

ECU remapping

# Map making

ECU remapping is all the rage, but what does it consist of, does it really work, and is it right for your Porsche?

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**R**emapping ECUs has become the modern equivalent of fitting twin carbs and sports air filters, and many wild and extravagant claims are made for the sort of power gains that are possible by simply plugging a laptop into your car and pressing a few keys. Indeed, there's a lot of misunderstanding about ECU remapping, probably because there's a lot of misunderstanding about the role of the ECU in a modern Porsche. So, before looking at the potential from ECU remapping, let's have a quick look at what the ECU does and how it helps optimise performance in any given set of conditions.

The ECU (electronic control unit) is a small computer system that is used to control various aspects of an engine's operation. A simple ECU might control only the quantity of fuel injected into each cylinder during each engine cycle. However, more advanced ECUs, such as those found on modern Porsches, control a wide range of parameters including the ignition timing, variable valve timing, turbo boost level, rev limits and more.

ECUs determine the amount of fuel, ignition timing and other factors by monitoring a range of engine sensors; these include throttle position sensor; air temperature sensor; oxygen sensor; and many others.

For example, ignition timing determines when, during the compression cycle, the spark is made to initiate combustion. Engine performance and economy are optimised when the spark is delivered at the correct time in the cycle, and this will vary depending on load, engine speed, fuel mixture and so on. An ECU will also be programmed to detect 'knocking' (when the spark occurs too early in the cycle) and will retard or delay the combustion accordingly.

But surely Porsche spends a lot of time and research perfecting the ECU programming for each model in its range, so how can this be improved upon? Well yes, a lot of effort is put into creating the best mapping but – and it's a big but – the ECU or programming for any given model is, by necessity, always a compromise. This is because it has to work for every car produced in that range and must accommodate a wide range of environmental and other

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variables. For instance, one of the key factors that has to be taken into account is the varying quality of fuel that is available in the different markets where the car will be sold (not least of which is the wide spectrum of petrol available throughout any given market). Also, although Porsche engines are built to close tolerances, there are also slight variations between individual units, and the ECU mapping must allow for this too.

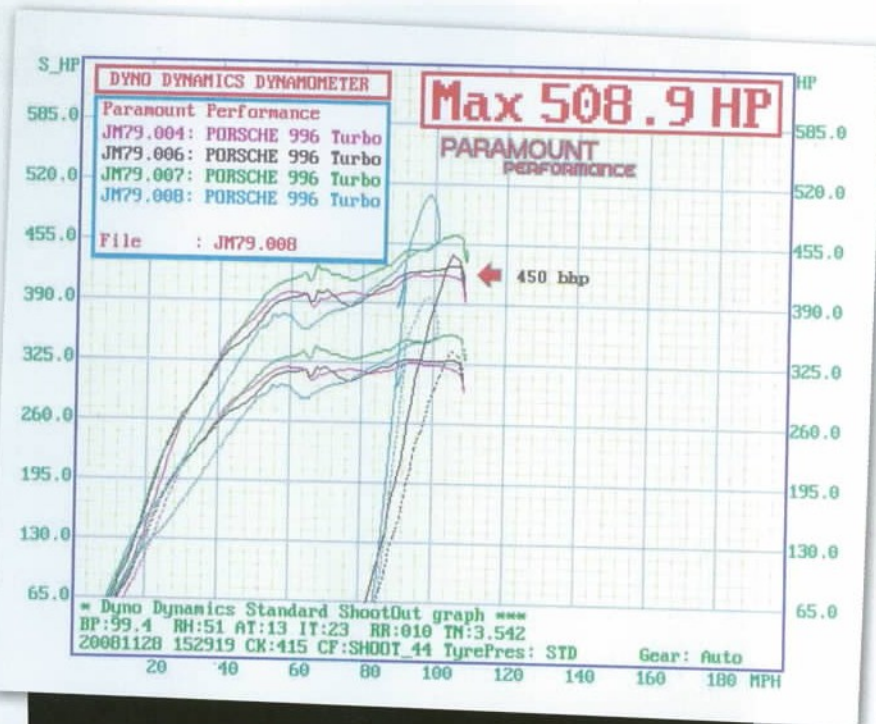
In other words, the ECU mapping in a new 997 is an 'average', designed to ensure that your car will perform according to its specification anywhere you might take it. Nor does it reflect the individual nuances of production that, inevitably, offer minor differences in performance between the same model in different circumstances.

So is there an opportunity to tweak a vehicle's map to improve performance (or, indeed, economy but most Porsche owners are more likely to be looking for a performance advantage)?

A quick review of Google's response to a search for 'ECU remapping' reveals an enormous choice of companies offering performance or economy improvements on most modern cars. This breadth of choice is matched by a wide range of pricing and options for location (many companies use mobile facilities and perform the remap at your home or office). With all this choice, then, there's a temptation to go for the cheapest and most convenient option. However, that's not necessarily a good plan with a high-performance car like a Porsche.

A modern Porsche is a precision machine designed to deliver performance among the best of any comparable production car (OK, we're among friends – a Porsche is designed to deliver performance better than anything remotely comparable!). So a simple, at-home, remapping – which usually involves an 'off-the-shelf' programme – might not be the best way of fine-tuning the engine.

Indeed, given the interaction between all aspects of



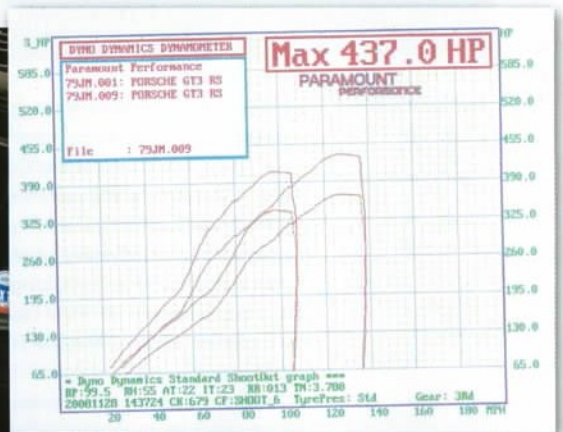
## 997 GT3 MAPS

- Ignition advance at part throttle – 4 maps
- Ignition advance at full throttle – 4 maps
- LOAD VS THROTTLE CONTROL  
Advanced during acceleration – 3 maps
- Injection at part load – 2 maps

- INJECTION AT FULL THROTTLE  
Injection during acceleration – 3 maps
- INJECTION PRESSURE  
Throttle response – 3 maps
- TORQUE CONTROL  
Air mass flow quantity – 6 maps  
Rev limiter  
Speed limiter



A laptop is connected to the car's data port and this downloads the ECU map and uploads the modified one



The dyno printouts for the RS (above) and the Turbo (top) show worthwhile increases for each

### DYNO TO GO?

A dyno such as the one used by Paramount costs about as much as a GT3 RS but is, perhaps, even more expensive to run, with a team of experts required to prepare the vehicle, read the map, model the changes, install and test the improvements and so on.

To the best of our knowledge, no one has yet developed a rolling road based dyno for domestic use but now help is at hand – from the Apple iPhone, of all things. An iPhone incorporates accelerometers and these are used by an application called Dynolicious to measure 0-60mph time, quarter-mile elapsed, lateral G-forces, horsepower and more.

The iPhone doesn't need to be electronically connected to the car, simply mounted along the axis of the vehicle (although it can be tilted, it must point forwards to give accurate readings). A flat piece of Blu-Tak held my iPhone to the top of the centre console and the application was no trouble to use.

It needs more experimentation to determine Dynolicious' full capability and that requires a stretch of road or track where standing starts are not likely to catch the attention of the local traffic police.

But Dynolicious is remarkable value at just £7.49! [www.dynolicious.com](http://www.dynolicious.com)



a modern Porsche, the only way fully to ensure optimal remapping is to analyse both the before and the after on a rolling road; this ensures that the readings taken for the factory map (the starting point for any changes) reflect the engine under load (a typical rolling road measurement takes place with the car 'travelling' at about 150mph).

But there is more to remapping than just ensuring that the engine is measured under load; a 997 GT3 or GT3 RS, for example, has a multitude of ECU maps as shown on the previous page.

To ensure that any remapping provides the optimal performance improvement and maintains engine integrity it is vital that all maps are reviewed and that the interaction of each and every change is considered.

To find out what's involved in a remap and to see what performance gains are possible, I took both my 911s – a 996 Turbo Cabriolet and a 997 GT3RS – to tuning specialist Paramount Performance in Slough.

Starting with the GT3RS before it is loaded onto the Dyno Dynamics rolling road, Paramount's technicians make a series of adjustments to the road's controller to set it for current air pressure, relative humidity and ambient temperature (accuracy is increased seriously by matching the sensors to the current conditions).

Having backed the 911 onto the rollers, the next step is to strap the rear end to the restraining harness, using four straps each with a five-ton breaking strain; a simple but

effective strap test verifies that the vehicle is safe before the tests begin – the car will be running at over 150mph so it's vital to ensure that it will be held fast in the unlikely event of the rollers jamming!

The final preparation is to reproduce the wind effect of driving at speed; two huge fans force air into the front of the car so that the radiators are fed sufficient air to the radiators.

With a laptop computer connected to the car's data port (located under the passenger glovebox) the Porsche is taken up through third, fourth and fifth gears for the basic (factory fitted) map to be recorded. This real-time view of the engine's performance and its relationship to driver input is the basis for the next stage – what can be done to improve performance while maintaining overall system integrity?

Most of this work is then carried out offline, using simulation software that allows the proposed updates to be verified and correlated without using the engine as a test bed (it would be an expensive route to use the engine to verify that a particular change was dangerous or liable to seek performance outside of the safety envelope).

The proposed changes, when ready, are then uploaded to the ECU via the data port and the car once again brought up to about 150mph. The projected improvements are readily compared with the actual improvements as the Dyno controller displays the real-time performance of the car on the system display.

The RS's factory specification maximum power is 415bhp

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and the initial readout for my car reports a delivery of just 412.5bhp. However, the remapped version increases the maximum output to 437bhp. This six percent increase might sound modest but it's not just maximum output that is improved; good remapping will bring improved response and better mid-range performance and generally make the car more responsive.

With the RS done, it's the turn of the Turbo. Once again the straps are installed and tested. This car expects to receive air via the two side intakes as well as the fronts, so three fans are used this time; one at the front and one at each side.

With a little less noise than the RS, the Turbo is nevertheless impressive doing 150mph without moving, and ear defenders are definitely advisable for anyone within 30 feet of the car!

My Turbo has the factory X50 option, which produces an

extra 20bhp, thanks to changes to the intercoolers and other minor modifications. With a factory spec of 450bhp mine was obviously made on a good day as our dyno run shows it provides 474bhp as delivered from Stuttgart. So, the Paramount boys had their work cut out to show significant improvements. But, they came up trumps and didn't disappoint, as the gauge rose to an 508bhp following the sorcerer's art being applied to the standard map.

Finally, does remapping invalidate the manufacturer's warranty? Probably, although there's a school of thought that says such changes are impossible to detect, so your dealer is not going to find out. The ECU can also be returned to standard, simply by returning to the company that made the change and asking them to reinstall the original mapping.

And all this extra power was achieved without even opening the engine compartment or getting our hands dirty!

The car is strapped down securely – travelling at 150mph, you wouldn't want it suddenly flying forward!

### FREE DYNO DAY

Paramount Performance is offering a free dyno day at its facility in Slough, UK, for 911 owners. This is a great chance to find out just how much power your 911 is producing.

The date is 21st March 2009. Places are, of course, limited so to register your interest email [info@purelyporsche.com](mailto:info@purelyporsche.com) with details of your car. Paramount will provide refreshments and, as an

extra treat, will arrange for you to view the amazing collection of automobilia on display next door at STS, where you can also see the largest selection of aftermarket alloys in the UK.

Even if you're not having your car dyno'ed, you're welcome to come along to watch.

[www.paramount-performance.com](http://www.paramount-performance.com)