A Helpful Walkthrough to Understand the Basic's of Tuning

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Presented by Mach Racing

FORZA MOTORSPORT 3

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PART 1 - INTRODUCTION

Allrighty folks, after 2+ years of playing Forza Motorsport 2, and only 3 weeks of Forza Motorsport 3, the question of all questions still remains...
“I want to learn how to tune but where do I start?”
So here it is, ‘Project R8’…a step by step guide. We’ll do our best to deliver some sense and clarity to the great question.

Before we start, there’s a few incidentals that need to be discussed. For one, your ability to tune goes hand in hand with your ability to run clean laps. You don’t need to be the fastest guy (I’m not) but in order to feel what the car is telling you, you have to run consistently. Telemetry will only take you so far. Tuning is a ‘seat of your pants’ endeavor. The car will talk to you if you care to listen.

The next thing that needs to be addressed, and its of utmost importance, is that when you tune, make sure you have adequate heat in the tires before you go playing around with the sliders. If your tires aren’t in their optimal operating range, you’re not going to get the feedback you need, so be sure to ‘heat those meats’ first.
That said, if there’s anything elseyou should absorb before you begin, it’s the answers to a few simple questions...

Q: How do I know when my tune is good?

A: Excluding driver error, try to get through the lap as quietly as you can. Quiet tires are happy tires, so listen to them. Excessive tire scrub is the earmark of an unbalanced car. Tires are the only part of the vehicle that touch the road….3,000 lbs of screaming metal traveling at ridiculous speeds on four tiny patches of rubber. It’s all about the tires, so we want to keep them in their happy place. The quieter you can keep the car while driving at the limit, the faster you’ll be and speed is the name of the game we play. Every time your tires scream at you, you’re scrubbing off time. That said, here’s 3 simple rules to follow while testing a tune:

1. Listen to your tires
2. Listen to your tires
3. Listen to your tires

One simple way to get physical feedback from the car is through your hands. If you’re using the controller (and I’ll assume from the wheel as well) pay attention to the vibration. If the controller is vibrating in your hand, something is out of whack. The more vibration you have, the more out of balance the car is. Don’t confuse the vibration with a touch of tire squeal. If I’m going through a corner and the tires are making some noise but the controller is calm in my hand, I just attribute it to being at the limit of adhesion and the tires are ‘telling me’ that I’m pushing about as hard as the car can go.

Q: Is it me or the car?

A: It may be you, and you need to know the difference. There’s no magic tweak to dial out bad driving. If you’re a no assists driver and you’re getting wheelspin coming out of the hairpin at Suzuka (Turn 11) in a 750 hp RWD, don’t go fiddling with the sliders trying to fix something that isn’t broken if a little throttle control is all that’s required.
Remember, a little more available power at the driven wheels than the tires can handle is a good thing. It means with skillful driving, you can be sure to be at the limit of tire adhesion at all times. Read up on Tires in the DIY section of the site.

Also, are you a late braker? Late braking is the first thing the inexperienced racer needs to get out of the habit of doing, especially if you’re accustomed to relying on the driving line in the game. For the most part if you follow the line, you’ll be going too deep into the corners and then start fiddling with the sliders to dial out the understeer that isn’t there.

Don’t confuse the car being ‘pushy’ with braking too late. Late braking causes you to go too deep into the corner, which causes you to turn the wheel more, and extreme steering inputs will get the tires scrubbing and make it impossible for you to objectively evaluate your tune. Although sometimes it’s an inevitability (especially with the controller) that we’ll have to lock the steering wheel in certain corners, locking the wheel as little as possible will make you faster.

Since this is the preface to ‘Project R8’ which is an AWD car, understanding that dealing with understeer (when compared to a RWD car) is an inevitable by-product of the beast. We need to consider the differences between the two and set up the car in accordance with how we need to drive it to be fast. With All-Wheel Drive, ‘slow in and fast out’ is the name of the game. As such we want to get the car to turn in as best we can, then rely on certain set up techniques to get the back end to rotate better when we apply throttle. What we may lack in initial turn in, we can compensate for with throttle steer on our exit. So be sure to brake earlier than you think you’d have to.

PART 2 – TRACK CONDITIONS

The other key to putting together a good tune is knowing the variety of track conditions that we're going to experience with a particular circuit. My two favorite examples of extreme opposites that require different tuning approaches are Maple Valley and Road America.

Maple Valley is a momentum track. It has a lot of fast corners and sweepers, with a tricky downhill chicane at the end and hardly any braking zones. To set up the car for this track we start with a good build. Firstly, you might want to leave the stock brakes on and save the points since we'll barely be using them. We most likely need to get our Handling number as high as we can so cutting weight and upgrading tires are most likely a better bet than adding gobs of power. Since there are no long straights on the track, the top end speed you get from spending PI points on horsepower will go to waste since you won't be reaching it. Race wing and front splitter with plenty of downforce will be needed to generate cornering force around the fast curves, and a relatively stiffer setup will be required for the transitional response necessary to go full throttle through the frantic downhill chicanes at the end of our lap.

Road America presents the need for a totally different approach. It has long, fast straights, hard braking zones, and a bunch of slow speed 90 degree corners. A good Road America build would likely need good brakes, extra horsepower, and as little downforce necessary to keep the car stable. A good tune would start with getting the car to point in on turn entry as quickly as possible, and since the corners are tight with little room (post apex) for corner exit, we need a back end that rotates quickly when we apply the power. With the exception of the carousel, there isn't a lot of high speed, steady state cornering to set the car up for, so the benefits of running a lot of downforce will be outweighed by the aerodynamic drag we'll get on the fast straights.

PART 3 – TUNING WALKTHROUGH – A STEP BY STEP GUIDE

1 - Drive a bunch of stock cars and pick a car that drive well.

I can't emphasize this point enough. If you're going to paint a pretty picture, start with a nice canvas to work off of. The worst thing you can do is just randomly pick a car out of your garage and start slapping parts on it without knowing its tendencies. First of all, without knowing the car, you won't know what parts to put on it. So drive cars thoroughly and evaluate their performance. If you're a noob to tuning, avoid picking a car that understeers on turn entry and oversteers on turn exit. If you do, you're dealing with both understeer and oversteer and now you're going to take on the job of trying to dial out both simultaneously. Why take on such a task?

Keep in mind the dilemma. If a car is pushy in the turns, specifically, the nose of the car doesn't point in and progressively gets worse, the front end is too stiff. Too much roll stiffness is overloading the laden front tire and making the car push. We need to reduce weight transfer to the laden wheel and we'll need to loosen the front ARB (among other things) to get it to turn in. So forecast ahead, what's this going to do to the back end? Less weight transfer up front means more weight transfer in the rear. Gravity sucks, so the weight is always going to transfer, it's up to you to decide how that transfer is distributed. If the car is prone to wheelspin in the back, well now you stiffened the back end to fix the understeer and guess what you have now? More wheelspin. So how do you fix it? Soften the rear end and now guess what? The damned car is pushing again. So you're running around in circles and its just no freaking fun. I say pick your battles.

With 400 cars in the game, there's a lot of cars that drive well out of the showroom, so choose wisely.
We picked the R8 because we thought it would be cool to offer our inaugural tune using the cover car, but there were other reasons why we thought it was a good candidate for tuning...

2 -You picked a car you like, now evaluate the numbers.

The first phase of evaluation is looking at the car's numbers and figuring out in what class it will be competitive (if at all). Picking the right class for the car is very important.

My golden rule for noob tuners in regard to this is simple: **'Don't be a hero'.** If you've chosen a D-Class car you like, don't get too creative and try to turn it into an upper class sleeper. The problem by and large with taking a lower class car and trying to bring it up to supercar status is the handling. Pumping power into it generally isn't a problem considering all the engine swaps and aspiration conversions that can be done, and since there's so much room with the PI, cutting weight isn't an issue either. But power to weight aside, a car that has a stock handling of 4.2 isn't going to deliver the goods in A-Class where you need a car with a handling around 6 to be competitive. No matter what you do, if you can't get the handling on par with the class, it's just going to suck. (Obviously there are exceptions where a horsepower monster can be successful, like Old LeMans, but by and large, that handling number needs to be consistent with the class it's running in).

The problem is, even though you're installing coilovers, sway bars, mounting R-compounds, and welding in a roll cage, the suspension geometry, control arms and chassis are still stock. If you look at the cars in A-Class you have Lamborghinis, Porsches, and our $155,000 Audi R8. There are reasons why in stock form, these cars cost so much money and your crappy

handling, 650 hp Ford Fiesta just isn't going to get the job done. My advice in the early stages of your tuning career is stay in class or go up one class. If you want to make a more drastic jump, make sure your handling number can be brought on par with the class you're bumping the car up to.
A good way to see where the car stands in stock form is to go to the Search function in 'Buy Cars' and search by class to see how your car stacks up against comparable vehicles.

If you're looking to tune a Leader Board car to see what vehicles are putting up the best times, run a replay of the car on the LB you're interested in and pull up the telemetry screens. You'll be surprised at what you can learn from watching replays. For one, you can figure out the build for the most part by watching the HP output while the car is accelerating. If there's a turbo, you can figure out which one they're running by the boost pressure. Once you figure out the HP of the car, the rest of the build will pretty much fall into place. You can also get a handle on the suspension stiffness by running telemetry on that, and observing how the car reacts in the fast corners and under the brakes. And lastly, you can also see for a given circuit how many gears someone is running in the car, where the shift points are, and what gear is being used for each turn.

Also keep in mind the drive type of the car you're looking to tune. The numbers and approach you take to tuning will vary greatly between AWD and RWD cars.

Our bone stock, **AWD 2010 Audi R8 5.2** is listed as follows: **Class: A-558**

522 hp	7.9 Speed
391 ft/lbs tq	5.8 Handling
3,571 lbs	7.0 Acceleration
44% front / 56% rear	7.7 Launch
5.2 liter displacement	5.8 Braking

Comparatively speaking the numbers look pretty good. Using things like power to weight is an okay barometer that is useful as a reference during your build, but its by no means an exact science. Of all the comparable AWD cars in A-Class, the R8 has a good power to weight ratio, it's speed of 7.9 is impressive and handling of 5.8 can be improved upon. By comparison, here's the other AWD cars we have in the class:

2005 Lamborghini Gallardo **- A544 -** Power to Weight: 7.12 - Handling 5.9
2007 Lamborghini LP640 - **A547** - Power to Weight: 6.43 - Handling 5.9
2005 Lamborghini Murcielago - **A526 -** Power to Weight: 7.01 - Handling 5.8
1987 Porsche 959 - **A541** - Power to Weight: 7.08 - Handling 5.4
2007 Porsche 911 Turbo - **A556** - Power to Weight: 7.28 - Handling 5.7

2010 Audi R8 – A558 – Power to Weight: 6.84 – Handling 5.8

Without going into all the details of every car here, right off the bat, you can see the Lambo LP 640 is a freaking beast. It has the lowest Power to Weight (lower is better) with a whopping 633 hp. It's likely a car that can be dominant in the class with the possibility of improving upon that number with a first level weight reduction. And since its handling is already 5.9, with a weight reduction, aero, and race suspension, there's a good chance we'd be able to run it on stock tires without issue.

On the flip side, I wouldn't go anywhere near the Porsche 959. It has a higher Power to Weight ratio and the handling of 5.4 is unacceptable for A-Class. I'm not in the habit of trying to make chicken salad out of chicken shit, and lacking any additional info from anyone that's actually built one, there's better talent out there to spend my hard earned credits on.

In any event, our R8 looks like it can be competitive in A-Class (in case you just landed here on Earth and haven't seen the leaderboards). We're not going to cloud the issue by seeing if we can bump it up to S-Class. Let's keep it simple and get on with the build.

3 -Evaluate your car's driving impressions

Put in the time, and run enough laps to get a feel for what the car is good at and what it lacks and note the initial driving impressions. I can't stress this enough. Make mental notes of what the car did and didn't do. It's also a very good idea to drive the car on a variety of tracks, this way you have a game plan when you go to upgrade. In the case of AWD, you can take it to Road America or Sebring and it will likely feel pretty good. AWD cars turn in fairly well in slow speed corners, and accelerate well, so they come out of the corners quickly. All-wheel cars in Forza 2 did very well on tracks with a lot of hard braking, slow corners, and long straights. But AWD cars' shortcoming is on momentum tracks with a lot of high speed sweepers and fast turns where their pushiness becomes apparent. This is why they were worthless at Maple Valley, and semi-worthless on tracks that were more technical like Mugello (with it's three long sweepers) where only the most skilled drivers could put up fast times.

The point is, if you only take the car to one type of track, you won't really know what the car's potential is. Even with AWD, I'll take it to technical circuits like Suzuka to get a feel for its abilities because some AWD cars understeer a lot less than others. If the car is best suited for faster tracks like Road America and Sunset, you might want to load it up with power. If the car displays a surprising amount of agility for AWD, you might want to cut weight, upgrade the tires and take your shot at turning it into an AWD sleeper that's 'money' at Mugello.

The good thing about choosing the R8 is I drove it so much in the demo that I had a great handle on its tendencies, although (being an AWD) it didn't take long to figure out what it needed:

The track in the demo, (Camino Viejo) had a lot of hills, and after breaking loose in the last turn about a thousand freaking times, it was immediately clear that the car was too stiffly sprung and tire compliance was an issue. Testing a car on hilly tracks with a lot of elevation changes helps evaluate your car for tuning. The last corner at Camino Viejo de Montserrat forces you to not only turn, but roll over a small hill at the same time. The combination of surface change in conjunction with steering input makes it a tough corner for a stiff car. Immediately I knew the spring/damper combo was limiting suspension travel. And behold, when the full version of FM3 finally came out, I was looking at a car with 1,018 lb/in springs in the back. Yikes!

The next major issue was the car pushed like crazy. After exiting the decreasing radius sweeper at the bottom of the hill and watching the car wash out and hit that godforsaken rail on the right side a gazillion f@#*ing times, it was obvious that the key to a good tune was we've got to loosen up this beast and get its rear end to rotate better.
Now being aware of the car's shortcomings, how did I know that the car was a good candidate for tuning? Because with no TCS I could mash the accelerator, even coming out of the slow corners in 2nd gear, and the back end would never step out no matter what I did. So we have bad understeer but not even a hint of oversteer or wheelspin on corner exit when we apply throttle. This is a good deal.

This point of interest is extremely important for two reasons: For one, it tells me that if I can get the car to turn in, that I probably won't have headaches with the rear end stepping out when I loosen up the front end. Don't forget, the less weight transfer we have in the front, the more we're going to have in the back. The weight WILL transfer, its up to the tuner to decide how it's distributed. The second reason is that I can take a lot of 3rd gear turns in 2nd gear and 2nd gear turns in 1st gear if I choose to set the transmission up that way, and get great acceleration out of the slow corners without wheelspin issues. And just as importantly, taking the esses at Suzuka (for example) in 3rd gear as opposed to 4th, means the car will turn better. This is a major win for fixing the horrendous understeer.

4 -Build it

First thing you need to do with your build is install the 'essentials' which are:

1 -Race Transmission
2 -Race Clutch (If it cuts down on shift time, you want it)
3 -Race Coilovers (Springs and Dampers)
4 -Race Anti-Roll Bars
5 -2 way Differential
6 -Forza Front Bumper and Forza Wing (generally, for higher powered cars)

On the Audi R8, the installation went as follows:

Stock	**A558**
Race Transmission	A574
2 Way Differential	A573
Race Springs and Dampers	A577
Race Anti-Roll Bars	A576
Forza Front Bumper	A576
Forza Wing	A575
Race Clutch	A577

Our new numbers at this point are as follows at A577:

7.1 Speed
5.9 Handling
6.7 Acceleration
5.8 Launch
6.0 Braking

After installing the essentials, the next question is do we cut weight, upgrade tires or add power? Considering we're already at A577 we only have 23 PI points to play with so a weight reduction of any kind is out of the question since it'll bump us to S-Class.

We'll have to use our points wisely, and to do so, let's evaluate the car's initial performance. First of all, we got a braking boost which is good considering the car is pretty heavy (3,571 lbs – stock). The other thing is there is no upgrade option for brakes. Let's assume that a $155,000 AWD supercar comes with some heavy race brakes from the factory. The good news is the stock brakes are fully adjustable, so we're going to have to roll with them.

Let's also assume that for $155,000 the Audi R8 comes with some pretty capable tires from the factory. The car felt planted and was easy to manage in stock form, so grip wasn't an issue. There was no wheelspin, just understeer. Now understeer is, in itself, a lack of grip on the front tires, but the question is, can we fix it with a re-distribution of the weight and a balanced tune? The car was very easy to handle on the stock tires. This is a huge consideration for keeping the tires and adding power...

Going into the tires menu we play around with the numbers:

Stock tires	handling 5.9	1.084 lateral g's	A577
Sport tires	handling 6.0	1.156 lateral g's	A587
Race tires	handling 6.1	1.226 lateral g's	A596

It's easy to see the immediate impact of race tires, with a .142 boost in cornering capacity. If we go this route, we'll have a few points left over to reduce the unsprung mass of the car with some lightweight rims, but we'll be racing with the stock power, which isn't too shabby at 522 hp. But before we continue, there's more to the story...

MISHAP LEADS TO DISCOVERY #1

We decided that for the purposes of the project that we'd go with a balanced build and take a middle of the road approach to the situation so the car would be capable on a variety of tracks. For one, if we added some variety to the build, it would be more well-rounded from an 'educational' perspective than just adding power or just putting race slicks on it and being done with it. We also figured it'd be cool if our DIY readers could take the build and tunes, maybe tweak them a bit to suit their personal taste, then go out and whip some ass online in one single, well tuned machine, with our paint and logo on it.

Then there was the understeer issue. When Forza 3 came out, I was thrilled with the idea of being able to independently mount different tire sizes/widths, front and rear.

Now the stock tire widths on the R8 are 235mm – front and 295mm – rear.

If we went with the sport tires, we would have gotten handling of 6.0 and been able to add sport cams to add 31 hp (553 hp – total) which not only raises the redline but somewhat flattens out the horsepower curve at the top of the RPM range. This would have brought us to exactly A600 with a power to weight ratio of 6.49.

But playing around with the possibilities, I had my mind made up that sticking with the stock tire compound and 295mm rear tires while mounting the widest possible tires on the front was the smart move. Mounting the 255mm tires on the front would help cure the understeer by adding more rubber, and would still bring the handling up to 6.0. Plus, we had the added benefit of having 5 extra PI points left over to reduce our rotational inertia with a Race Driveline by 29 lbs. as well as reduce our unsprung mass by saving 31 lbs. of rim weight with the Buddy Club P1 Racing QF wheels.

When all was said and done we got: speed of 7.3, handling of 6.0, acceleration of 6.9, launch of 5.9, improved braking at 6.1 and with the weight savings we ended up with a vehicle weight of 3,524 lbs and an improved power to weight over the sport tire build at 6.37. It seemed like a no-brainer, and I was feeling all proud of myself and whatnot.

That was until we tried it out on the track...
It proved difficult to tune out the tire scrub. It wasn't so bad at Road America, but it was absolutely miserable at Suzuka. With a pushy, mid-engined AWD car, a stiffer rear spring bias and softer front ARB were logical adjustments. But we kept stiffening the rear ARB and softening the front, however, the softer we went on the front bar the worse the tires scrubbed. We tried alignment tweaks, spring rate tweaks and as a last resort tried to fix it by playing with the damping rates. In an act of desperation I sacrificed a chicken and smeared it's blood on a stone altar I built in my backyard. It didn't help.

Out of sheer curiosity, Mike (Beuksux) decided to put the stock, 235mm front tires back on the R8 and Shazzam! Our world made sense again. It was back to the upgrade shop to tweak the build, but we learned what we already knew….bright idea on paper don't always translate on the track.

MEANWHILE, BACK AT THE UPGRADE SHOP...

With the 235mm front tires back on the R8, we decided to leave well enough alone and roll with the stock tires and compound. We had a few extra points to play around with so we added a sport exhaust which added 6 hp (559 total) which also trimmed a few lbs. of weight. We were also able to squeeze in a street flywheel as well. We changed out the rims to make everything jive and ended up with a lighter car (3,517) that made a few extra hp, (Power to Weight 6.29) and despite what the handling of 5.9 might indicate, we indeed had a better handling car than we did before.

THE FINAL A600 AUDI 'PROJECT R8' 5.2 BUILD AND STATS:

The Build:
Race Transmission
Race Clutch
2 Way Differential
Race Springs and Dampers
Race Anti-Roll Bars
Forza Front Bumper
Forza Wing
Stock Weight (no reduction no roll cage)
Stock tires (sizes, widths, and compound)
Sport Camshafts
Sport Exhaust
Street Flywheel
Race Driveline
Motegi - SP10 wheels 5.9 Handling

The Stats:
7.4 Speed
7.0 Acceleration
5.9 Launch
6.0 Braking
559 horsepower
400 lb/ft torque
3,517 lbs
Power to Weight Ratio 6.29

5 - Where to start - Putting Together Your Base Setup

All right folks, it's time to get serious, and I'll state for the record right from the get go that I don't claim to know everything. This is my way of doing things, just as it was in Forza 2. Each car is different, and there's likely going to be exceptions to every rule, so experimentation and seat time will be required, but that said, the good news is that the math involved with establishing balance seems to be even more effective with the physics in Forza 3.

We seem to think that this is the case because extreme, whacky adjustments don't work anymore. With AWD cars, for example, the old Forza 2 trick of setting the front ARB to 1 and the rear ARB to 40 turns your car's handling into a hot mess really quickly. Dropping spring rates to 120 lb/in, setting rebound to 15 and bump to 2 doesn't work anymore either. This time around, you kind of actually need to know what you're doing, and as such, changes too far in one direction will muck up your tune.

Using ARB settings as an example, understeer can be caused by two basic problems:

1. **Front ARB too stiff** – Too much weight is transferred to laden front tire in a corner, tire is overloaded and the car pushes.
2. **Front ARB is too soft** – Body rolls too much and 'gets over' wheel, positive dynamic camber causes tire to roll over on outer edge, contact patch is diminished, grip is lost, and the car pushes.

As you can see, tuning in Forza 3 is about finding the 'sweet spot' which poses a challenge to the sensible tuner. If you don't believe me, take a car that otherwise drives nicely with the default tune, and set your ARBs to 1 and 40 and see what happens.

If you have a calculator and are willing to do some basic math, you can easily get a balanced base setup. The other benefit is also that as you move forward through your tune, using simple math will keep you from throwing the car's balance out of whack by making some radical adjustments that infects all of your other settings and gets you lost.

We've set up base tunes to about a dozen cars so far in Forza Motorsport 3 and as far as we can tell, this systematic approach yields very good results. Math is your friend so stick to it as you go.

AWD Tuning Fundamentals

If you're a total noob to tuning, the simple understanding of the fundamentals of vehicle balance will take you a long way. Lets establish a raw guideline. The car in general is either:

Oversteering - back end breaks loose (wheelspin, rear end slides out).
Understeering - front end pushes (doesn't turn when you steer).

**Note – A car can both understeer and oversteer although I haven't seen it in an AWD car yet. You'll find it in RWD cars in Forza 3, but that's another story for another day.*

Tuning for the two basic phases of a turn:

Turn entry - you lift OFF throttle and turn the steering wheel.
Turn exit - you APPLY throttle and unwind the steering wheel.

Since the **R8 is prone to understeer** in all phases of cornering, and is most common in AWD vehicles, we'll concentrate our efforts on this aspect of tuning.

Turn entry understeer can be fixed by:

* Softening the front springs and damping rates relative to the rear.
* Softening the front anti-roll bar relative to the rear.
* Increasing the front downforce relative to the rear.
* Decreasing the rear downforce relative to the front.
* Toe out of the front wheels.
* Increasing front caster angle.
* Decreasing the rear Deceleration setting of the differential. (Off throttle turn in).
* Increasing rear brake bias (non ABS)

One caveat to note in regard to turn entry and downforce. Keep in mind that downforce increases with speed, so the faster the corner, the more downforce we generate with our aero bits. As such, we get diminishing returns on using aero for balance in slow corners. As a general rule, we need speeds in excess of 60 mph before the aero becomes useful. For slow speed corners, a little front toe out and/or a softer front spring rate yield far better results.

Turn exit understeer can be aided by setting up the car to 'throttle steer' which is using the accelerator to get the back end of the car to rotate by:

* Stiffening the rear springs and dampers relative to the front.
* Stiffening the rear anti-roll bar relative to the front.
* Toe out of the rear wheels.
* Increasing the front acceleration setting (more front end grip) and increasing the rear acceleration setting (more back end oversteer) of the differentials.
* Increasing the torque distribution toward the rear differential.
* Decreasing rear downforce relative to the front.

THE R8 – DEFAULT SETTINGS (on next Page)

THE R8 – DEFAULT SETTINGS

Tires:	30 psi front / 30 psi rear
Gearing:	Default (we'll deal with this later)
Alignment:	Camber: -0.5 front / -0.5 rear
Toe:	0.0 front / 0.0 rear
Caster:	5.0 degrees
ARBs:	29.15 front / 24.09 rear
Springs:	946.0 lb/in – front / 1,017.6 lb/in – rear
Ride Height:	4.2 – front / 4.4 – rear
Dampers:	Rebound: 8.8 - front / 9.5 - rear
Bump:	6.2 - front / 6.6 - rear
Downforce:	75 lbs - front / 195 lbs - rear
Brakes:	50 / 50- bias / 100% pressure
Differentials:	Front - Acceleration: 50% / Deceleration: 0%
Rear - Acceleration:	75% / Deceleration: 75%

Step 1 – Balance the car by the numbers for a base setup

The first piece of information you need is the front to rear weight ratio.

The R8 is 44% front and 56% rear. Divide 44/56 = .785 Also divide 56/44 = 1.272

Next you'll need to convert the % to decimals:
Front weight - **.44** (also: .785 of the rear)
Rear weight - **.56** (also: 1.272 of the front)

I write these number down in a notebook, having them as a handy reference for making future adjustments saves time and avoids confusion when you have a half dozen tunes saved for the same car.

Next thing you need to do is calculate the following:
Total Spring, Total ARB, and Total Rebound for re-distribution. Just add fronts and rears together as follows:

Front Springs (946.0) + Rear Springs (1,017.6) = 1,963.6 Total Spring
Front ARB (29.15) + Rear ARB (24.09) = 53.24 Total ARB
Front Rebound (8.8) + Rear Rebound (9.5) = 18.3 Total Rebound

Now were ready to re-distribute the rates as follows:

Set your spring balance. The Total Spring is **1,964.0** (rounded up)
Front Spring – 1,963.6 x .44 = 864.0
Rear Spring - 1,963.6 x .56 = 1,100.0

Set the Anti-Roll Bars. The total ARB is **53.24**
Front ARB – 53.24 x .44 = 23.4
Rear ARB – 53.24 x .56 = 29.8

Set the damping rates. The Total Rebound is **18.3**
Front Rebound – 18.3 x .44 = 8.05 (rounded up to 8.1)
Rear Rebound - 18.3 x .56 = 10.2

To set the bump, the Forza tutorial in-game says that **Bump** should be 50% to 75% of the **Rebound.** 62.5% would be right in the middle of that, represented as a decimal: **.625**
Front Bump – 8.1 x .625 = 5.06 (rounded up to 5.1)
Rear Bump – 10.2 x .625 = 6.37 (rounded up to 6.4)

continue to next page.....

Our initial experiences with bump rates is we've been setting them between 50-60% of the rebound rate, but this is hardly scientific. It's more of a feel thing. 75% seems a little restrictive and tight, and 50% is workable, but seems a little soft on some tracks. Right now on production cars we're setting the bump at 60%, but with the LMP –R1 racers, we've been setting the bump at 50% with good results. Honestly, we don't mess with them for balance (oversteer/understeer). We're finding that in regard to the issue of tire compliance, we're getting the most noticeable change in performance from spring rate adjustments with the damper adjustments moving in the same direction (softer/stiffer) as the springs.

Set your ride height.

This is an easy one. If you recall from the DIY section on tuning, Carroll Smith says of spring rates that he sets his spring rates according to the ride height that he wants to run. Since the Forza 3 in-game tutorial says the lower the ride height, the better the car will handle, why set the ride height any higher than the lowest possible setting? So slam it, set your springs accordingly, and try it out. If you have the car set up nicely and next thing you're running it at Sebring, you might just opt to raise the RH a few clicks as opposed to messing with the suspension rates. If you're taking suspension damage, stiffen the suspension or raise the RH? Its your call. Our take on this dilemma is pretty simple. If we have to stiffen the suspension so much that the car is stiff, sliding, and losing tire compliance in order to keep the car off the ground, we'll opt to raise the ride height:

Ride height – 3.9 front / 4.1 rear

My personal observation on ride height is that the car does handle noticeably better when lowered, and since we don't have to worry about real world suspension geometry issues such as control arm lengths, roll center heights, and the like, just set it low as it'll go.

Set the downforce.

Downforce, unlike the other settings that we're doing with a calculator, is a subjective and interpretive setting that doesn't have any hard and fast rules to follow. If we're running Maple Valley we need a lot of it, if we're running Road America, we need a lot less.

How much do we need for the R8? Let's reference the driving impressions: Pushy, lots of understeer, and a rock solid back end. Our conclusion? Maximum front aero and minimum rear aero. We need this beast to turn in and the front splitter doesn't make a whole hell of a lot of downforce to begin with. We also need the rear end to come around on corner exit, so a looser back end may be what we need:

Front Downforce – 100 lbs. / Rear Downforce – 118 lbs.

Set the Differentials.

The differentials on an AWD car are a powerful tool. On corner exit we want to be able to put the power down and get the back end to rotate quickly. More rearward bias on the torque split is the first part of the equation. Our stock split is 86% rear. This is a pushy car and I'll venture a guess that the engineers at Audi know what they're doing, so we're leaving it. The other part of the equation is the effectiveness of the acceleration settings. The higher acceleration % we have, the more power-on oversteer we'll get in the rear, and in regard to the front acceleration, a higher setting will give you more front end grip on turn exit when we apply throttle. In general, I like the rear setting to be as high as I can go without having on-throttle oversteer issues. I like to leave the front setting at default (50%) and if I need more front grip to help power through on exiting a corner, I'll increase it.

Next thing is the deceleration settings. The front is easy – it's always 0%. The rear deceleration determines how well the car turns in when we lift off throttle and enter a corner. Obviously we need it to point in and keep turning in as we go. We want to set it as low as possible. The old Forza 2 days of running the open differential (0%) seem to be over. Once we get below 10% turn entry gets rough and the car starts to chatter. This is very noticeable in slow speed, tight sweepers and double apex corners. As a baseline tune, we've been setting the rear deceleration at about 20% but will go lower if track conditions allow it.

Base differential setup:
Front - acceleration: 50% / deceleration: 0%
Rear - acceleration: 75% / deceleration: 20%
Torque Split - 86% rear

Step 2 –Take it to the track for the 'feel tune'

Our first stop along the way is to Suzuka West to set our camber and tire pressures. It also gives us a chance to get a feel for our base tune. Remember to make sure you get enough heat in the tires before you start playing around with the settings.

Suzuka West is a good track to set your alignment up because it seems to do a good job of heating the tires evenly and makes getting the base camber settings a bit easier. It also has a good mix of turns to get a feel for the car's handling. It has a high speed kink (the famous turn – 130R), followed by two slow speed right handers, a fast corner, a medium speed corner, a

hairpin, a high speed curve, and the famous 'spoon' turn to finish the lap.
Adjust the camber once the tires are warm using the 'Heat' screen in telemetry. When all the inside / middle / outside sections of the front and rear tires are within a few degrees of each other and the tires are bright green, (with the insides a little hotter), you're in good shape. Meanwhile, your operating tire pressures give you optimal grip at 32 psi according to the 'Prima' in-game strategy guide. When the tires are warm, go into the 'Tires Misc.' screen of telemetry to make the adjustments.

The R8 Camber and tire pressures:
Camber: – 0.8 degrees - front / - 0.6 degrees - rear
Pressure: 29.0 psi – front / 29.0 psi - rear

About caster and toe.

We set caster and toe on a track by track basis, based upon conditions. Generally speaking, on an AWD car, front toe out is a big help with initial turn in, so we'll inevitably be pretty liberal with that setting. And because toe out creates a generally unstable condition in high speed straights, we'll run the caster high to offset this, as well as get us more dynamic negative camber on corner entry. As for rear toe, setting this 'out' does wonders for getting the rear end to rotate when we apply power on corner exit. It's value is often overlooked and this is one setting we encourage you to experiment with when you drive the R8 for yourself. When we toe out the rear wheels, we do so more sparingly than the fronts.

Use this time on the track to get a baseline for your spring rates. Honestly speaking, trying to give you hard and fast rules, or an iron clad answer to where the best place to set your spring rates, is the equivalent of trying to liquefy the atmosphere. Every track seems to have a different response to a set spring rate. Catalunya GP, with its off-camber curves and slippery feeling seems to like a softer spring rate than Suzuka, which seems to tolerate a stiffer one.

What we can tell you is that there's a method you can use to get the feel that suits you. While running laps at Suzuka West to set our camber and tire pressures, we take the opportunity to run the suspension telemetry in certain spots on the track. The first spot on the track is the entry to turn 2 after you exit 130R. This is the hardest braking point on the circuit. While under the brakes, watch the front suspension travel in the bump phase to see how far up into the wheel wells the tires are traveling. When we soften the suspension on the R8, we want to make sure we're not slamming the bump stops when braking hard. The second point on track is coming out of turn 8 (the hairpin). On the long fast curve (turn 9) the car is generating a lot of cornering force. Watch the suspension travel here (the two green meters on the left side) as the car leans left in the curve. As we soften the springs, the travel toward the bump stops will increase. We want to get close to the top without hitting the bump stops.

How soft is too soft? How stiff is too stiff? Stiffer is more responsive in transitions and softer is more compliant and provides more grip. My personal opinion is I like to go close to as soft as I can go without hitting the bump stops under the brakes and in fast corners. As for responsiveness, we can get the transitional response we need primarily by reducing body roll with our anti-roll bars.
With the R8, we have our front to rear multiplier of .785. So when we adjust our springs we do it in proportion to our base setup:

864/1100 785/1000 706.5/900 628/800 549.5/700 471/600 392.5/500

As I reduce the springs and run the laps, I'm paying attention to the suspension travel on the telemetry screen. On the R8, I settle in on a rear spring rate of about 600 lb/in.

As far as what I'm looking for, its hard to describe because it's a feel thing, but basically I want the car to feel agile, but not mushy. I'm looking for the car to grip, for the tires to be compliant with the road and for the car to be able to turn on a tight radius without washing out in mid corner.

As for the dampers, I'm not ready to start messing with them just yet. Even though we haven't softened them with the springs, they're still in balance. The front dampers and springs are still 78.5% as stiff as the rears, and the bump rates are still 62.5% as stiff as the rebound.

Next stop, Suzuka Full (next page)

Next stop, Suzuka Full

We took the R8 over to Suzuka Full. I like this track because it has all the key tuning points of Suzuka West but with the added elements of a fast sweeper (turns 1 and 2) which are a good barometer of both initial turn in response and cornering capacity at high speeds. The esses (turns 3,4,5, and 6) which are great for seeing where the car stands when called upon to turn in and transition from left to right. And another 'S' (turns 15 and 16) to see how the car handles slow speed transition.

After softening the springs, the car feels more agile, but I'm not real happy with the entry into turn 1. Because it's off-throttle understeer, **I lower the deceleration on the rear differential to 15%**

In the esses I notice the front tires are scrubbing a bit. I'm figuring that might be a by-product of the nose not pointing in quick enough so **I toe out the front tires +2**

Since I added toe out I go ahead and **max out the caster as well to 7.0 degrees.**

After a few more laps I check the tire temps and pressure. The pressures on all 4 tires are a little high so I drop the front pressure to **28.5 and the rear to 28.5.**

The front toe out has seemed to help the turn in response in the hairpin as well as turns 15 and 16. But my front tires are still scrubbing in the esses which tells me the front end is still pushy. Normally, I would opt to soften the front ARB, but there's literally no oversteer on this car whatsoever and we really need the back end to rotate better. I decide to try and increase the front grip (by decreasing front weight transfer) and aid turn-in by stiffening the rear ARB. Hopefully, this adjustment will also get the back end to start rotating. If I can get two benefits with one adjustment, I'll try it! (Remember ARBs play a major role in balancing oversteer/understeer). **I run some laps and raise the rear ARB in two 10% adjustments and settle in with a rear ARB of 36.00.**

Ahhh! This was a nice change. Car feels more agile, less scrub and better turn in. The front end is still not as smooth as I'd like it to be, so **I tweak the front ARB down to 22.0, 21.0, 20.0, 19.0 but it still doesn't feel right.**

I leave the front ARB at 19.0 (despite the increased tire scrub) and try turning the deceleration of the rear differential down to 10% thinking a little more off-throttle turn in might allow me to not have to turn the wheel as much in mid-corner. But all I get is more chatter and controller vibration, which tells me the front tires are still scrubbing hard.

I try balancing the front ARB with the rear (maybe stiffer is better since softer didn't work) and take the rear ARB (36.00) x .785 = front ARB of 28.3… I also set the rear deceleration back to 15%.

The car doesn't feel as agile and doesn't turn in as well as it did before. I start lowering the front ARB in small (5%) increments from 28.3…26.9….25.5….24.3 looking for the 'sweet spot'. Frustrated, I stop at **24.3.**

Not real happy with the lack of smoothness; I'm getting pissed off and kill another chicken. I try to stiffen the rear ARB again to get that turn in.

The car feels smoother and faster on other parts of the track so I like the stiff rear ARB a lot. It feels fantastic through the hairpin and 'Spoon'. I also note I can take turn 14 (130R) faster as well as turn 1, presumably this came about due to the resultant reduction in body roll in the high speed corners.
But the front tire scrub is driving me nuts. Maybe it's a damper issue. Maybe front dampers are too stiff?

MISHAP LEADS TO DISCOVERY #2

When I did the math earlier for my base setup, I had written down the front bump to be set at 5.1, except for some inexplicable reason I discover the front bump is at 3.6 by mistake. Oops! **Set front bump correctly to 5.1**

Front end finally feels smooth in the esses.
This little accident just reinforces the validity of our theory that using some basic math, as opposed to choosing arbitrary settings when we tune, yields better (and more consistent) results.

Now that we have the tire scrub issue worked out, the front feels pretty good, so we can finally work on the 'on-throttle', 'post-apex' part of the tune and concentrate on the back end of the car. I want more rear end rotation. Toe out rear tires 0.1 degrees.

This adjustment yields immediate results. I'll be keeping it. But we still want more oversteer: Increase the rear differential acceleration: **80%, 85%, and settle in on 90%.**

I'm noticing that we could use a little more front grip in the fast corners, especially in turn 130R. The car still pushes a bit at very high speed and we could stand to tighten up the car's turning radius a bit. I like the car's balance so I don't want to mess with the suspension too much. **I soften the rebound a few clicks, but reduce the bump to 60% of the rebound.**

The car feels a little more compliant and agile. The grip is a bit better.

We want our turn entry into 130R to be fast, and the sooner we can get back on the power the faster we'll be. To reduce the amount of 'off-throttle time we need going into that turn, **I decide to increase the front acceleration setting on the differential, and settle on 60%.**

The car pulls through the fast corner exit before we run out of track and as a result, I notice I can get back on throttle a heartbeat earlier. I'm satisfied for now...

Save File: Suzuka

Step 3 – Take it to the track for the 'fine tune'

The fine tune part of the process is the fun part. Maybe you even send the tune out to some friends for feedback, but in any case, the bottom line is: **tunes are about 'lap times'.** Take the car into 'Hot Lap' mode and run some serious laps, figure out what your best possible time is with the tune 'as is' to get comfortable with the setup before you make any adjustments.

I don't suggest fine tuning in test drive/tuning mode. I don't know about you, but if I run my all time fastest lap I want that shit to count! Plus, in Hot Lap mode, it'll prevent you from needlessly messing with the sliders since you need to quit the race you're in to adjust the tune.

Get into a rhythm on the track of choice. This way when you make an adjustment that yields an immediate savings in time, you'll know it. This is also the time to get your gearing optimized for the track. But that's another story for another walkthrough...

Some of my most notable tweaks:

The Audi R8 at Road America: I added a single click of extra toe-out on the front tires and immediately shaved about .600 off my average lap time. The initial turn in was better which allowed me to get on the power a heartbeat earlier in each turn.

The Accura #66 R1 car at Suzuka: I reduced the total spring by 10% and increased the total ARB by 10% and shaved a full second off my best lap time.

The key is to know what you're capable of running at a particular circuit. Once you know where you're at skill wise, you'll know when those tweaks to your tunes are good, and when they're not.