim has been set.

NOTE: CHANGING THE FRONT TRACK-WIDTH SETTINGS WILL CHANGE BOTH THE FRONT TOE AND FRONT CAMBER SETTINGS.

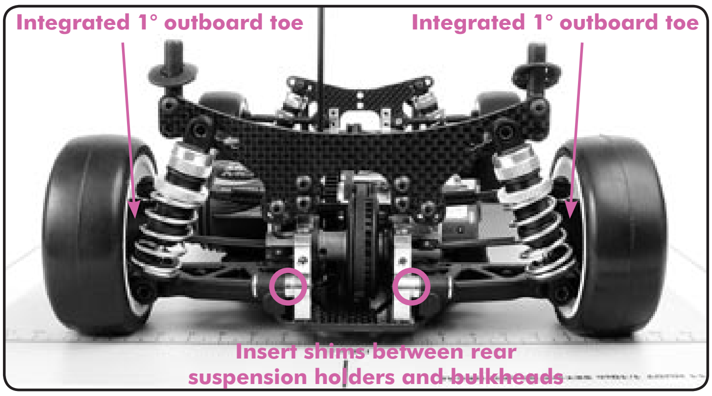
TOE - ADJUSTING



FRONT TOE

Increase
(more front toe-in) LENGTHEN both front steering rods equally.

Decrease
(less front toe-in, or front toe-out) SHORTEN both front steering rods equally.



REAR TOE

The rear uprights have an integrated outboard 1° toe-in. The rear toe is adjusted with adding shims of different thickness between the rear suspension holders and the rear bulkheads.

Increase
(more rear toe-in) ADD shims (thicker/more) between rearmost lower suspension holder and bulkheads on both sides equally.

Decrease
(less rear toe-in) REMOVE shims (thinner/less) between rearmost lower suspension holder and bulkheads on both sides equally.

Shims used (L+R sides)	Toe	+ 1° outboard toe	Final toe
0.4mm	0.5°	+ 1° outboard toe	1.5° toe
0.75mm	1°	+ 1° outboard toe	2° toe
1.15mm	1.5°	+ 1° outboard toe	2.5° toe
1.5mm	2°	+ 1° outboard toe	3° toe

30 3131	STEEL SHIM FOR LOWER SUSP. HOLDER 3x7.5x0.4 (10)
30 3132	STEEL SHIM FOR LOWER SUSP. HOLDER 3x7.5x0.75 (10)
30 3133	STEEL SHIM FOR LOWER SUSP. HOLDER 3x7.5x1.15 (10)
30 3134	ALU SHIM FOR LOWER SUSP. HOLDER 3x7.5x1.5 (10)

TWEAK - THEORY

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

The HUDY All-In-One Set-Up System uses a unique tweak station to set and measure tweak. The HUDY Professional Tweak Station has a sensitive, ball-bearing supported level built into one end, and this indicates when one end of the car is tweaked. With the set-up stands mounted on the car, one set of stands (front or rear) is set on the tweak station and keyed to the protruding pins. The other two stands (at the other end of the car) rest on the set-up board.

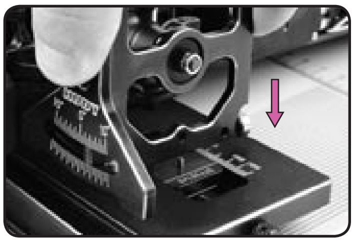
Other "bubble-type" tweak stations are not as effective at measuring tweak as the HUDY Professional Tweak Station. Bubble-type tweak stations are difficult and non-effective to use, as they must work on an ultra-flat surface, and if it is not then the readings will not be accurate. The HUDY Professional Tweak Station uses the tension of the suspension to determine the tweak,so you can use the tweak station under any conditions or on any surface. Also, the rear and front suspensions do not have to be aligned.

The HUDY Professional Tweak Station level indicates the amount of tweak of the end of the car resting on the set-up board (not the end of the car on the tweak station). For example, by placing the REAR stands on the tweak station and the front stands on the set-up board, the tweak station indicates the amount of tweak at the FRONT of the car.

TWEAK - MEASURING

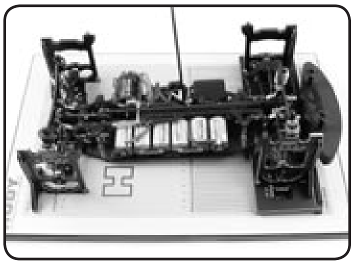
INITIAL STEPS	SET-UP COMPONENTS:
Prepare the car as follows:	Use the following set-up components:
• Shocks: Attach the front and rear shocks. • Anti-roll bars: Detach the anti-roll bars. • Wheels: Remove the wheels.	• assembled set-up stands • tweak station

1. Assemble the set-up stands.
2. Mount the set-up stands on the axles.
3. Place the tweak station upright on the set-up board.

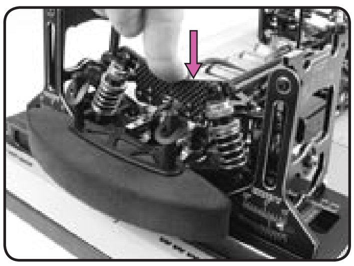


4. Mount the FRONT set-up stands on the tweak station pins. Place the REAR set-up stands on the set-up board. (You do this to check for tweak at the REAR of the car).

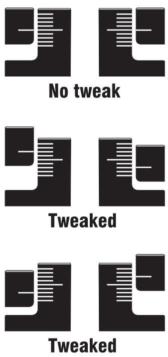
If the pins do not fit in the front set-up stands, use the adjustment knob on the side of the tweak station to change the track-width setting. Do this until the pins fit in the stands.



NOTE: It is very important that the car has symmetrical track-width at front and rear. For more information, see "Track-Width" section.



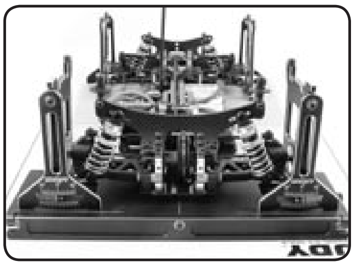
5. Push down and release the front and rear suspension a few times to settle it.
6. Look at the level at the edge of the tweak station to determine if there is tweak at the rear of the car.



NO TWEAK
Reference marks on the sides of the tweak station align with the long central marks on the level.

TWEAKED
Reference marks on the sides of the tweak station DO NOT ALIGN with the long central marks on the level.

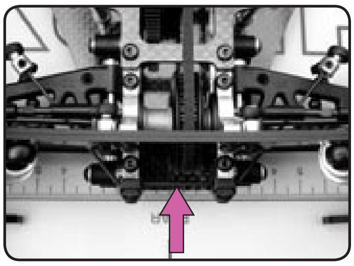
7. Adjust the REAR suspension until the tweak bar is level.



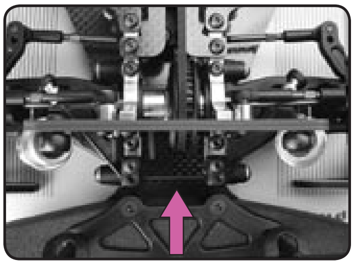
TURN THE CAR AROUND.

8. Place the REAR set-up stands on the tweak station pins, and place the FRONT set-up stands on the set-up board. (You do this to check for tweak at the FRONT of the car).

   Repeat the procedures to check and adjust tweak at the front of the car.



9. Attach the rear anti-roll bar.
   Place the front stands on tweak station, then check and adjust rear tweak again.



10. Attach the front anti-roll bar.
    Place rear stands on tweak station, then check and adjust front tweak again.

COMBATING TWEAK

If your car is tweaked, there are several things you can check or adjust. Check these areas in the following order:

- Chassis flatness
- Downstop settings
- Shock length and damping
- Binding parts
- Shock spring preload
- Anti-roll bars

CHASSIS FLATNESS
A twisted chassis will certainly cause a car to become tweaked. Since the chassis is the central attachment point for all suspension components, a twisted chassis will render all other suspension settings as unbalanced.
To check for a twisted chassis, remove the wheels, disconnect the springs, and remove the battery straps. Place the chassis on a perfectly flat surface (such as the HUDY Set-Up Board) and see if the chassis rocks from side to side. Even a small amount of twisting will result in a tweaked car.

To remedy a twisted chassis, you can try releasing the screws the hold the top deck, pressing the chassis flat on the set-up board, and then retighten the screws. If this does not solve the problem, you may have to replace the chassis.

DOWNSTOP SETTINGS
Check downstop settings to make sure they are equal on the left and right sides of the car.
For more information on downstops, see “Downstops.”

SHOCK LENGTH AND DAMPING
Check shock lengths and damping to make sure they are equal on the left and right sides of the car. You typically adjust shock length by tightening or loosening the lower pivot on the shock rod. Damping adjustment varies depending on the type of shock absorber.

BINDING PARTS
Make sure that all suspension components move freely without binding. This includes suspension arms and pins, pivotballs, ball cups, etc..

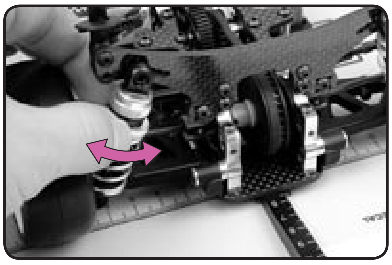
ADJUSTING TWEAK USING SPRING PRELOAD

Adjusting tweak using spring preload should be done only after all other items have been checked and corrected. Incorrectly adjusted springs can result in one side of the car being firmer or higher than the other, causing handling differences when turning left or right. After adjusting spring preload to remove tweak, if the preload on the left and right sides of the car are different by more than 1~1.5mm, then you should start over again and check for other areas that may result in tweak.

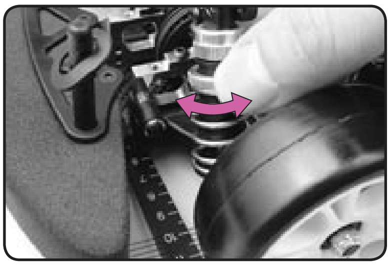
This section describes how to interpret the meaning of the tweak station readings, and the adjustments to make to spring preload to adjust tweak. Make sure that both anti-roll bars are detached.

Note that your car may use threaded spring preload collars or preload spacers. To adjust spring preload do the following.

Preload setting	Threaded preload collar
Increase	TIGHTEN collar so it moves DOWN the shock body.
Decrease	LOOSEN collar so it moves UP the shock body.



Changing rear spring preload



Changing front spring preload

ADJUSTING REAR TWEAK (SPRING PRELOAD)

FRONT STANDS: ON TWEAK STATION

REAR STANDS: ON SET-UP BOARD

FRONT RIGHT WHEEL TWEAK READING	FRONT LEFT WHEEL TWEAK READING	MEANING	ACTION
		No tweak at rear of car.	None.
		Excess load on FRONT LEFT wheel on tweak station. resulting from: Excess load on REAR RIGHT wheel on set-up board.	DECREASE spring preload on the REAR RIGHT shock. + INCREASE spring preload on the REAR LEFT shock. Adjust both rear springs equally but in opposite amounts, otherwise you will change the rear ride height.
		Excess load on FRONT RIGHT wheel on tweak station. resulting from: Excess load on REAR LEFT wheel on set-up board.	DECREASE spring preload on the REAR LEFT shock. + INCREASE spring preload on the REAR RIGHT shock. Adjust both rear springs equally but in opposite amounts, otherwise you will change the rear ride height.

ADJUSTING FRONT TWEAK (SPRING PRELOAD)

FRONT STANDS: ON SET-UP BOARD

REAR STANDS: ON TWEAK STATION

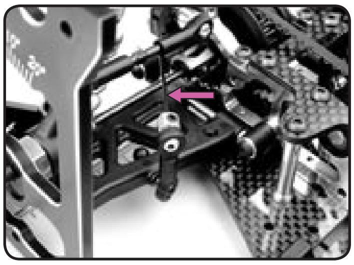
REAR LEFT WHEEL TWEAK READING	REAR RIGHT WHEEL TWEAK READING	MEANING	ACTION
		No tweak at front of car.	None.
		Excess load on REAR RIGHT wheel on tweak station. resulting from: Excess load on FRONT LEFT wheel on set-up board.	DECREASE spring preload on the FRONT LEFT shock. + INCREASE spring preload on the FRONT RIGHT shock. Adjust both front springs equally but in opposite amounts, otherwise you will change the front ride height.
		Excess load on REAR LEFT wheel on tweak station. resulting from: Excess load on FRONT RIGHT wheel on set-up board.	DECREASE spring preload on the FRONT RIGHT shock. + INCREASE spring preload on the FRONT LEFT shock. Adjust both front springs equally but in opposite amounts, otherwise you will change the front ride height.

ADJUSTING TWEAK USING ANTI-ROLL BARS

This section describes how to interpret the meaning of the tweak station readings, and the adjustments to make to the car's anti-roll bars to remove tweak. Adjusting tweak using anti-roll bars with anti-roll bars attached.

This section describes how to adjust tweak when using "wire-type" anti-roll bars.

ADJUSTING REAR TWEAK (ANTI-ROLL BARS)

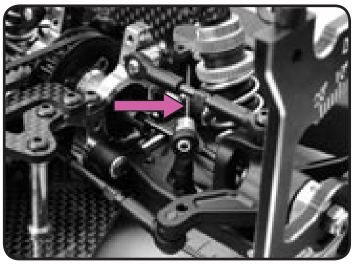


IMPORTANT: ADJUST TWEAK USING ANTI-ROLL BARS ONLY AFTER YOU HAVE ADJUSTED TWEAK USING SPRING PRELOAD.

FRONT STANDS: ON TWEAK STATION   REAR STANDS: ON SET-UP BOARD

FRONT RIGHT WHEEL TWEAK READING	FRONT LEFT WHEEL TWEAK READING	MEANING	ACTION
		No tweak at rear of car.	None.
		Excess load on FRONT LEFT wheel on tweak station. **RESULTING FROM:** Excess load on REAR RIGHT wheel on set-up board.	SHORTEN the REAR RIGHT anti-roll bar linkage. + LENGTHEN the REAR LEFT anti-roll bar linkage. Adjust both rear anti-roll bar linkages equally but in opposite amounts.
		Excess load on FRONT RIGHT wheel on tweak station. **RESULTING FROM:** Excess load on REAR LEFT wheel on set-up board.	SHORTEN the REAR LEFT anti-roll bar linkage. + LENGTHEN the REAR RIGHT anti-roll bar linkage. Adjust both rear anti-roll bar linkages equally but in opposite amounts.

ADJUSTING FRONT TWEAK (ANTI-ROLL BARS)

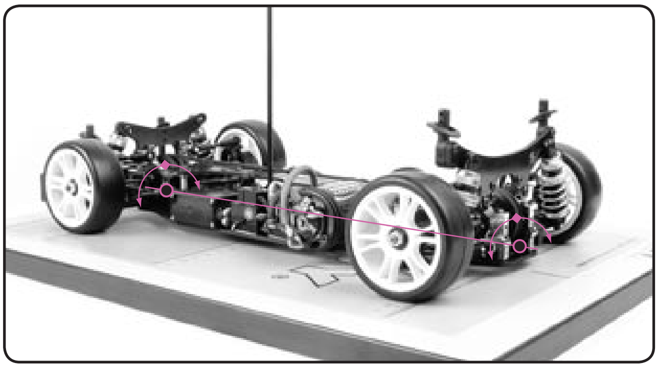


IMPORTANT: ADJUST TWEAK USING ANTI-ROLL BARS ONLY AFTER YOU HAVE ADJUSTED TWEAK USING SPRING PRELOAD.

FRONT STANDS: ON SET-UP BOARD   REAR STANDS: ON TWEAK STATION

REAR LEFT WHEEL TWEAK READING	REAR RIGHT WHEEL TWEAK READING	MEANING	ACTION
		No tweak at front of car.	None.
		Excess load on REAR RIGHT wheel on tweak station. **RESULTING FROM:** Excess load on FRONT LEFT wheel on set-up board.	SHORTEN the FRONT LEFT anti-roll bar linkage. + LENGTHEN the FRONT RIGHT anti-roll bar linkage. Adjust both front anti-roll bar linkages equally but in opposite amounts.
		Excess load on REAR LEFT wheel on tweak station. **RESULTING FROM:** Excess load on FRONT RIGHT wheel on set-up board.	SHORTEN the FRONT RIGHT anti-roll bar linkage. + LENGTHEN the FRONT LEFT anti-roll bar linkage. Adjust both front anti-roll bar linkages equally but in opposite amounts.

ROLL CENTER

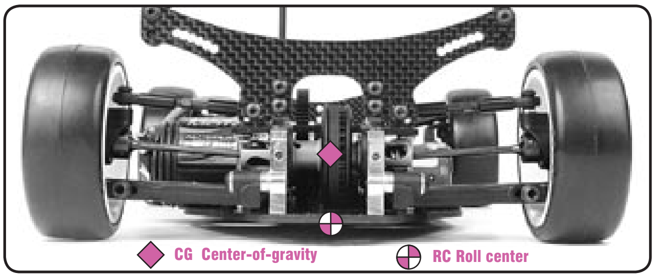


A "roll center" is a theoretical point around which the chassis rolls, and is determined by the design of the suspension. Front and rear suspensions normally have different roll centers. The "roll axis" is the imaginary line between the front and rear roll centers.

The amount that a chassis rolls in a corner depends on the position of the roll axis relative to the car's center-of-gravity (CG). The closer the roll axis is to the center of gravity, the less the chassis will roll in a corner. A lower roll center will generally produce more grip due to the chassis rolling, and the outer wheel "digging in" more.

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.

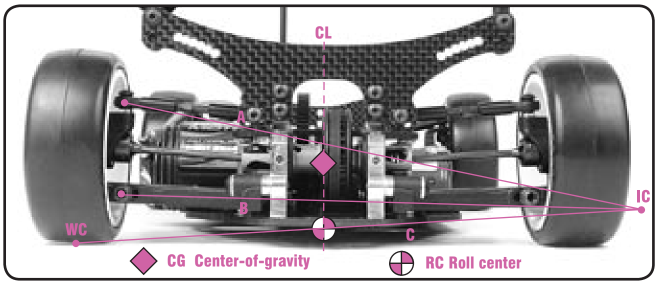
ROLL CENTER BASICS



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

- Roll center (RC) is the point around which the car rolls.
- Each end of the car (front and rear) has its own roll center.
- Center-of-gravity (CG) is where all cornering force is directed.
- RC and CG are (ideally) in the middle (left-right middle) of the car.
- RC is vertically below the CG in cars.
- More chassis roll equals more grip

DETERMINING ROLL CENTER LOCATION



Roll center is determined by the car's suspension geometry. Each end of the car has its own roll center, determined by the suspension geometry at that end of the car.

The following diagram shows how you can find a car's roll center at one end of the car or the other.

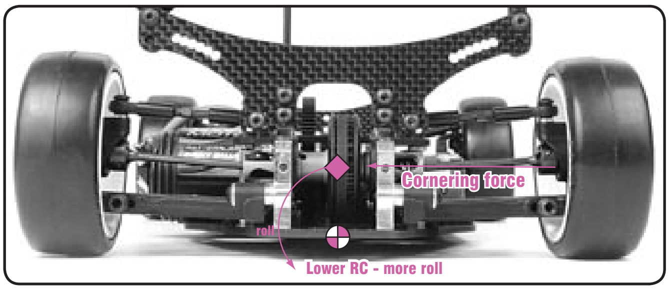
Here is a breakdown of the factors that determine roll center at one end of the car.

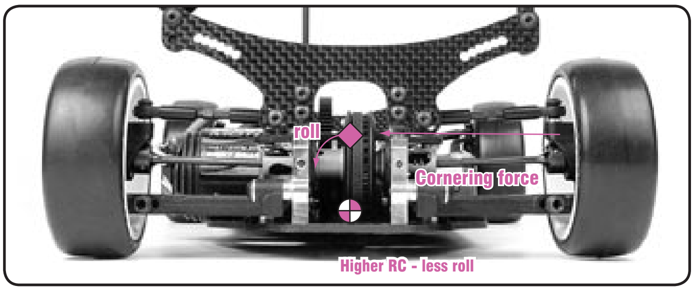
- Line 'A' is parallel to the upper suspension arm.
- Line 'B' is parallel to the lower suspension arm.
- Line 'A' and line 'B' intersect at point 'IC' (instant center).
- Line 'C' goes from the wheel contact point (WC – bottom center of the wheel) to point IC.
- The point at which line 'C' crosses the car's centerline (CL) is the roll center.

ROLL CENTER IN ACTION

When cornering, centrifugal force is applied to the car's CG, which tends to push the car to the outside of a corner. This causes the CG to rotate around the RC. Since the RC is below the CG, cornering force causes the car to rotate AWAY from the force. Hence, the car rolls 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.
- 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.
- If the RC was right on top of the CG, when the car corners the CG has no leverage on the RC, so the car would not roll at all.
- Depending on what the car is doing, you will want one end or the other to roll more or less. You change the height of the RC accordingly to make it closer or further from the CG (which for all intents is a fixed point).





EFFECTS OF FRONT ROLL CENTER ADJUSTMENT

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

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

EFFECTS OF REAR ROLL CENTER ADJUSTMENT

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

Rear Roll Center	Effect
Lower	• Increases on-throttle grip. • Decreases weight transfer at rear of car, but 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, but 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).

ROLL CENTER – ADJUSTING ON THE T3

Adjusting the T3 front or rear roll center is the best way to change mid-corner grip at either end of the car, as well as to balance out the overall grip between the front and rear.

There are two tuning options available to change the roll center on the T3:

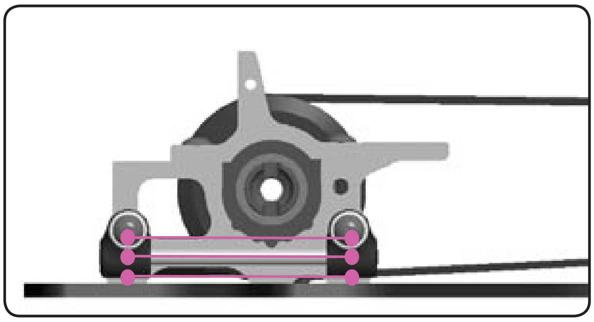
- **Lower arm position**
- **Upper camber link position**

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

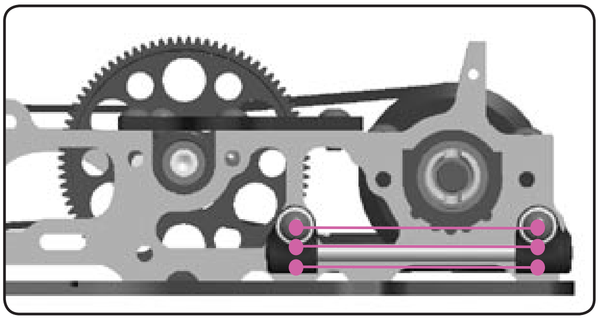
To change the lower position of the arms in front and rear you need to use different eccentric suspension holders included in the kit.

IMPORTANT! Changing roll center settings impacts several other settings on the car, such as downstops, camber, and ride height. When changing front or rear roll center, re-check your other settings.

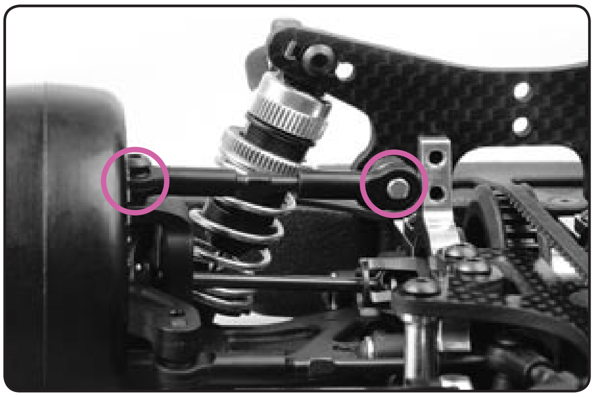
FRONT LOWER ARM POSITION



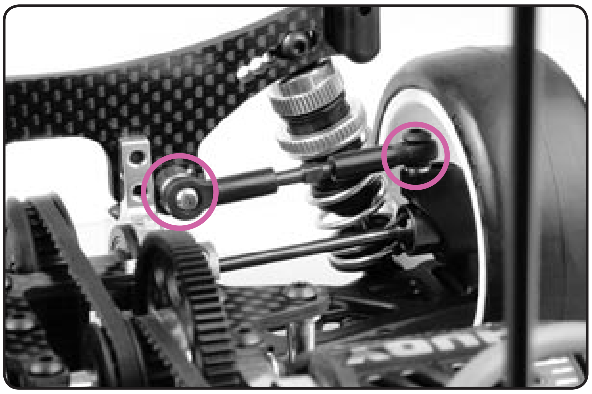
REAR LOWER ARM POSITION



FRONT UPPER CAMBER LINK POSITION



REAR UPPER CAMBER LINK POSITION



ADJUSTING FRONT ROLL CENTER

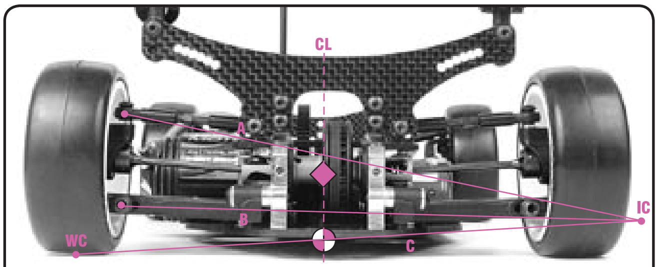
Effect	Suspension Arm	Change the following… Inner Pivot	Change the following… Outer Pivot
Lowering front roll center	Front upper camber link	Raise and/or move inward the inner pivot mounting position using the XRAY Quick Roll Center positions on the shock tower.	
Lowering front roll center	Front upper camber link		• Lower the outer pivot by removing shims from in between the link and the hub. • Move the outer pivot to the outer mounting position on the hub.
Lowering front roll center	Front lower arm	Lower the position of the front lower arm's inner pivot pin, using different suspension pin holders (lower value).	

Effect	Suspension Arm	Change the following… Inner Pivot	Change the following… Outer Pivot
Raising front roll center	Front upper camber link	Lower and/or move outward the inner pivot mounting position using the XRAY Quick Roll Center positions on the shock tower.	
Raising front roll center	Front upper camber link		• Raise the outer pivot by adding shims in between the link and the hub. • Move the outer pivot to the inner mounting position on the hub.
Raising front roll center	Front lower arm	Raise the position of the front lower arm's inner pivot pin, using different suspension pin holders (higher value).	

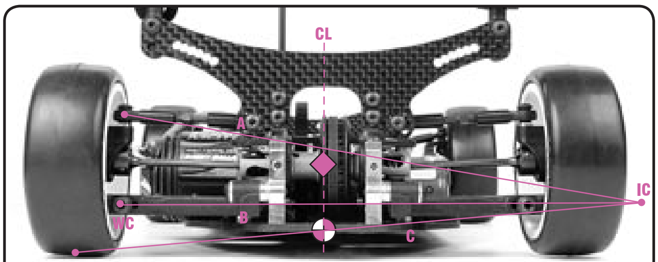
ADJUSTING REAR ROLL CENTER

Effect	Suspension Arm	Change the following… Inner Pivot	Change the following… Outer Pivot
Lowering rear roll center	Rear upper camber link	Raise and/or move inward the inner pivot mounting position using the XRAY Quick Roll Center positions on the shock tower.	
Lowering rear roll center	Rear upper camber link		• Lower the outer pivot by removing shims from in between the link and the hub. • Move the outer pivot to the outer mounting position on the hub.
Lowering rear roll center	Rear lower arm	Lower the position of the rear lower arm's inner pivot pin, using different suspension pin holders (lower value).	

Effect	Suspension Arm	Change the following… Inner Pivot	Change the following… Outer Pivot
Raising rear roll center	Rear upper camber link	Lower and/or move outward the inner pivot mounting position using XRAY Quick Roll Center positions on the shock tower.	
Raising rear roll center	Rear upper camber link		• Raise the outer pivot by adding shims in between the link and the hub. • Move the outer pivot to the inner mounting position on the hub.
Raising rear roll center	Rear lower arm	Raise the position of the rear lower arm's inner pivot pin, using different suspension pin holders (higher value).	



Lower Roll center (arms flatter)



Higher Roll center (arms more angled)

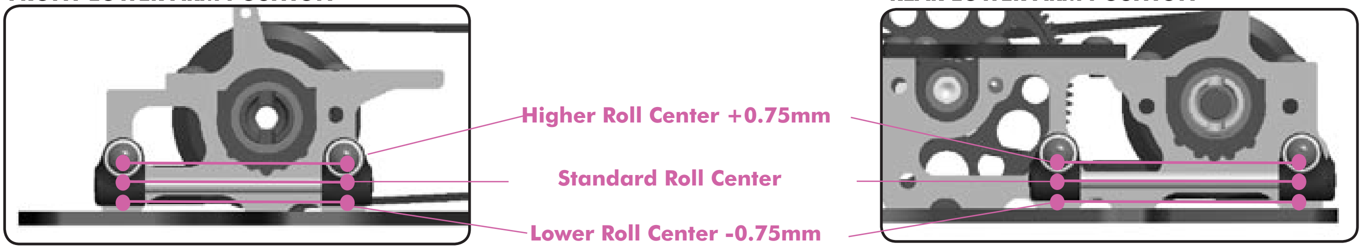
ROLL CENTER – ADJUSTING USING LOWER ARM POSITION

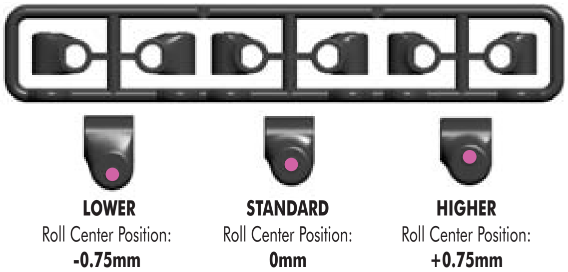
Adjusting the position of the lower arms will produce the largest changes in roll center. This is done by using the different offset lower suspension holders: 0mm (standard), +0.75mm (raised), and -0.75mm (lowered).

A) Raise the roll center – Raising the lower arm inner hinge pin will raise the roll center. Replace both of the arms standard 0mm suspension holders with +0.75mm suspension holders.

B) Lower the roll center – Lowering the lower arm inner hinge pin will lower the roll center. Replace both of the arms standard 0mm suspension holders with -0.75mm suspension holders.

FRONT LOWER ARM POSITION **REAR LOWER ARM POSITION**





ROLL CENTER - ADJUSTING USING UPPER CAMBER LINK POSITION

To fine tune the front or rear roll center, adjustments can be made to the angle and length of the camber links. Note that changing the upper link angle or length will affect the amount of camber rise/gain. The more angled the camber link, or shorter the length, the more camber gain the wheels will have as the chassis rolls.

The length of the camber links primarily affects camber gain primarily, but it also affects the rate at which the roll center shifts as the chassis rolls. Changing the camber link angle affects grip throughout the entire corner, while changing the length has more of an effect in the middle of the corners.

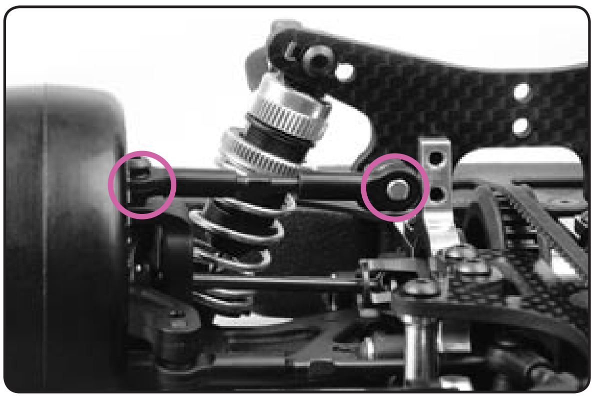
A) Raise the roll center (shorten or increase the angle of the links)
- Increase the height of the camber link OUTER ball joint by placing shims between the ball joint and the hub.
- Decrease the height of the camber link INNER ball joint by using one of the LOWER Quick Roll Center™ positions on the shock tower.
- Shorten the camber link by using one of the OUTER XRAY Quick Roll Center™ positions on the shock tower. Remember to mount the outer ball joint to the INNER mounting position on the hubs, and adjust the length to achieve the proper camber angle.

NOTE: Camber gain will increase as the chassis rolls.

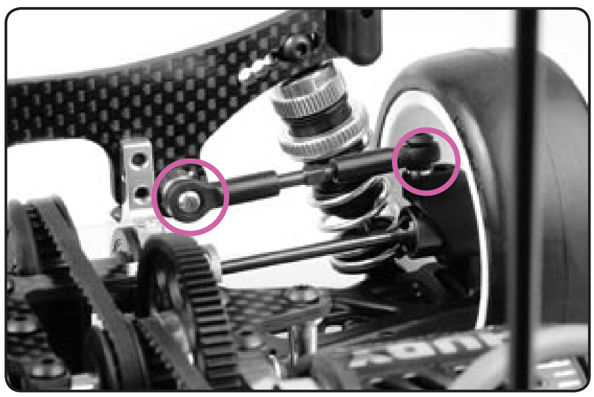
B) Lower the roll center (lengthen or decrease the angle of the links)
- Decrease the height of the camber link OUTER ball joint by removing shims in between the joint and the hub.
- Increase the height of the camber link INNER ball joint by using one of the upper XRAY Quick Roll Center™ positions on the shock tower
- Lengthen the camber link by using one of the INNER XRAY Quick Roll Center™ positions on the shock tower. Remember to mount the outer ball joint to the OUTER mounting position on the hubs, and adjust the length to achieve the proper camber angle.

NOTE: Camber gain will decrease as the chassis rolls. We recommend that the camber link always be angled so the outer ball joint is higher than the inner ball joint.

FRONT UPPER CAMBER LINK POSITION



REAR UPPER CAMBER LINK POSITION



XRAY MULTI-FLEX TECHNOLOGY™

Chassis flex (rigidity) is not a readily-available tuning option in typical RC cars. Up until now the nature of chassis technology resulted in a fixed amount of flex being built into each chassis plate and top deck. Therefore racers have always used chassis flex as an unchanging foundation from which they have used all other tuning options to dial in a working setup. Each major change in track and/or tire grip conditions required an entire re-build of their car with either a thicker or thinner chassis. This limitation reduced the ability for drivers to effectively adapt their car's fundamental setup from week-to-week, or race-to-race. Same day changes that were needed due to significant temperature or weather changes were simply out of the question.

With necessity being the mother of invention, the advent of top decks differing in width, mounting points and thickness have become the standard for tuning chassis flex. However, the flex characteristics they provide alone are still inadequate when extreme changes are needed.

With XRAY Multi-Flex Technology™ (MFT), drivers can now not only change the amount of overall flex to the extreme, but they are also able to fine-tune the differing characteristics of both torsional (twisting) and lateral (front to rear) flex. MFT works by simply using, or not using, the rigidity of the aluminum bulkheads between the chassis plate and top deck. For larger changes in flex, screws connecting the bulkheads to the chassis (at strategic locations) are either inserted or removed ; for fine tuning flex, screws mounting the top deck to the bulkheads are either inserted or removed. This provides the ability for the driver to change chassis flex, within minutes, from a stiff setting - resembling today's common 3mm+ chassis plate and wide/thick top deck (high grip foam racing) - to a flexible setting resembling today's common 2mm chassis plate with slim/thin top deck (low grip asphalt racing).

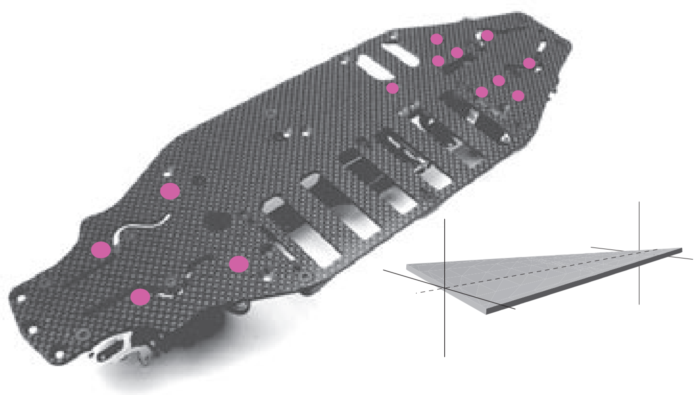
Utilizing this technology in conjunction with the rest of the T2 innovations from XRAY, drivers can now easily and quickly change the T2's fundamental setup without ever having to disassemble the chassis/deck/bulkhead and introduce unwanted chassis tweak.

With the MFT™ chassis and top deck you can easily adjust the T2 to three different flex characteristics (soft, medium, stiff) or anywhere in between to best suit your track conditions.

CHASSIS FLEX SETTING

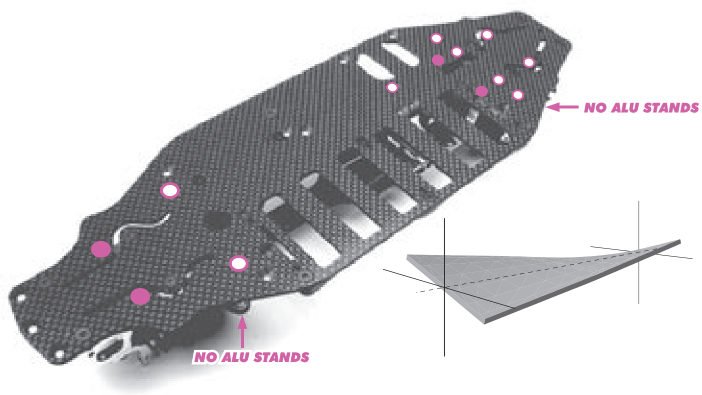
STIFF SETTING

- screw not used
- screw used



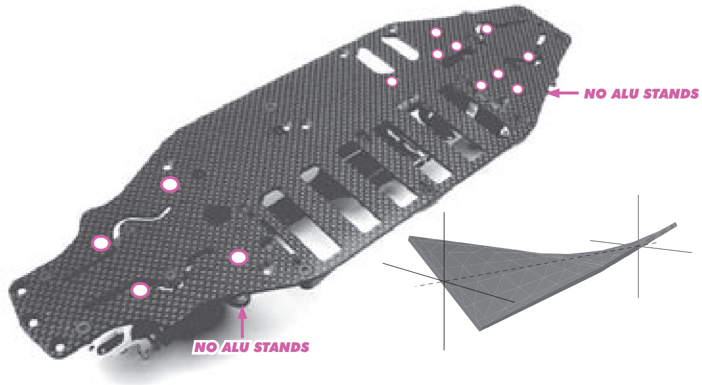
MEDIUM SETTING

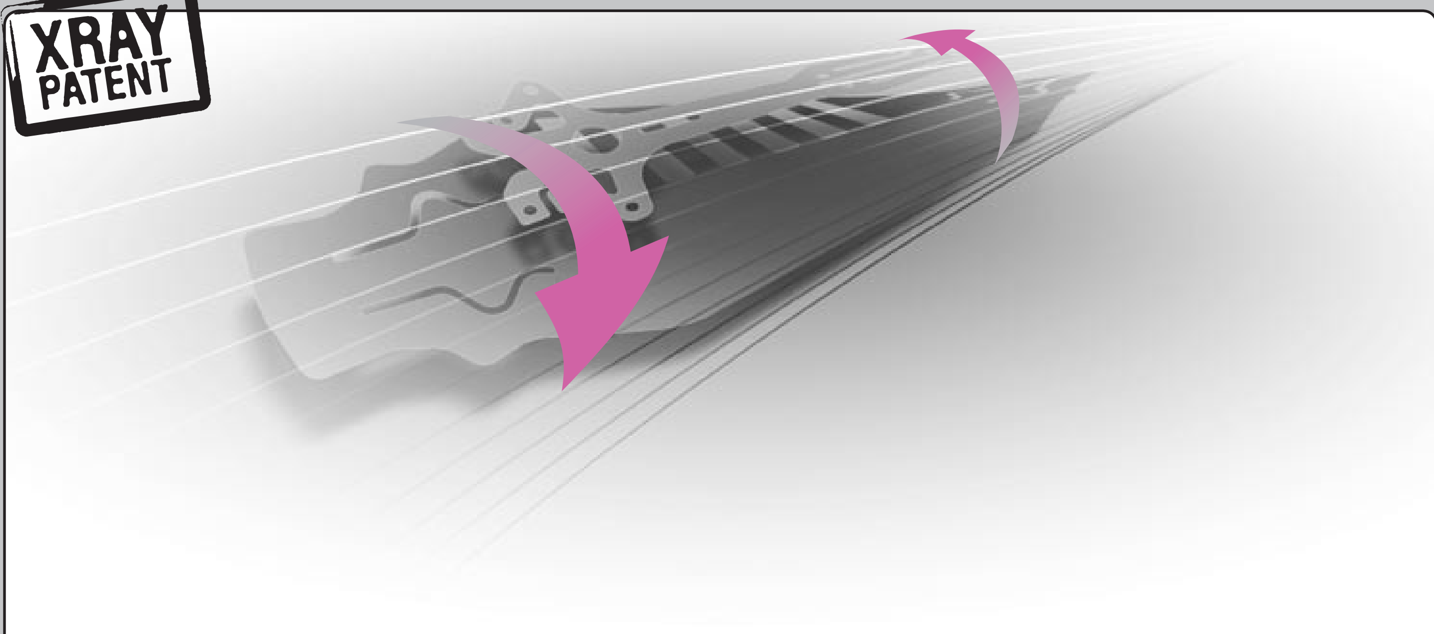
- screw not used
- screw used



SOFT SETTING

- screw not used
- screw used

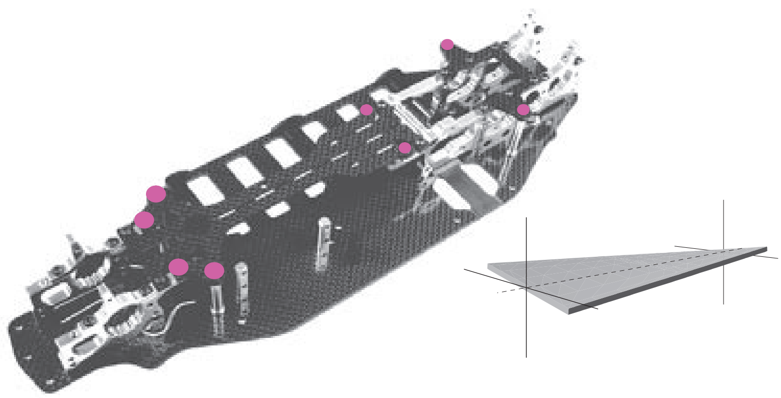




TOP-DECK FLEX SETTING

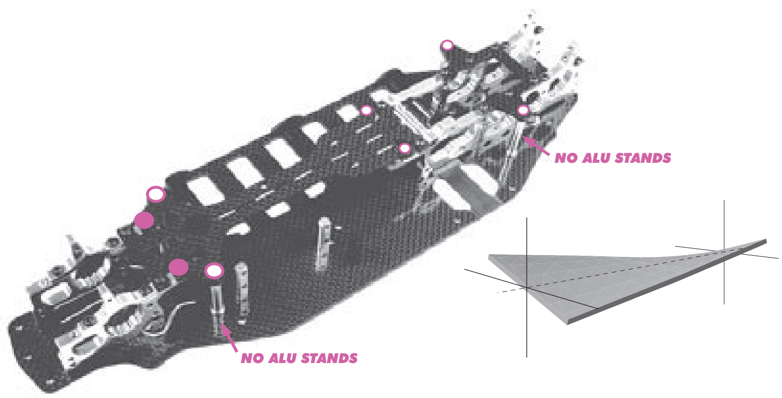
STIFF SETTING

- ○ screw not used
- ● screw used



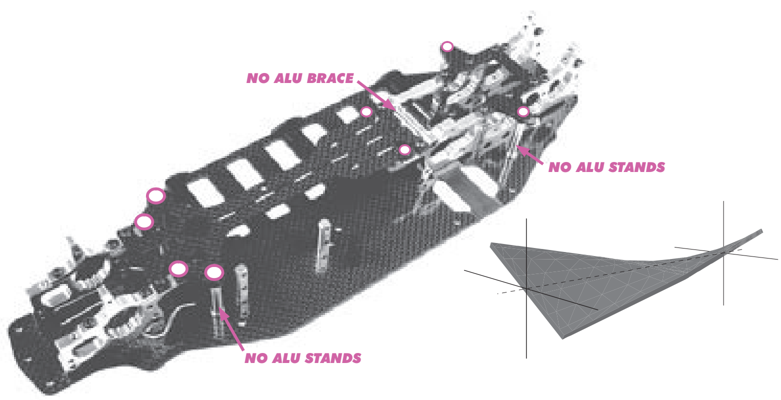
MEDIUM SETTING

- ○ screw not used
- ● screw used



SOFT SETTING

- ○ screw not used
- ● screw used

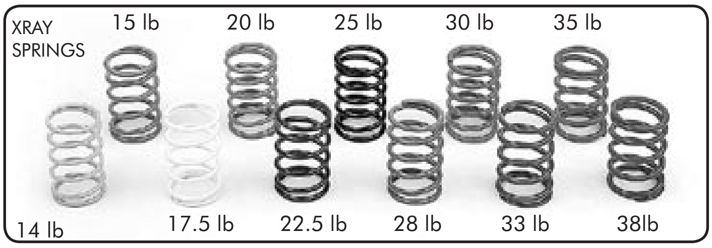


SHOCK ABSORBERS

Shock absorbers, or shocks, are the suspension components that allow the wheels to keep as much contact as possible with the track surface. The XRAY T3 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.

SPRINGS



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

Spring tension 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 tension. Spring tension 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 30lb) is considered "harder" since it will be more difficult to compress than a spring with a lower "spring weight" number (such as a 20lb spring).

XRAY 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; an XRAY silver spring will not have the same spring tension as a silver spring from another manufacturer.

EFFECTS OF SPRING SELECTION

Stiffer springs	• Makes the car more responsive. • Car reacts faster to steering inputs. • Stiff springs are suited for tight, high-traction tracks that aren't too bumpy. • Usually when you stiffen all of the springs, you lose a small amount of steering, and reduce chassis roll.
Softer springs	• Makes the car feel as if it has a little more traction in low grip conditions. • Better for bumpy and very large and open tracks. • Springs that are too soft make the car feel sluggish and slow, allowing more chassis roll.

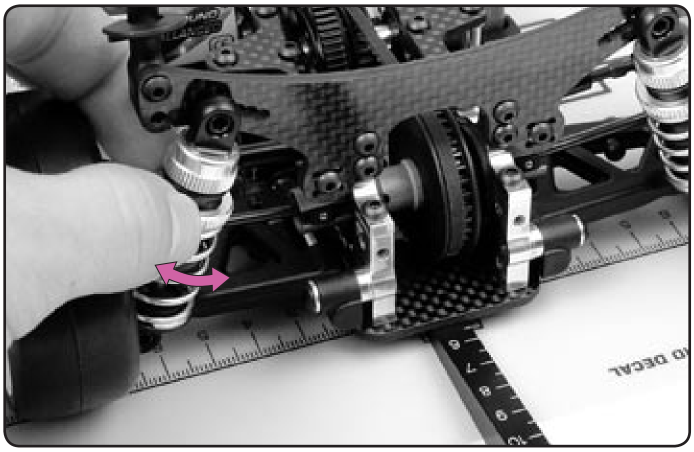
Stiffer front springs	• Increases mid-corner and corner-exit understeer. • Increases steering under braking. • Increases the car's responsiveness, but makes it more "nervous".
Softer front springs	• Makes the car have more steering, especially mid-corner and at corner exit. • Front springs that are too soft can make the car understeer under braking.
Stiffer rear springs	• Makes the car have less rear traction, but more steering mid-corner and at corner exit. This is especially apparent in long, high-speed corners.
Softer rear springs	• Makes the car have more rear side traction mid-corner, through bumpy sections, and while accelerating (forward traction).

30 8390	XRAY SELECTED ULTIMATE RACING SPRINGS (24)
30 8393	XRAY SPRING-SET D=1.4 (14 LB) YELLOW - SUPER-SOFT (4)
30 8394	XRAY SPRING-SET D=1.5 (17.5 LB) WHITE - SOFT (4)
30 8395	XRAY SPRING-SET D=1.6 (22.5 LB) BLUE - SOFT-MEDIUM (4)
30 8396	XRAY SPRING-SET D=1.7 (28 LB) VIOLET - MEDIUM (4)
30 8397	XRAY SPRING-SET D=1.8 (33 LB) PURPLE - MEDIUM-HARD (4)
30 8398	XRAY SPRING-SET D=1.9 (38 LB) RED - HARD (4)

30 8380	ADDITIONAL XRAY ULTIMATE RACING SPRINGS (20)
30 8384	XRAY SPRING-SET D=1.5 (15 LB) BLUE-GREEN (4)
30 8385	XRAY SPRING-SET D=1.6 (20 LB) LIGHT-BLUE (4)
30 8386	XRAY SPRING-SET D=1.7 (25 LB) DARK-BLUE (4)
30 8387	XRAY SPRING-SET D=1.8 (30 LB) LIGHT-PURPLE (4)
30 8388	XRAY SPRING-SET D=1.9 (35 LB) LIGHT-RED (4)

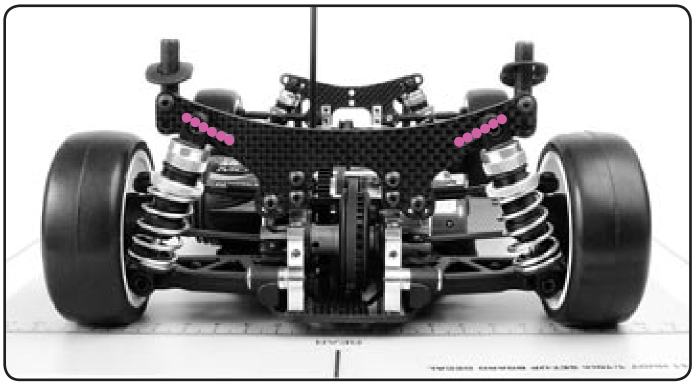
SPRING PRELOAD

PRELOAD SETTING	THREADED PRELOAD COLLAR
Increase	TIGHTEN collar so it moves DOWN the shock body.
Decrease	LOOSEN collar so it moves UP the shock body.



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 sections "Ride Height" and "Tweak."

SHOCK POSITION



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

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 XRAY Silicone Shock Oil, which is available in numerous viscosities. XRAY Silicone Shock Oil is specially formulated to be temperature-resistant and low-foaming for use in XRAY shocks. To be able to compare your setup with other XRAY drivers, we advise using only XRAY Silicone Shock Oil.

30 9520	SILICONE OIL 20W
30 9525	SILICONE OIL 25W
30 9530	SILICONE OIL 30W
30 9535	SILICONE OIL 35W
30 9540	SILICONE OIL 40W
30 9550	SILICONE OIL 50W

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.

T3 features non-adjustable or adjustable shock pistons.

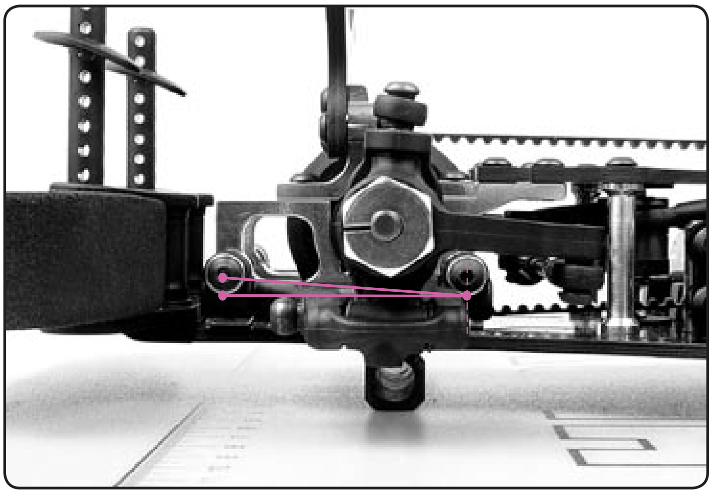
- Non-adjustable pistons usually use a 1-piece piston with a set number of holes in it. To change the shock damping, you must disassemble the shocks and replace the piston with another piston with a different number of holes.

- Adjustable pistons come in different forms, but the main idea behind them is that you can change the shock damping by altering the shock pistons without having to disassemble the shocks and changing pistons. Adjusting the shock pistons may compress an internal O-ring in the piston, or may align a different number of holes in the pistons.

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	• Slower steering response.
			• Decreases initial steering at corner entry.
			• Increases oversteer at corner exit/under acceleration.
Harder Damping	Thicker	Less holes	• Faster steering response.
			• Increases initial steering at corner entry.
			• Increases understeer at corner exit/under acceleration.
Rear Shocks			
Softer Damping	Thinner	More holes	• Faster steering response.
			• Increases rear grip at corner exit/under acceleration.
			• Decreases rear grip under braking.
Harder Damping	Thicker	Less holes	• Slower steering response.
			• Decreases rear grip at corner exit/under acceleration.
			• Increases rear grip under braking.



Front anti-dive is used as a tuning aid to run a softer front spring rate without introducing a tendency to dive downward too much in the front under braking. In order to prevent 100% of the cars weight transfer force from being exerted onto the softer springs anti-dive is used to allow a certain percentage of the weight transfer to be absorbed by the front lower arms.

Pro-dive (front kickup) is used as a tuning aid to increase corner entry and exit steering. Pro-dive angles the arms to where more pressure is exerted onto the springs off-power as the car's weight shifts forward. In addition, the angle increases overall caster and therefore corner exit steering is also increased.

Either option is accomplished by angling the front lower arms so that the rear hinge is positioned higher (anti-dive) or lower (pro-dive) - compared to the front hinge - when looked at from the side of the car.

EFFECTS OF FRONT DIVE ADJUSTMENT

Anti-dive - the FRONT arms are angled DOWNWARD from the center forward with the rear suspension holder mounted higher than the front suspension holder:

ANTI-DIVE front arms angled DOWNWARD	• The front suspension resists compressing on corner entry. Off-power steering and front end grip is reduced by transferring less weight forward on corner entry. • The front suspension takes longer to reach its maximum roll point allowed by the springs in the corner. Mid-corner steering and front end grip is reduced until the throttle is applied. • The front suspension will promote compression on corner exit. However, on-power steering is decreased due to reduction in caster. On-power steering will increase only if C-hub caster is increased to compensate. • Reduces the ability for the front suspension to handle large or successive bumps. This can be countered by using softer front springs. • Works well for cars with a forward weight bias when grip is medium-to-high.

Pro-dive or "front kick-up" - the FRONT arms are angled UPWARD from the center forward with the front suspension holder mounted higher than the rear suspension holder:

PRO-DIVE / KICK-UP front arms angled UPWARD	• Off-power steering and front end grip is increased on corner entry by transferring more weight forward on corner entry. • Mid corner steering and front end grip is increased. • On-power steering and front end grip is increased on corner exit if C-hub caster remains unchanged and there is minimal front droop to allow the front end to lift. This is due to the fact that the overall caster is increased by the arms' new angle. • Increases the ability for the front suspension to handle large or successive bumps.

ADJUSTING FRONT DIVE

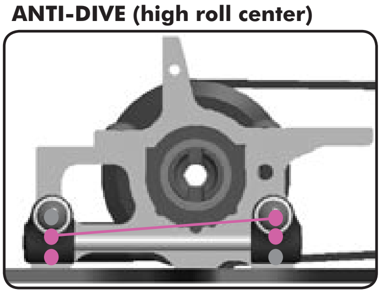
Front dive is adjusted by using different eccentric suspension holders. There are thee different eccentric holders marked with a dot. Always use same suspension holders on left and right sides.

LOWER
Pin Position:
-0.75mm

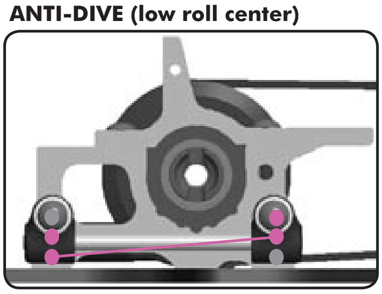
STANDARD
Pin Position:
0mm

HIGHER
Pin Position:
+0.75mm

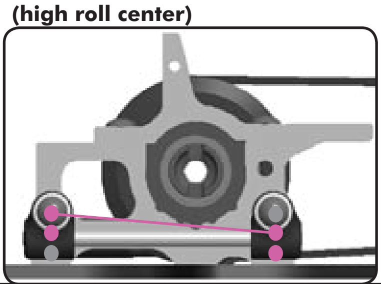
ANTI-DIVE (high roll center)



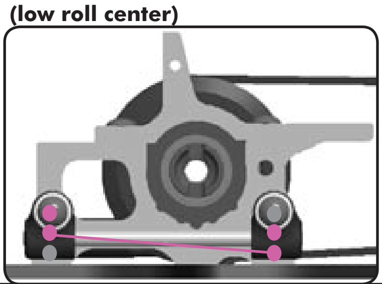
ANTI-DIVE (low roll center)



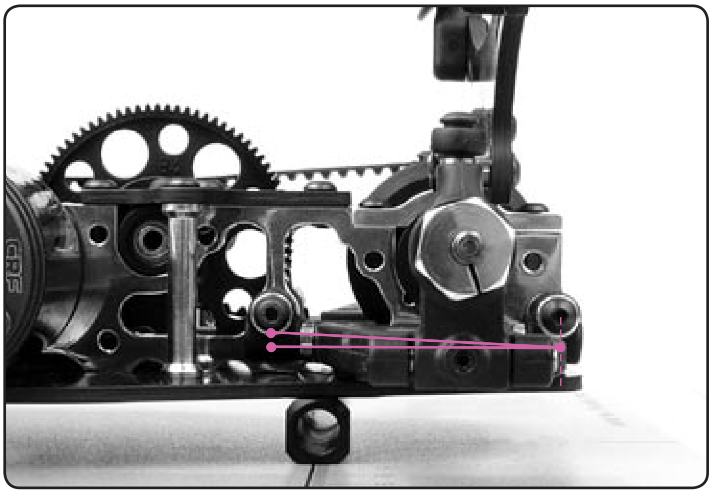
PRO-DIVE / KICK-UP (high roll center)



PRO-DIVE / KICK-UP (low roll center)



SQUAT (REAR)



Rear anti-squat is used as a tuning aid primarily when cars need to run a soft rear spring rate and they have a tendency for the rear end to squat down too much under acceleration. An added benefit of anti-squat is quicker initial acceleration at the start of a race. In order to prevent 100% of the car's weight transfer force from being exerted onto the softer springs, anti-squat is used to allow a certain percentage of the weight transfer to be absorbed by the rear lower arm motion.

Pro-squat is used as a tuning aid to increase corner entry steering and corner exit rear grip. This is a useful option for low grip asphalt conditions.

Either option is accomplished by angling the rear lower arms so the rear hinge is positioned higher (pro-squat) or lower (anti-squat) - compared to the front hinge - when looked at from the side of the car.

EFFECTS OF REAR SQUAT ADJUSTMENT

Anti-squat - the REAR arms are angled DOWNWARD from the center rearward with the front suspension holder mounted higher than the rear suspension holder:

ANTI-SQUAT (REAR KICK-UP) rear arms angled DOWNWARD	• The rear suspension resists lifting on corner entry. Off-power steering may be reduced when using a stiffer front spring and little rear droop. • The rear suspension will reach its maximum roll point more quickly. Mid-corner steering is reduced until the throttle is applied. • The rear suspension will resist squatting on corner exit. On-power steering is increased immediately after the throttle is applied by transferring less weight rearward and reducing rear end grip on corner exit. • Increases the ability for the rear suspension to handle large or successive bumps.

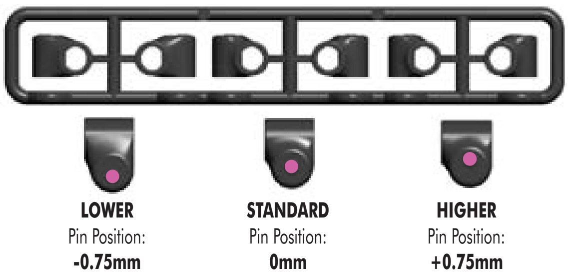
Pro-squat - the REAR arms are angled UPWARD from the center rearward with the front suspension holder mounted lower than the rear suspension holder:

PRO-SQUAT rear arms angled UPWARD	• Off-power steering is increased significantly by transferring more weight forward and reducing rear end grip on corner entry, unless there is minimal rear droop to allow the rear end to lift. • Mid-corner steering is increased by reducing rear end grip until the throttle is applied. • On-power steering is reduced immediately after the throttle is applied by transferring more weight rearward and increasing rear end grip on corner exit. • Decreases the ability for the rear suspension to handle large or successive bumps. • Works well for rubber tires on low-grip smooth asphalt.

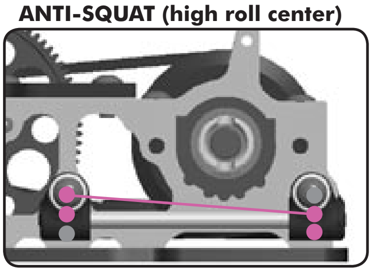
All of these options usually make the car's steering more responsive to throttle changes in the corner. Increasing or decreasing droop at the end of the car where you have implemented anti/pro-dive/squat, will have an effect on whether the arms' angle creates the affects stated above during on-throttle, off-throttle or both. Keep in mind that if your rear ride height is higher than the front, then your arms are already tilted in relation to the track surface which gives you a small effect similar to anti-dive and pro-squat on corner entry only. The more rear droop you have, the more the effect. But since the rear springs are usually softer and compress more under acceleration, there is no mid-corner or on-power effect that you would have with actual anti-dive and pro-squat.

ADJUSTING REAR SQUAT

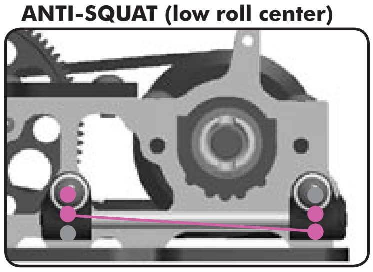
Rear squat is adjusted by using different eccentric suspension holders. There are thee different eccentric holders marked with a dot. Always use the same suspension holders on left and right sides.



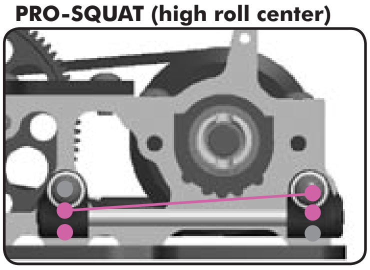
ANTI-SQUAT (high roll center)



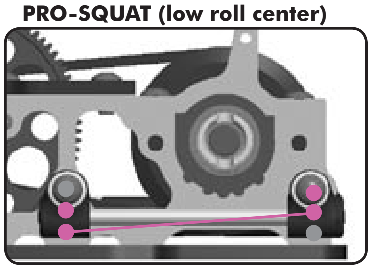
ANTI-SQUAT (low roll center)

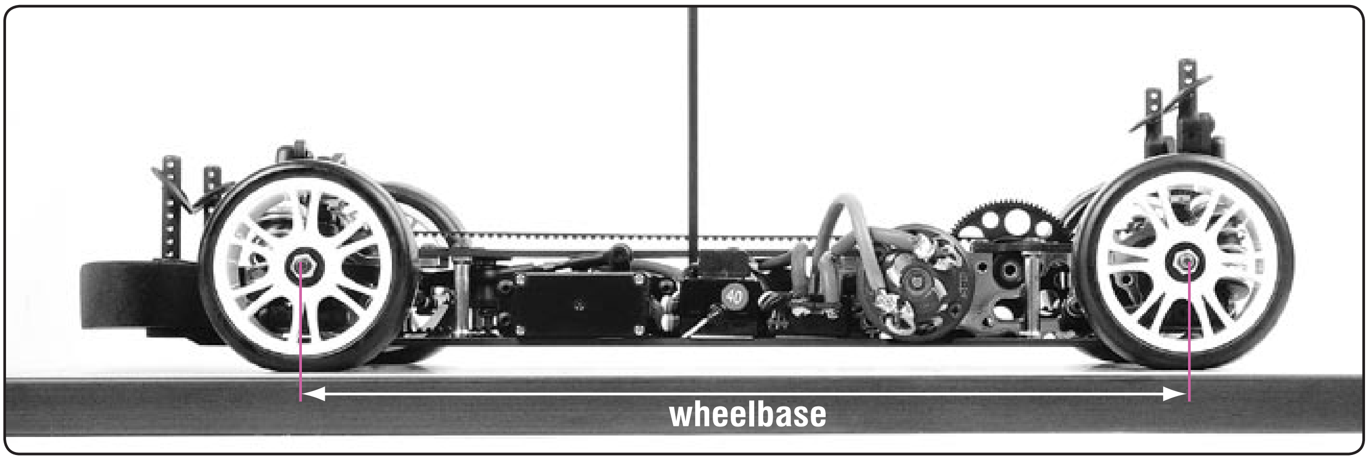


PRO-SQUAT (high roll center)



PRO-SQUAT (low roll center)





Wheelbase refers to the horizontal distance between the front and rear axles. Changes to wheelbase can have a dramatic effect on the handling of your car, since it readjusts the distribution of weight on the wheels, which adjusts traction. Not all R/C cars have the option to adjust the wheelbase.

By adjusting the wheelbase at one end of the car, you affect the traction at that end of the car. For example, by shortening the wheelbase at the rear of the car, you place more weight over the rear wheels (resulting in more rear traction.)

EFFECTS OF WHEELBASE ADJUSTMENT

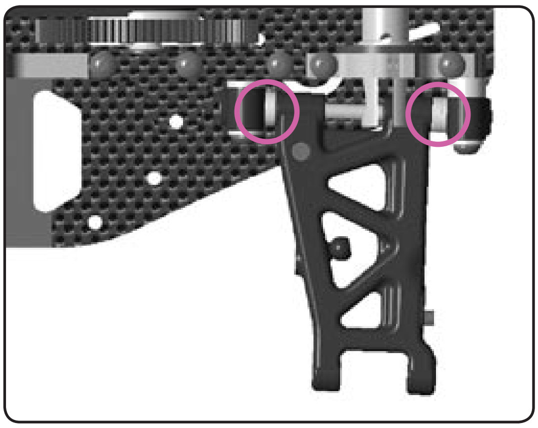
Longer wheelbase	• Car more difficult to turn around sharp corners. • Increased stability. • Better handling over bumps and ruts. • Better on more open tracks with high-speed corners.
Shorter wheelbase	• Car turns sharp corners more easily. • Increased steering response. • Better on tighter, more technical tracks.

ADJUSTING WHEELBASE

Wheelbase is adjusted by using shims of different thickness on the rear lower (inner) pivot pins in front and behind the rear lower arm. There is a total 5mm adjustment range of the wheelbase, 255~260mm.

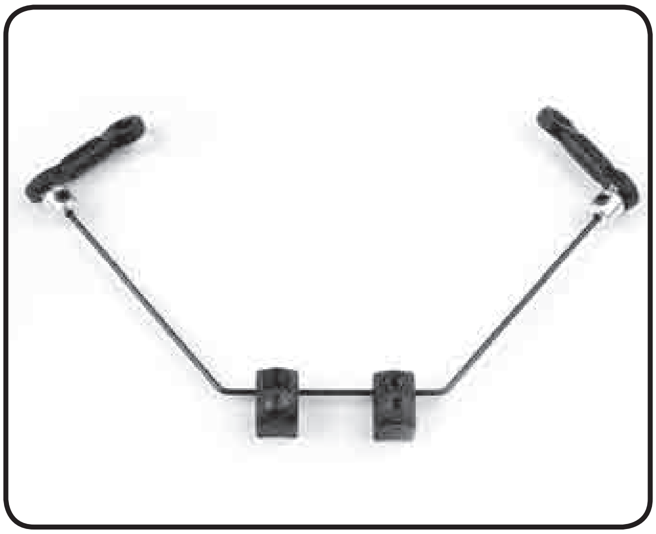
Use the following shims to adjust wheelbase:

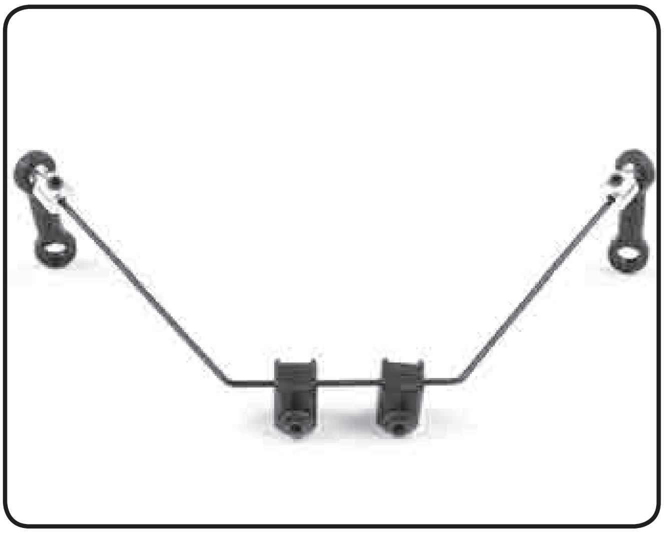
30 3122	ALU SHIM 3x6x1.0MM (10)
30 3123	ALU SHIM 3x6x2.0MM (10)



Wheelbase (mm)	Use these shims (mm)	
	Front of rear arm	**Behind rear arm**
255		2+2+1
256	1	2+2
257	2	2+1
258	2+1	2
259	2+2	1
260	2+2+1	

ANTI-ROLL BARS





Anti-roll bars are used to adjust the car's side (lateral) grip. They can also be used in conjunction with a softer spring rate to handle bumpy tracks more efficiently without excessive chassis roll at mid-corner. Anti-roll bars resist chassis roll and by doing so transfer wheel load from the inside wheel to the outside wheel. The stiffer the anti-roll bar, the more load is transferred. 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 stiffness 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 traction of a car cannot be changed, but it can be balanced by distributing wheel loads. Anti-roll bars are a very useful tool to change the balance of the car. Chassis stiffness plays a very important role in the effectiveness of anti-roll bars, 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

STIFFER	• Decreases chassis roll. • Decreases front grip (increases rear grip). • Decreases off-power steering at corner entry. • Quicker steering response.
SOFTER	• Increases chassis roll. • Increases front grip (decreases rear grip). • Increases off-power steering at corner entry. • Slower steering response.

REAR ANTI-ROLL BAR

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

EFFECTS OF REAR ANTI-ROLL BAR ADJUSTMENT

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

ADJUSTING ANTI-ROLL BARS

To adjust the anti-roll bar stiffness you need to exchange the anti-roll bar wires which are available in different thickness. #302401 Front and #303401 Rear Anti-roll Bars include 1.2, 1.4 and 1.6mm anti-roll bars.

Modern R/C cars can use several different types of front and rear axles. The choice of front and rear axles depends on track conditions and driving style. You may use any combination of front and rear axles, but some work better together than others.

Front Axles	Rear Axles
• ball differential • front one-way axle* • solid one-way axle* • solid front axle*	• ball differential • solid axle

* Modes available in XRAY Multi-Diff™

BALL 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.

For optimal performance, a ball diff should be as free as possible, with no (minimal) slippage. Make sure the diff does not slip under power; this causes power loss and excessive wear of the diff.

Depending on the design of the ball differential, the diff may or may not be externally adjustable. Externally-adjustable ball differentials can be easily adjusted while in the car. This enables very quick changes to the steering characteristic and overall behavior of the car.

FRONT BALL DIFFERENTIAL

Using a front differential combines some of the braking advantages of the solid front axle while allowing inner-outer wheel speed difference.

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

On very high traction surfaces, both front and rear diffs can be adjusted tighter for better response.

EFFECTS OF FRONT BALL DIFF ADJUSTMENT

TIGHTER	• Decreased steering response. • More stability under braking, but less turn in. • Better on power steering at corner exit.
LOOSER	• Increased steering response. • Less stable under braking but better turn in. • Car will understeer on power at corner exit.

REAR BALL DIFFERENTIAL

A rear differential has the same construction as a front ball differential. A rear differential is a very common choice for the rear axle type, and it can be combined with all front axle types. Drawbacks of the rear differential are that the weight and inertia are considerably higher than the solid axle, and more maintenance is required.

EFFECTS OF REAR BALL DIFF ADJUSTMENT

TIGHTER	• Car understeers slightly at corner entry, but makes the car more difficult to control at corner exit (powerslides). • Increased on-throttle steering. • Usually better on high-traction surfaces, but may decrease rear end stability at mid corner.
LOOSER	• More stability mid corner and corner exit. • Understeer on-throttle. • Better on low-traction surfaces or in conjunction with a front one-way.

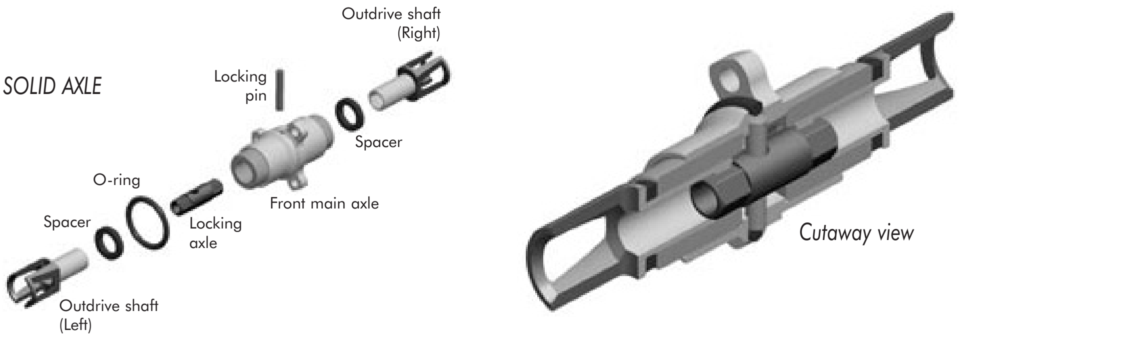
SOLID AXLES

A solid axle ties both left and right wheels together so they rotate at the same speed at all times. The effect of a solid axle is dependent on which end of the car it is used on, and the other type of axle being used with it.

REAR SOLID AXLE

The rear solid axle is typically used when track grip is very high. It is most commonly used with the front one-way axle. Note that when using this combination of axles, braking is only done by the rear wheels; you may have to adapt your driving style to compensate for this.

FRONT FULL-TIME SOLID AXLE



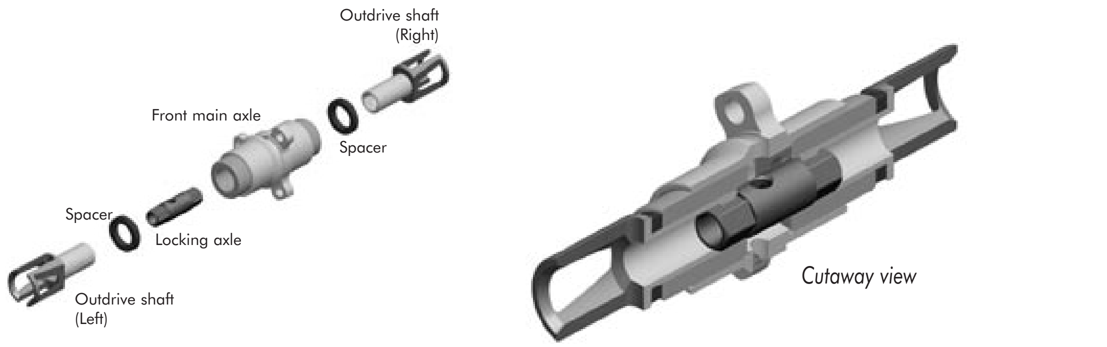
When using an XRAY Multi-Diff™ in "full-time solid axle" mode, both outdrive shafts (left and right) are connected to front main axle by internal locking axle and locking pin. The car achieves maximum 4WD braking, while being very stable and easy to drive.

Off-power and on-power:	Both front wheels rotate at same speed, matched to speed of front main axle.
Best used with:	rear ball differential
Best used when:	there is low-to-medium traction, and the leans towards off-power oversteer and/or the track requires braking for the corners. Using this axle gives less off-power steering and efficiency (less runtime). Best suited to an aggressive driving style.

A front full-time solid axle is typically used on large open outdoor tracks, or tracks that feature braking areas or slippery (low traction) conditions. A front solid axle increases on-power steering, and allows the car to brake using all four wheels. This lets you brake much later than if you were using a front one-way axle (which would give rear wheel braking only). Overall, using the front solid axle makes the car quite easy to drive.

Considerations: With a front solid axle, there is less off-power steering, and the car becomes more sensitive to tire diameter differences. To compensate for these effects, changes can be made to the suspension (for example, roll center, front spring rate and/or damping, shock position, or caster).

FRONT SOLID ONE-WAY AXLE



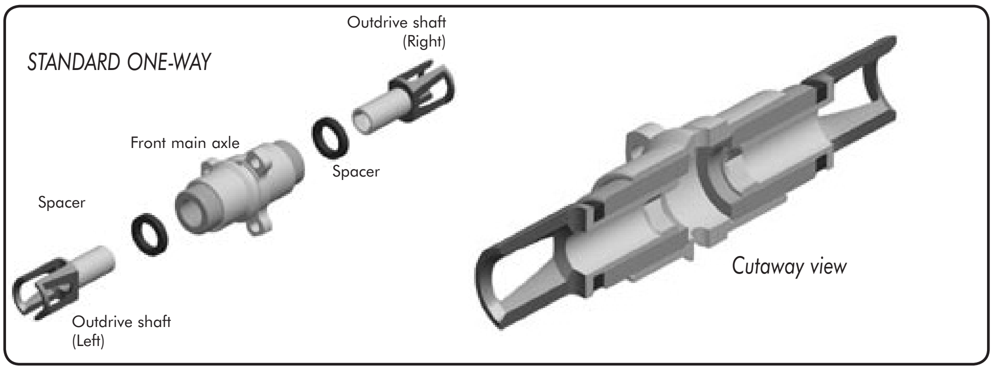
When using an XRAY Multi-Diff™ in "one-way" mode, outdrive shafts (left and right) are not connected to each other, nor to front main axle.
This mode combines the characteristics of a solid axle and a differential.

Off-power:	Both front wheels rotate forward together (but independently of the front main axle).
On-power:	Both front wheels rotate forward together (locked in one-way bearings), at same speed as front main axle.
Best used when:	there is medium-to-high traction, and the track does not require braking for the corners. Will give good off-power steering and efficiency.

ONE-WAY AXLES

There are two types of one-way axles for use in an R/C car. The most common is a front one-way axle; the other is a central one-way pulley.

FRONT ONE-WAY AXLE



When using an XRAY Multi-Diff™ in "one-way" mode, outdrive shafts (left and right) are not connected to each other, nor to front main axle. This mode combines the characteristics of a solid axle and a differential.

Off-power & braking (corner entry & mid-corner):	Front inner and outer wheels rotate forward independently of each other, making axle behave like a front ball differential. There is NO front braking.
On-power (mid-corner and corner exit)	Both front wheels rotate with front main axle (locked in one-way bearings) at the same speed, making axle behave like a front solid axle. Introduces some on-power understeer.
Best used with:	rear differential or solid rear axle.
Best used when:	traction is high, the car leans towards off-power understeer and the track does not require braking for the corners. Will give maximum off-power steering and increase efficiency (more runtime). Best suited to a smooth driving style.

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.

Considerations: It is very important to know that when using a front one-way axle, you get no front wheel braking. While this gives you better steering response going into a corner, the effect may cause the rear of the car to break traction more easily.

ONE-WAY PULLEY

The optional one-way pulley for the T3 is a pulley on a one-way bearing, which rides on the central layshaft. This pulley is connected to the front axle. The one-way pulley allows the front wheels to spin independently from the rear wheels.

The adjustable one-way pulley is used to set how freely the front axle turns in relation to the rear axle. You can tighten the adjustment of the one-way pulley on the layshaft; from fully-tightened to lock the front wheels to the rear (full-time 4WD) to fully-loosened to let the front free wheel off-power (4WD on-throttle, RWD off-throttle). Or it can be set somewhere in between to match your driving style.

EFFECTS OF ONE-WAY PULLEY ADJUSTMENT

Looser	• More off-power steering. • Less drive train drag at maximum speed. • Increased top speed. • Should only be used on high traction surfaces or large tracks where minimal braking is required. Since only the rear wheels are used for braking, spins induced by a locked rear tire are more likely.
Tighter	• Lessens steering. • Better braking. • More drive train drag. • Better under slippery conditions.

FRONT ONE-WAY AXLE VS. ONE-WAY PULLEY

When using a front differential and a one-way pulley, you still get differential action under acceleration. That means that when going through a corner on-throttle, if the inside wheel breaks traction it can still "unload" and prevent the outer wheel from getting any power. A front one-way axle gets around this problem by giving each wheel its own independent one-way bearing. That way, the two wheels can rotate at different rates, like with a regular differential, but on-throttle, if one wheel loses traction, the other one still gets power to pull the car through the corner.

Keep in mind that when using the one-way pulley with a loose setting or when using the front one-way axle, no drag brake should be used. Most racers will also find it more convenient to set their radio to give less braking action (use the throttle EPA setting); this will prevent the rear tires from locking unexpectedly.

Use table below as a general guideline for the use of a front one-way axle and one-way pulley.

Track surface	One-Way Pulley		Front One-Way Axle
	Tight	Loose	
Low traction	✓		
Medium traction (slow, tight corners)	✓	✓	
High traction (slow, tight corners)		✓	
High traction (fast, sweeping corners)			✓

GEARING

Proper gearing is one of the most essential tuning options required to maximize the performance potential of a touring car. The key to proper gearing is finding and maintaining the best "rollout" for each track environment, motor/chassis setup and driving style.

Rollout is the distance a car will travel in one revolution of the motor shaft. Pinion and spur gears are used to generate the rollout desired, considering the diameter of the tires mounted. Rollout determines top speed and acceleration. Usually a higher rollout will provide less acceleration and more top speed, and a lower rollout will be quicker off the line, but with less top speed. However, electric motors generate their maximum torque at only 1 RPM and lose torque as the RPM increases. With this in mind, it is possible to lose too much low-end torque needed to effectively accelerate the weight of the car out of a slow corner by undergearing to a smaller rollout and having the motor at too high RPM with very little useable torque. On the other side of the spectrum, if a motor is overgeared at too high of a rollout, the excessive torque will draw amperage from the batteries too quickly and cause the motor to heat up too fast and literally start to burn internally and destroy itself. A "best case scenario" is that your batteries won't last an entire race, and a worst case scenario is that your motor will be completely unusable to race again.

In order to accelerate the process of dialing in the best gearing combination at a track that you have never raced at, it is recommended that you ask fellow drivers using the same brand and model of motor for their rollout. Using this information and the calculations explained below, you will be able to match your car's rollout to theirs as a good starting point, regardless of the differences between cars.

NOTE: Keep in mind that all of the numbered values in this example will not necessarily yield the same results for your model of car!

DRIVE TRAIN RATIO (DTR) - INTERNAL RATIO

The "drive train ratio" (DTR) is the ratio of all the internal gears from the transmission, including differentials and pulleys. The drive train ratio is usually different for each model of car. Your owner's manual should provide this information, but keep in mind that some manufacturers use the words "transmission reduction" to indicate the DTR. The DTR in most cases cannot be changed, unless you are able to change the number of teeth on the pulleys and/or gears.

The T3 has a DTR of 1.9.

PRIMARY DRIVE RATIO (PDR)

The "primary drive ratio" (PDR) is the ratio between the pinion and spur gear. This number is commonly rounded up to the nearest thousandth after the decimal point.

Spur / Pinion = PDR

Sample PDR: 84T spur / 22T pinion = 3.818

FINAL DRIVE RATIO (FDR)

The "final drive ratio" (FDR) is the ratio between the DTR and the PDR. This number is commonly rounded up to the nearest hundredth after the decimal point.

PDR x DTR = FDR

Sample FDR: 3.818 x 1.9 = 7.25

ROLLOUT

Rollout is the distance that the car moves forward for one revolution of the motor shaft (or pinion gear). Rollout is not affected by the motor, batteries, or electric components you are using; it simply defines how all of the gears, belts/shafts and tires work together to make the car accelerate and reach top speed.

Rollout is calculated using the circumference of a tire and therefore the diameter of both foam and rubber tires make a difference. The diameter is more important if using foam tires since they can be used with a diameter anywhere from 64mm down to 54mm. As foam tires wear and get smaller, your rollout value will change a lot more quickly. Rubber tires do not wear down nearly as quickly or as much so the change to rollout will be very small over time.

Tire circumference is commonly rounded up to the nearest hundredth after the decimal point. Rollout is commonly rounded up to the nearest thousandth after the decimal point for American standard (inches), and to the nearest tenth after the decimal point for Metric. Most rubber tires have a diameter of 63mm (2.480 inches).

Tire Diameter x 3.14 (value of PI) = Tire Circumference

Tire Circumference / FDR = Rollout

Sample tire circumference: 63mm x 3.14 = 197.82mm
(or 7.788 inches)

Sample standard rollout: 197.82mm / 7.25 = 27.27mm
7.788" / 7.25 = 1.07"

The calculated rollout shows that the car will travel 27.27 mm (1.07 inches) for each revolution of the motor shaft.

Some gear combinations will yield similar results. For example, with 63mm rubber tires:

84/22 (spur/pinion) results in an FDR of 7.25 and a rollout of 27.27mm
87/23 (spur/pinion) results in an FDR of 7.19 and a rollout of 27.52mm

Increasing the number of teeth on the pinion by 1 is similar to increasing the number of teeth by 3~4 on a 48-pitch spur, and by 4 teeth on a 64-pitch spur. This knowledge is very useful, due to the fact that the size of the spur and pinion dictates the forward/rearward position of the motor in the chassis. The closer the motor to the front, the more overall steering the car will have and vice versa.

Final Drive Ratio (FDR) Chart

SPUR GEAR 48 PITCH

PINION SIZE	80	81	82	83	84	85	86	87
13	10.46	10.59	10.72	10.85	10.98	11.12	11.25	11.38
14	9.71	9.84	9.96	10.08	10.20	10.32	10.44	10.56
15	9.07	9.18	9.29	9.41	9.52	9.63	9.75	9.86
16	8.50	8.61	8.71	8.82	8.92	9.03	9.14	9.24
17	8.00	8.10	8.20	8.30	8.40	8.50	8.60	8.70
18	7.56	7.65	7.74	7.84	7.93	8.03	8.12	8.22
19	7.16	7.25	7.34	7.43	7.52	7.61	7.69	7.78
20	6.80	6.89	6.97	7.06	7.14	7.23	7.31	7.40
21	6.48	6.56	6.64	6.72	6.80	6.88	6.96	7.04
22	6.18	6.26	6.34	6.41	6.49	6.57	6.65	6.72
23	5.91	5.99	6.06	6.13	6.21	6.28	6.36	6.43
24	5.67	5.74	5.81	5.88	5.95	6.02	6.09	6.16
25	5.44	5.51	5.58	5.64	5.71	5.78	5.85	5.92
26	5.23	5.30	5.36	5.43	5.49	5.56	5.62	5.69
27	5.04	5.10	5.16	5.23	5.29	5.35	5.41	5.48
28	4.86	4.92	4.98	5.04	5.10	5.16	5.22	5.28

Final Drive Ratio (FDR) Chart

SPUR GEAR 64 PITCH

PINION SIZE	110	111	112	113	114	115	116	117	118
19	9.84	9.93	10.02	10.11	10.20	10.29	10.38	10.47	10.56
20	9.35	9.43	9.52	9.61	9.69	9.78	9.86	9.94	10.03
21	8.90	8.99	9.07	9.15	9.23	9.31	9.39	9.47	9.55
22	8.50	8.58	8.65	8.73	8.81	8.89	8.96	9.04	9.12
23	8.13	8.20	8.28	8.35	8.43	8.50	8.57	8.65	8.72
24	7.79	7.86	7.93	8.00	8.07	8.15	8.22	8.29	8.36
25	7.48	7.55	7.62	7.68	7.75	7.82	7.89	7.96	8.02
26	7.19	7.26	7.32	7.39	7.45	7.52	7.58	7.65	7.72
27	6.93	6.99	7.05	7.11	7.18	7.24	7.30	7.37	7.43
28	6.68	6.74	6.80	6.86	6.92	6.98	7.04	7.10	7.16
29	6.45	6.51	6.57	6.62	6.68	6.74	6.80	6.86	6.92
30	6.23	6.29	6.35	6.40	6.46	6.52	6.57	6.63	6.69
31	6.03	6.09	6.14	6.20	6.25	6.31	6.36	6.42	6.47
32	5.84	5.90	5.95	6.00	6.06	6.11	6.16	6.22	6.27
33	5.67	5.72	5.77	5.82	5.87	5.92	5.98	6.03	6.08
34	5.50	5.55	5.60	5.65	5.70	5.75	5.80	5.85	5.90

Rubber Tire Rollout Chart (63mm diameter)

SPUR GEAR48 Pitch Spurs

PINION SIZE	80	81	82	83	84	85	86	87
13	18.92	18.69	18.46	18.24	18.02	17.81	17.60	17.40
14	20.37	20.12	19.88	19.64	19.40	19.18	18.95	18.73
15	21.83	21.56	21.30	21.04	20.79	20.55	20.31	20.07
16	23.28	23.00	22.72	22.44	22.18	21.92	21.66	21.41
17	24.74	24.43	24.14	23.85	23.56	23.28	23.01	22.75
18	26.20	25.87	25.56	25.25	24.95	24.65	24.37	24.09
19	27.65	27.31	26.98	26.65	26.33	26.02	25.72	25.43
20	29.11	28.75	28.40	28.05	27.72	27.39	27.08	26.76
21	30.56	30.18	29.82	29.46	29.11	28.76	28.43	28.10
22	32.02	31.62	31.24	30.86	30.49	30.13	29.78	29.44
23	33.47	33.06	32.66	32.26	31.88	31.50	31.14	30.78
24	34.93	34.50	34.08	33.66	33.26	32.87	32.49	32.12
25	36.38	35.93	35.50	35.07	34.65	34.24	33.84	33.46
26	37.84	37.37	36.91	36.47	36.04	35.61	35.20	34.79
27	39.29	38.81	38.33	37.87	37.42	36.98	36.55	36.13
28	40.75	40.25	39.75	39.28	38.81	38.35	37.91	37.47

Foam Tire Rollout Chart (116 Tooth 64P Spur)

TIRE DIAMETER

PINION SIZE	53	54	55	56	57	58	59	60	61	62	63
19	16.04	16.35	16.65	16.95	17.25	17.56	17.86	18.16	18.46	18.77	19.07
20	16.89	17.21	17.52	17.84	18.16	18.48	18.80	19.12	19.44	19.75	20.07
21	17.73	18.07	18.40	18.73	19.07	19.40	19.74	20.07	20.41	20.74	21.08
22	18.58	18.93	19.28	19.63	19.98	20.33	20.68	21.03	21.38	21.73	22.08
23	19.42	19.79	20.15	20.52	20.89	21.25	21.62	21.98	22.35	22.72	23.08
24	20.26	20.65	21.03	21.41	21.79	22.18	22.56	22.94	23.32	23.71	24.09
25	21.11	21.51	21.91	22.30	22.70	23.10	23.50	23.90	24.29	24.69	25.09
26	21.95	22.37	22.78	23.20	23.61	24.02	24.44	24.85	25.27	25.68	26.10
27	22.80	23.23	23.66	24.09	24.52	24.95	25.38	25.81	26.24	26.67	27.10
28	23.64	24.09	24.53	24.98	25.43	25.87	26.32	26.76	27.21	27.66	28.10
29	24.49	24.95	25.41	25.87	26.33	26.80	27.26	27.72	28.18	28.64	29.11
30	25.33	25.81	26.29	26.76	27.24	27.72	28.20	28.68	29.15	29.63	30.11
31	26.17	26.67	27.16	27.66	28.15	28.64	29.14	29.63	30.13	30.62	31.11
32	27.02	27.53	28.04	28.55	29.06	29.57	30.08	30.59	31.10	31.61	32.12
33	27.86	28.39	28.91	29.44	29.97	30.49	31.02	31.54	32.07	32.59	33.12
34	28.71	29.25	29.79	30.33	30.87	31.42	31.96	32.50	33.04	33.58	34.12

BUILDING SHOCKS

COMPOSITE PARTS PREPARATION

Carefully use a hobby knife (at a perpendicular angle) or fine file to gently remove excess composite material from the outer edge of each piston. This is a critical step; the outer edges of the shock pistons must be smooth and round.

LOWER SHOCK BALL JOINT INSTALLATION

1. Install the metal pivot ball into the shock lower ball joint.
2. Pre-thread the ball joint using an M3x8 screw.
3. Hold the shock rod with a shockrod clamping tool, or use a pair of side cutters to grip the top groove of the threaded end section. Tighten the ball joint onto the shock rod. If using side cutters, make sure the flat side of the wire cutter blades are facing the ball joint. If necessary, use a pair of gripping pliers (e.g. Vise Grips™) to hold the handles of the side cutters to prevent the shock rod from turning.
4. While gripping the shock rod, screw the ball joint on a few turns with your fingers. Then use pliers to clamp the pivot ball inside the ball joint and tighten the ball joint all the way onto the threads.

PERIODIC SHOCK MAINTENANCE

The most important maintenance task for keeping consistent shock performance is refilling and bleeding them correctly. If built correctly, it will not be necessary to re-build them often. Replacing warped/hard rubber bladders and o-rings, scarred piston rods, or shaved/split/loose composite upper and lower ball joints are also important.

- For club racing, it is recommended to check the shocks for air inside before each race and only re-fill and bleed them if necessary. Before each race day, make sure you take the spring off of each shock, hold it up to your ear, and quickly compress the shock rod fully into the body while listening for any air making a "whistling" or "squishy" sound as it passes through the piston holes. If you hear any air, refill and bleed your shocks. For high competition racing, it is recommended that the shocks be re-filled and bled before a large event.
- If building or pairing new shocks, always make sure they are the same length using a shock length measuring tool and adjust the lower ball joints as needed.
- If installing new rubber bladders, carefully trim the thin excess rubber from the edges of their lips. Curved body scissors work the best.

FILL AND BLEEDING PROCESS

1. Unscrew the top aluminum shock cap nut and remove the entire top assembly.
2. Drain the oil from the shock body.
3. Unscrew the end cap from the bottom of the shock body.
4. Clean all of the shock parts thoroughly with electric motor cleaner. Make sure to only use a cleaner that DOES NOT leave a residue.
   - For adjustable pistons, open all four piston holes .
   - Fill the shock body with cleaner and pump the cleaner through the piston holes three or four times by pushing/pulling the shock rod.
   - Dry all of the parts thoroughly.
5. Completely cover both the purple and black o rings under the end cap with shock oil and screw on the end cap.
6. Make sure all four holes are open and the piston/rod is at the bottom of the shock body.
7. Fill the shock body with shock oil until just below the brim.
8. Air bubble removal:
   - Pump the piston once, without letting it come close to the surface of the oil.
   - If using adjustable pistons, close and reopen all holes to eject small air bubbles caught between the piston halves.
   - Rotate the piston by 1 position.
   - Repeat this process 8 or more times.
9. Fill the shock body all the way to the brim with shock oil
10. Membrane and top cap installation:
    - DO NOT insert the membrane directly from the top.
    - Place one side of the membrane's edge on the lip of the shock body with the membrane sitting at an angle
    - Gently use your finger to press the rest of the membrane down into the body until it is seated on the shock body's lip.
    - If using foam inserts, place the insert into the recessed hole of the bladder as it is resting on top of the shock body.
    - Hold the shock body (with the membrane resting on the top) with one hand and with the other hand, carefully place the top pivot mount & cap assembly on top of the body, while being careful to keep the bladder/assembly from lifting back up
    - Twist the cap nut CCW until you feel the threads click and see the assembly flatten out.
    - Tighten the cap nut down firmly onto the shock body. If the cap seems to tighten quickly after 1-2 full turns, then it is crooked and the threads are not aligned. Twist the cap nut back off a few turns until you feel the threads click and try again until the cap nut threads all the way on correctly.

NOTE: If the cap nut is not tightened enough, it may unscrew itself when you try to adjust the ride height using the threaded spring collars.

11. Adjusting rebound:
    - Once the top cap has been tightened down firmly, check the rebound speed by pressing in the shock rod all the way and letting it go.
    - If the rebound is too fast, unscrew the top cap 2 turns and push in the piston all the way, in order to let more oil leak out of the sides of the cap, and then screw the top cap back on firmly.
    - It is important to have all four shocks provide a similar medium-quick smooth rebound
12. Use motor cleaner to clean any excess oil from the outside of the shock.
13. Place a small amount of light oil onto the threads above the aluminum ride height collar and let it soak in. This will keep the collars from binding on the shock body threads when adjusting ride height.

NOTE: It is normal for some oil to bleed out of the bottom of freshly-filled shocks during the first few runs of the car. However, they will equalize at the right pressure without letting any air in if the O-rings are still in good condition.

FOAM TIRES - GENERAL TIPS

- Make sure you rotate the front and rear pair from side-to-side after one or at the most two runs on the track. This will allow them to wear evenly throughout their life as most tracks cause one side to wear more than the other. Uneven wear is common since most tracks have either a high speed sweeper or more turns in one direction.
- Use a micrometer to measure the diameter of your tires before and after each run. Taking measurements will help you to make sure that any handling problems are not caused by unequal tire diameters. Taking measurements of the inside and outside edges of each tire after a run will also help you to diagnose setup problems, such as improper or unequal camber or camber rise settings.
- Mark each tire with its original position (LF, RF, LR & RR) on the car with a permanent marker. Include its compound if there is more than one compound being used at any given time and they are not already marked. This will help you to keep track of what is happening with each tire concerning the tips below and also minimize mounting the wrong compound on the front or rear.

FOAM TIRES - TRUING/SIZING TIPS

- Use the #102003 HUDY Tire Truer to trim all new sets of four tires down to 60mm to start with, and use them for practice only (if possible) until the smallest one of the set reaches 58mm.
- Then lightly skim the other three tires down with the tire truer until they are all exactly 58mm and use them for qualifiers until the smallest one reaches 56mm.
- Then even them out again with the truer and use them for main races only, until they reach the legal minimum diameter as stated by the rules at the race. If there is not a minimum diameter rule, usually anything under 55mm at the start of a race is not recommended.

NOTE:

If your setup causes your rear tires to wear faster than the front tires, then add .2mm to .5mm of diameter to the rear tires when truing them down. This will make sure that they do not wear down to a smaller diameter during a race and cause the rear end to abruptly lose traction. Maintaining even diameters on all four tires throughout an entire run is the goal. However, larger rear tires are always better than smaller ones.

FOAM TIRES - TIPS FOR PREVENTING CHUNKING

- Aside from hitting things, your tires will chunk more often if there is not enough negative camber in the middle of the turns at full chassis roll to keep them from riding on their outer edges. This happens more often on the rear tires than on the front.
- Check the diameters of the inner and outer edges of each tire after each run. Pay particular attention to the side of the car that wears the tires down the fastest as this side will shoulder the greatest amount of cornering forces for any given track. Treat both front and rear tire pairs separately, even if they are the same compound. If either tires outer edges within a front or rear pair have a smaller diameter than their inner edges, then increase the static camber in 0.5° increments, rotate the tires from left to right and track test them again. Keep increasing the static camber until the tires wear evenly flat on the front, and one or both of the rear tires wear just a little bit more on their inside edges (no more than 0.1mm after two or more runs). If you follow these steps and reach -3.0° camber on a set and one or both of them are still wearing the outside edge, then you need to increase the amount of negative camber rise on the outside wheel as the suspension compresses during cornering. This is accomplished through shortening the camber links by moving the inner pivot point to an outer position using the XRAY Quick Roll Centers™ adjustment. If you are already using the outer holes, then you can use shims between the outer pivot ball joints and the hubs to raise them up so that the camber link rods slant downward from the outside in towards the center of the car. Slanting the camber links also increases negative camber rise. However, increasing the slant angle of the camber links will raise the roll center at that end of the car as well.
- Place a semi-thick coat of CA glue on the entire outer sidewall of the tire, from the edge of the rim to the top of the sidewall and let it dry sufficiently (20-30 minutes). You can speed up the drying process by wrapping the outer/bottom surface of the tire with a paper towel, and spraying instant cure onto the wet CA glue. Wrapping the surface keeps the instant cure spray off the tires contact patch and possibly minimizing grip. Mount the tire on a tire truer and use a file or sandpaper to round off the inner and outer edges of each tire and remove approximately 1mm of the CA glue from the top edge of the outer sidewall. This will allow the outer sidewall of the tire to flex some while cornering and keep the CA from cracking. You will need to round off the edges every two to three runs as well.

BEARING MAINTENANCE

The following procedures are recommended to clean all of the bearings in your T3. For high-competition racing, we recommended doing this every 3-4 weeks, or before a major race.

1. Remove the blue seals on both sides of the bearing by inserting the tip of a hobby knife into the inner seam and prying the seal up and out.
2. If the seal bends a little and you can see a kink, carefully flatten the kink out by hand.
3. Spray the seals with motor cleaner and blow dry with compressed air.
4. Spray the bearing on both sides with motor cleaner.
5. Spin the bearing while it is still wet to dislodge any particles with the cleaner.
6. Spray the bearing on both sides again.
7. Blow both sides of the bearing dry with compressed air to make sure particles come out.
8. Hold the inner part of the bearing with my left thumb/forefinger and spin it to make sure it spins free without any abnormal vibrations or sounds.
9. Place one drop of bearing oil into each side of the bearing.
10. Replace both seals at the same time by lining them up on each side of the bearing and lightly pressing them in all the way around the bearings circumference with your thumb and forefinger. Do not press too hard or use any type of tool, such as a wrench tip, to push the blue seals in as they will push in too far, bend and cause drag.

If you spin test the bearing after you have re-oiled and sealed it, it will not spin freely for an extended period of time. The lightest of oils may allow it to spin for 1-2 seconds. This is normal and once you have mounted the bearings in the car again, the drive train will spin freely.

Make sure you use a motor cleaner that does not leave a residue after it dries as this may cause drag and wear in the bearings.

teamxray.com

XRAY EUROPE

XRAY, K VÝSTAVISKU 6992, 91101 TRENCIN, SLOVAKIA, EUROPE
PHONE: +421-32-740 11 00, FAX: +421-32-740 11 09, info@teamxray.com

XRAY USA

RC AMERICA, 167 TURTLE CREEK BLVD. SUITE C, .DALLAS, 752 07 TEXAS, USA
PHONE: 214-744-2400, FAX: 214-744-2401, xray@rcamerica.com

The T3 Set-up Book may show previous XRAY models in photographs contained within it. However, the methodology and set-up theory are the same for all modern touring cars.

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