



1990+ Nissan Z specialists

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Due to interest in our Z1 Motorsports AshSpec ECU upgrades the following article was prepared to explain the benefits and advantages.

The 300ZX engine, the VG30DE and TT, use a computer to monitor all of the engine sensors and appropriately control systems such as fuel delivery and ignition timing. This computer is a 3MHz computer that has its own 'operating system'; like the Windows of your PC. This 'operating system software' contains the instructions that the computer follows and it is all contained in a device called an EPROM. It is the 'chip' that people commonly refer to in aftermarket performance vehicles. By modifying the information within the chip we can effectively tune the car.

From the factory, the ECU is mapped in an unsafe manner for running boost levels above 12psi or so. It primarily has to do with the ignition timing being too far advanced. To safely run higher levels of boost, one must modify these settings to keep from damaging the engine from detonating it to pieces. This is done through painstaking hours of running the engine, monitoring sensor data, changing the fuel delivery and ignition timing and then re-running and verifying the results. By doing this one psi at a time, a complete map can be constructed that will cover any upgrade up to a specific airflow range. This allows you to run boost levels up to the limits of your upgrade stage without worrying about the timing being too advanced or running lean.

It would fall short of a good product to engineer an engine control system without implementing fail safe functions, so, the ECU also has safety features to handle situations when something isn't right. The system employs a knock sensor, which is basically a microphone attached to the engine block and it monitors for the frequency of detonation. When that noise is detected, the ECU then reverts to the secondary fuel and timing maps. These secondary maps have less advanced ignition timing and greater fuel delivery to try and ward off the detonation. If for whatever reason the engine continues to knock even after this point, the ECU will continue to use these low octane maps AND it will trigger safety boost. Safety boost is when the turbochargers will limit manifold pressure to 7psi (down from 9.5psi or whatever your boost jets were making it run). This is done to protect the engine and the driver will certainly notice the decrease in performance and either take it in

to a shop for troubleshooting or take care of it themselves.

They even went a step further. There are actually fuel maps specifically for 5th gear. These maps introduce a little more fuel because 5th gear WOT runs generally pull for very long times at very high speed. This introduces heatsoak of the engine and without introducing additional fuel to keep the cylinder temperatures down, the engine could exceed reasonable exhaust gas temperatures.

Another parameter in the ECU's software that is designed for engine safety is called a fuel-cut. This part of the software is designed to interrupt the flow of fuel when too much air is flowing into the engine. This condition can occur with runaway boost such as one would see if the wastegate actuator hoses popped loose or the actuators failed. This has good points as well as bad points though. For the daily driver who doesn't care about high performance, its good because it will keep them from blowing up their engine with a stock ECU when the boost runs rampant. Without a fuel cut in place, the engine would certainly meet a catastrophic death to the unknowing of drivers. However, for performance tuning, this fuel-cut presents an airflow barrier that WILL cause problems. Since we will be raising the bar on manifold pressure, we are introducing much more air into the system than was being pumped in before. However, we are doing this intentionally and controllably. If the fuel cut points are not altered, you will certainly bump into this nasty bugger. So, the datapoints for the fuel cut cannot be removed, however, to get around it, all we do is set them to impossibly high values and therefore will never experience 'fuel cut'. The same method is used for the vehicle speed limiter. At its highest possible value in the ECU, the speed limiter is 510km/h, which is roughly 315MPH.

What all this means is that Nissan deployed a good deal of effort in designing a system that will do its best to keep you from destroying your engine. As long as proper oil changes are made, proper grade fuel is run, cooldown period is observed, and other mechanical preventive maintenance is done, a VG30DETT will (and many many have) get years of reliable service even when run hard frequently.

These safety features that Nissan has built into the ECU can (and should) be taken advantage of when tuning for performance on a daily driver. While remapping of the primary maps is necessary to allow a daily driver to run 16psi of boost safely, the secondary maps must also be addressed properly. Increasing fuel delivery by 8-10% and retarding ignition timing by 3-5 degrees will maintain that same level of safety that Nissan deployed in the original design. It will also become very apparent to the driver when knock is being detected (above and beyond

the audible aspect, some detonation isn't easily heard) as engine performance will notably suffer with ignition timing dropping back so much. This is indication that either something is wrong or they are simply overboosting the system for the environmental conditions that exist.

Unfortunately, no aftermarket ECU tuner for the Z32 take advantage of ANY of the additional maps. All of their maps are the same as the primary map. What this means is that when you start to detonate, perhaps your girlfriend put bad gas in your car and she's out with her girlfriend showing off with all the power, the ECU will revert to the secondary maps, but since they are the same, it will not correct the condition. So it will continue to knock and knock until the ECU finally kicks into safety boost. If you have a boost controller, god help your engine in this case. Additionally, on long 5th gear runs, although the timing and fuel delivery *may* not be too advanced or lean, it begs the question: Did they tune the car for long high speed 5th gear pulls or did they tune it for all the other gears? I would be inclined to say they tuned it for 4th gear pulls on a dyno, then backed off a degree or two and bumped the fuel up for sake when the driver is in 5th gear, but that's not performance tuning in my book. Performance tuning is taking everything into account and tuning for safe power, but also for the maximum power. Not taking advantage of the low octane maps or the 5th gear fuel maps specifically for their intended use is very unprofessional and lackluster, especially for the money paid for one of these 'other' ECU upgrades. You cannot go on the assumption that everything in all cars is working 100%, you have to tune for these circumstances and you do that by taking advantage of the secondary mapping.

Performance and safety are the two key elements kept in mind when remapping this ECU. Although they almost seem like opposites at first glance, this document demonstrates how it is actually achieved. The simple fact is, the ECU's original design has this same idea in mind. The Z32 is very reliable in stock form and very forgiving when something is wrong because of this programming ethic. Properly setting ignition timing and fuel delivery while maintaining the safety by properly mapping secondary maps is key to producing a safe and powerful program.

Thanks,
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