THE ULTIMATE LEXUS

A Detailed Instruction Manual on

CONVERTING YOUR LEXUS SC300 to SUPRA TWIN TURBO POWER

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INTRODUCTION

October 10, 2001: It had been almost a full year since I began the project to install a Supra MKIV Twin Turbo engine in my Lexus SC300 coupe. After many delays and heartaches, I have finally completed all the connections to my new engine, and ready for the first test.

Anxiously, I slide behind the wheel. Beside me is the empty passenger compartment, still missing the seat removed so long ago. On the passenger floorboard lies the "guts" of the engine brain, or ECU. Literally scores of wires are lying on the pulled-up carpet. The entire center console has been removed, along with the air conditioning controls and radio.

I take a deep breath, depress the clutch and hit the starter. The engine, sitting dormant for over 2 years, starts right up and purrs like a kitten. My wife, ever the ardent supporter, who has patiently endured many evenings watching me pore over wiring diagrams from the factory manuals, hears the engine start to life. By the time I have shut the engine down, she has managed to find a bottle of champagne and open it, bringing a glass to me for celebration. I shed a little tear of joy with the realization that an unskilled non-mechanic finally accomplished a task that local shops told me was impossible!

Within the next few days, after careful monitoring of the engine's vital signs, and resolving a few last-minute details, I was able to experience and enjoy the fruit of my year-long endeavor. My first adventure with the car on the road left me literally speechless. The first time I "got on it", the streets were a bit wet from an earlier rain. I carefully selected second gear and smoothly released the clutch. Slowly pushing

the "pedal to the metal", the turbo "came on" at about 3,000 RPM. All of a sudden I felt like someone had just lit the afterburner behind me. The rear end of the car broke away and I had to release the power to keep control! Acceleration is frightening at first, coming on so fast as to seem almost uncontrollable. The front end raises up, even with my stiff Eibach springs, and makes the car act like it wants to go airborne! This has GOT to be one of the fastest stock engines ever built! With the larger intercooler, aftermarket air/fuel sensor/controller, and larger exhaust, all indications are that the engine develops in the neighborhood of 450 horsepower! The engine runs smooth, is extremely tractable throughout the entire operating range, and very docile in demeanor, hiding the snarling monster underneath that is ready to unleash its awesome power at a second's bidding.

In actual fact, my true story had a few additional false starts prior to that final successful engine launch. There were numerous minor oversights leading to the success of that final startup day (one wire had pulled loose from the fuel pump, etc., etc.), but a natural progression led me to the final triumphant results!

With the knowledge I have gained from this conversion, I now believe I could repeat this installation with a new car and engine in less than two weeks time. Although I have had an incredible amount of willing help and assistance from a number of Supra owners and speed shops, I have come to the conclusion that nowhere does there exist a detailed guide for successful completion of this conversion. Even shops who advertise themselves as specialists in Supra/Lexus conversion either do not have all the complex and critical wiring documented in writing, or choose not to share it. It is my intent to fill the void of information about this incredible conversion by creating this manual. I am confident that the reader will find that the fee paid for this manual will be the

biggest bargain of the project, and will save the builder hundreds of hours in trial-and-error research.

WHY A LEXUS?

I have been in love with my 1992 Lexus SC300 since the moment I first laid eyes on it. The car offers everything an auto enthusiast could ever want. Ultimate luxury with all the gadgets, self dimming mirror, memory seats, automatic steering wheel adjustment, the world's best cruise control (adjust speed easily in increments of one mph!), one of the best factory sound systems ever, beautiful leather interior, sunroof/moonroof, etc. Combine this with killer good looks that continues to age well ten years later, and great handling with variable-assist rack-and-pinion steering.

My wife's 5-series BMW of similar vintage just cannot compare in terms of reliability, fit and finish, and durability. While the BMW always leaves a little oil spot on the driveway, the Lexus, at 140,000 miles is perfectly dry underneath. The BMW has had two complete sets of brake rotors, multiple alignments, and frequent wheel balancing, and still shimmies on the road. The Lexus has NEVER had a wheel alignment, still has the original rotors, and rides rock-solid down the road.

In my opinion, the only factor that has prevented the Lexus from being the ultimate motor car is the lackluster performance of its normally-aspirated 225 horsepower engine. I purposely chose the SC300 so that I could enjoy the crisper acceleration and control of the 5 speed manual transmission. In spite of this, the car has always seemed to fall way short in the performance department.

In the year 2000, as the result of my frustration with lack of horsepower, I started considering trading in the Lexus on something with more power. Unfortunately, after looking around, there were very few choices available which offered quality construction, superior handling, and a manual transmission. The only real choice available was the upcoming BMW M3. But at a demand premium of almost $10,000, and at risk of looking like boy-racer yuppie, I just couldn't bring myself to part with the Lexus.

It was about this time that I picked up a magazine which talked about a few hardy souls who had undertaken to install the 340 horsepower Toyota Supra Twin Turbo engine in their Lexus. This naturally piqued my interest, and I immediately embarked on an extended internet search and research. What I found is that the Lexus engine (made by Toyota, of course) is virtually identical on the lower end to the Supra engine. The difference being the upper head and turbos, of course. In fact, the original Lexus 2JZ-GE engine is identical to the one installed in non-turbo MKIV Supras. I also found that a derivative of the Supra turbo engine IS installed in a Japanese-only version of the SC300, and called the SOARER. Therefore, the car body has all the accommodations for the Supra engine. The new engine sits right on the existing engine mounts, and mates right up to the existing Lexus transmission with no modifications whatsoever. There are even pre-existing openings in the Lexus body to accommodate the plumbing for the turbo intercooler pipes with no

modification. All the engine-side connectors on the Supra wiring harness fit without modification into the Lexus. This includes the connectors to the manual transmission, and presumably, to the automatic as well.

Armed with this bit of knowledge, and the hope of creating the ultimate motoring experience, I embarked on my own personal journey. This manual is the end result of that journey.

MY PERSONAL BUILDER'S EXPERIENCE

MY CAR

I now believe that I truly have created the ultimate motoring vehicle. My Lexus SC300 still looks like new after 10 years and almost 150,000 miles. Although the original leather interior looked beautiful, I felt this project deserved new upholstery, so I purchased original factory-design leather replacements (see SOURCES Page 29). To accompany the used, low-mileage Supra engine, I added the following:

- Replaced original 15" Lexus wheels with 16" AMG-style wheels, and added Pirelli P7000 P245/50 ZR 16 tires.
- Engine came without Mass Air Flow Meter or Intercooler. Replaced with:
- HKS brand Vein Pressure Controller (VPC) and HKS side-mount intercooler with polished aluminum intercooler pipes
- HKS air filter
- HKS dual hi-flow exhaust for Lexus, along with Rod Millen-style free-flow downpipe
- Greddy small-diameter EGT and Boost Gages (I fabricated a wooden mounting insert to replace the center console ashtray, and matched the wood to the original Lexus wood trim)

- EGR block-off plate from Powerhouse Racing to disable unnecessary EGR
- Fluidyne high-capacity all-aluminum radiator (Supra model fits the Lexus perfectly)
- Supra upper radiator fan shroud
- Supra stock fuel pump (Lexus pump output capacity is marginal for the Supra engine)
- Eibach sport springs, front and rear, approximately 1" lower ride height

THE BASIC PROCESS

The Lexus and Supra engines, ECUs, engine compartments, and components bear uncanny resemblance to each other. However, there are just enough differences to make one want to pull one's hair out! Each engine comes with its own unique engine wiring harness (loom). This loom connects to every component on the engine, the starter, and also connects to the igniter, resistor, noise-suppressor, and main relay/power box, all of which are located on the upper fender on the driver's side of the car. Toyota/Lexus was nice enough to use unique connectors for every individual component in the engine compartment, so it is impossible to plug any connector on the loom in the wrong place. With the exception of a few ground wires, everything plugs in. Piece of cake!

The entire engine loom enters the interior of the car at the upper passenger-side firewall, and is actually quite easy to pull through the firewall, thanks to a connector held in place by just two bolts.

Inside the interior, in the front passenger-side foot well, resides the main engine ECU computer. Three large connectors plug right into the ECU, and connect up all of the engine components, including various sensors and switches located further aft on the transmission housing. The LEXUS and SUPRA ECU's are NOT interchangeable. You MUST have a SUPRA ECU, and it must be configured for manual or automatic transmission as appropriate (as well as the wiring loom). This is the easy part. There are no modifications necessary to this part of the harness. Just plug it right in, and the basic engine functions should work fine!

On the outer bulkhead, in the passenger foot well, just next to the ECU is a large connector block where many other

connections between the engine compartment (via the main engine wiring harness) connect to interior components. These include such things as power for the ECU, Air conditioner, temperature, oil pressure, check engine lights, fuel pump power, etc., etc. This is the complicated part. While the three big connectors to the main ECU are identical between Lexus and Supra, for some reason, the remaining connectors from the engine room harness to the bulkhead connector block are completely different. This is where the wiring cross-reference diagram is worth it's weight in gold! Just carefully follow the diagram to make the connections, and you will have no problems.

Because of the significantly higher fuel flow rates for the turbo engine, it is necessary to replace the stock Lexus fuel pump with a Supra pump. Again, the connections and mounting are identical, and the replacement is a piece of cake.

Again, the much higher operating temperatures of the Supra engine require a larger radiator than the stock Lexus. I opted for an aftermarket Fluidyne all-aluminum radiator. The cost was just about the same as Toyota's stock part, and it is supposed to be more efficient, as well as looks good!

The stock Lexus exhaust, nice as it looks, will not work for the Supra engine, although could probably be modified. It is just not large enough in diameter. The turbo output is significantly improved by going to a larger diameter free-flowing exhaust. For those who want to make a lot of noise, forget it! The two turbos themselves muffle the sound quite a bit, so the exhaust note, while powerful, is nicely muted.

The engine removal and re-installation is a fairly simple process, and, once the exhaust and all other connections are

removed, the actual in and out shouldn't take more than a couple of hours!

PARTS LIST

TOOL LIST

You will, of course, need a basic set of mechanics tools. If you do not have flex-joint sockets or universals, do yourself a favor and buy a set before you get started, you'll be glad you did. Most all the connectors on the Lexus/Supra are metric sizes, so you need a good complete set of metric sockets (1/4, 3/8, ½ inch drive, as well as deep socket) and metric-size hex/allen wrenches.

In addition, the following special tools/equipment will be needed:

- Good quality floor jack (Drive-on ramps sound nice, but you'll never clear the front-end nose piece to get up on them.
- Jack stands
- Mechanic's Creeper (Optional, but VERY useful)
- Engine Hoist (Can be rented when ready to remove engine
- Supra/Lexus Clutch alignment tool
- Size E10 Torx Socket (needed to remove the A/C compressor from engine. This is the FEMALE Torx socket, somewhat rare, but absolutely essential unless you want to disconnect AC hoses!)
- Torque wrench
- Butane soldering iron (Trust me, just get it.. you will be doing a LOT of wiring, and this is the greatest invention known to man.. I'm not talking about the huge bottle of propane/torch kind of thing. Just a small, self-lighting propane-powered iron). My favorite: Ultratorch, made by Master Appliance Corp, Racine, WI *www.masterappliance.com*. (Also complete kits of connectors, irons and heat guns on the website)
- Shrink wrap tubing, various sizes
- Heat gun, or butane lighter to shrink the tubing

- Wire stripper
- Tie wraps various sizes
- Vacuum hose
- Latex 'surgeons' gloves (go ahead and get at least two huge boxes. May look stupid, but you'll thank yourself when taking the little lady out for dinner after a long day under that Lexus)

EXPERTISE REQUIRED

Believe it or not, this is NOT rocket science we're going to attempt here. All the intricate electronics are all wrapped up inside that ECU, and not even God himself knows what goes on inside there. All that is required is a lot of patience and some simple map-reading abilities (Connect Tab A to Slot B). You will need basic soldering expertise, although nothing really tricky, we will just be connecting lots of wires together by solder. If you've never soldered before, do a bit of research. Learn that you heat the desired joint and NOT the solder itself. Let the heat draw the solder into the joint.

You obviously must have some basic mechanical experience and aptitude. If you've never replaced a clutch or starter, you may be a bit in over your head here, but again, we're talking basic removal and replacement of big items, nothing tricky like removing the head, etc.

GENERAL CONSIDERATIONS JAPANESE Vs. AMERICAN SPEC ENGINE

WIRING HARNESS… THE BIG JOB

This section of this manual is why you paid the purchase price. The cross-reference tables shown here are the result of literally hundreds of hours of going over both Lexus and Supra wiring manuals, and checking and double checking.

NOTE: Do the job correctly! Assemble the proper equipment before beginning the wiring job. Take the time to use proper size and color of wire (lamp cord is going to look horrible in your engine compartment). This means having an appropriate soldering iron (a butane powered iron is highly recommended. Heats up fast, and is completely portable without need for electrical power), good electrical solder (NOT acid core), and a big supply of heat-shrink tubing in several sizes to accommodate the wire connectors. Do NOT be tempted to use crimp-on connectors. There is NO other way to do this job right so the connections don't cause problems later on. This is not a sales pitch, but I have used my little Ultratorch butane soldering iron for years. The Master Appliance website offers a great, complete kit of assorted connectors, crimp tools, heat guns and soldering irons. You'll be glad you made the investment in the right equipment!

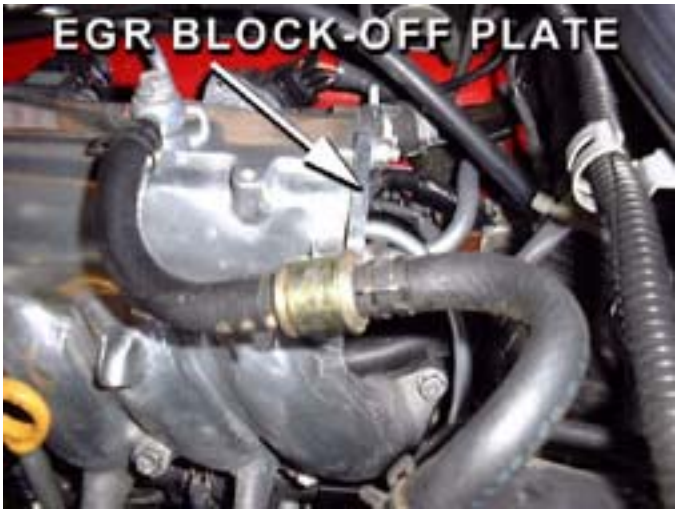
Don't get in a hurry. Complete ALL connections shown to the wiring harness BEFORE installing the engine. It can be very difficult to resolve a wiring problem, or change a connection while laying upside down in the passenger foot well!

WIRING CROSS-REFERENCE TABLE

SUPRA CONNECTORS

LEXUS CONNECTORS

REQUIRED HARNESS MODIFICATIONS



REQUIRED INSTALLATION MODIFICATIONS

OPTIONAL MODIFICATIONS

ELECTRIC FAN

AFTER-MARKET TURBO BOOST CONTROLLER

AFTER-MARKET MASS AIR FLOW REPLACEMENT

ABOUT O2 SENSORS

REMOVING/REPLACING THE ENGINE

Complete as much of the engine connector hookup BEFORE installing the engine into the car. You will be glad you did! This engine really fills up the engine bay once installed.

FIRST OPERATIONAL ENGINE TEST

TROUBLESHOOTING

SOURCES

There is a wealth of information on Supra specialists on the mkiv.com website. The list below represents companies I have had personal, and satisfactory experiences with.