

INTELLIGENT THINKING

STORY BY JACK DREWETT



MOTEC

www.motec.com.au

Like the tallest yardie in the bottle-shop window, MoTeC management systems are impossibly desirable as well as highly exclusive. Considered the best by many in the know, those involved in professional motorsport (particularly circuit racing) will agree a MoTeC is worth every cent of the retail price.

It does not matter whether you are talking about V8 Supercars, single-digit-zone drag racing, or high-performance street monsters. For an entry-level six- or eight-cylinder Commodore, it's hard to go past an M48.

The MoTeC touch is considered by many to be even more valuable than the Midas touch, and everything the little gold boxes touch turns into horsepower.

An M48 will happily power even the most serious street cars (especially with the highly optioned PRO package). However, there is something for those

wanting even further features and an unrivalled level of control.

Grab the nearest stepladder to find the M600 or M800 on the top of one of the highest top shelves around.

These feature fully programmable trigger control and over an hour's worth of memory logging (up to 306 minutes if you option the M880 package). The products are aimed at high-end racers looking for a computer to improve the performance of their cars and their drivers.

Like many aftermarket management companies, MoTeC has now released a unit specific to modern V8s, including LS series Commodores. The MoTeC MLS is based on the M4, but it comes in at a fair whack cheaper than other MoTeC units.

This makes it a highly viable option for those packing eight cans worth of injected Chevrolet grunt under the bonnet of their third-gen Commodores.

Is your new head and cam combo just that little bit too angry? Does that new turbocharger mean you need to swap over to bigger injectors? Maybe you just can't quite seem to get those AFRs right?

Regardless of the reason, you have reached a significant crossroad on the well worn and rubber-stained road of high-performance vehicle modification.

The engine-management system can make or literally break a set-up, and it is arguably the single most important aspect of any highly modified road or race injected engine.

A correctly configured computer system is required for any kind of efficiency or performance. Plus, the lack of a perfectly selected and tuned ECU can cause catastrophic engine failure faster than you can even begin to say 'she'll be right'.

When the time comes to consider aftermarket management for your ride, a whole bunch of decisions must be made – each as critical as the last.

In order to make things less daunting, we have broken down the most popular ECU manufacturers and the products they offer to suit our beloved Commodores.

Most LS1 tuning workshops use VCM Suite



VCM SUITE

<http://www.vcmsuite.com.au/>

VCM Suite is a phenomenally popular method of tuning Gen-III and Gen-IV-powered Commodores Australia wide, and with very good reason.

VCM Suite tunes vehicles to achieve maximum performance and to retain a factory-like quality idle. This is something extremely difficult to achieve with a stand-alone aftermarket ECU.

Tapping into the vehicle's control module, the tuner is able to tinker with the inner workings of the LS series engine-management system without soldering a single wire.

This gives the tuner the ability to reconfigure ignition timing, fuel mixtures, idle control and speed, knock retardation, RPM limiters and even transmission shift options such as firmness and shift points.



AUTRONIC

www.autronic.com

Autronic is considered by many tuners to be the ultimate compromise between a well-natured street computer and an all-out, race-oriented, data-logging maximum-performance management system.

Autronic offers three computers, and they can all work wonders for your pride and joy in the right hands. The highly regarded SMC has been at the top of the game for quite some time now, and has found its way into many topnotch Commodores over the years.

Featuring eight injector and four ignition outputs, the SMC is packed full of high-end features. For example, the anti-lag and flat-shift with waterproof casing and Autronic's amazing AutoTune feature optional.

Although the SMC contains more features than the vast majority of ECUs on the market, different applications may lead to a different choice from the Autronic stable. Look for the best for you and your Commodore.

The dedicated circuit racer would struggle to find a better management unit than the SM2. It features the same ignition and injector drives as the SMC, and the SM2 is also blessed with traction control.

There is MoTeC dash compatibility amongst other handy motorsport-oriented features too. This makes it one of the most powerful ECUs on the market.

Autronic's latest release, the SM4, brings a whole host of new cards to the playing table. Going all in on a super-high starting pair, the SM4 is designed to excel under the toughest of conditions.

It features boost per gear, closed-loop idle, launch control, flat-shift, anti-lag, dedicated idle, boost and air conditioning control, nitrous control and knock control (standard knock control is included with individual cylinder control optional).

The SM4 will no doubt become a favourite amongst cashed-up Commodore owners who only want the best for their rides.




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HALTECH

<http://www.haltech.com.au/>

Haltech was the very first company to bring aftermarket reprogrammable ECUs to the market. The team has experienced nothing but success in road and track applications since the company's founding in 1986.

Haltech computers are one of the most popular choices, and the products (especially the E6X) are found in a huge amount of moderate to seriously modified vehicles Australia-wide.

Haltech has only become even more popular through the release of 'plug-in patch' looms for certain models. This cuts down dramatically on installation times.

For those with injected Holden V8s and V6s, whether it is a VL Walkinshaw or a VS Calais, the E6GMX would be the preferred Haltech weapon of choice. An E6X is the perfect crime under the kick panel of a six-cylinder screamer.

Although most LS1 owners opt to re-map their standard computers, the Haltech Interceptor is offered for this application. With this, the owner can jump across to a complete aftermarket controlling system.

The great new 'Interceptor Platinum' piggyback computer allows the retention of factory cold start and idle control, as well as numerous other luxuries. These are often lost when the bridge into aftermarket-management town is crossed.



FOR THOSE WITH INJECTED HOLDEN V8S AND V6S, WHETHER IT IS A VL WALKINSHAW OR A VS CALAIS, THE E6GMX WOULD BE THE PREFERRED HALTECH WEAPON OF CHOICE

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IN THE HOT SEAT

Being the CEO of Link ElectroSystems, it's safe to assume that Philip Royds knows a thing or two about aftermarket ECUs.

Philip was kind enough to share his wisdom and answer a couple of questions. These may arise when considering computer choice or the ever-baffling spec-sheets that manufacturers provide.

Q: When reading the specification sheets regarding many brands of aftermarket computer, a term that arises frequently is 'wasted spark'. What does this mean?

A: Wasted spark is a term used to describe an ignition configuration where the system uses a single coil pack for each pair of cylinders. Each coil pack is triggered to fire for the combustion stroke igniting each of the pair it supports.

This means that every time the coil pack fires, one of the two sparks it discharges is essentially 'wasted'. It fires into a chamber not yet in the compression stage.

An example of this can be found in the Commodore 3.8L V6. The engine runs three coils, six cylinders and a wasted-spark configuration.

The other commonly used method of ignition is a sequential set-up. Here, each cylinder has its own dedicated coil pack, firing only when its chamber requires it.

Q: How is an 'individual coil per cylinder' set-up superior to a wasted-spark set-up?

A: Because each plug gets its own coil pack, you are able to individually adjust ignition timing to suit each cylinder's behaviour. This is excellent for owners of very high-performance vehicles looking to extract the most from their engines.

Also, it is interesting to note that with some engines, the ability to run a sequential set-up is part of the engine design.

One example is the LS1. The LS1 has eight cylinders and eight coils from the factory, and those eight coils are designed to run sequentially. It gives them necessary time to 'charge' between spark events.

Q: What is 'stepper idle'?

A: Idle-speed control hardware is usually either 'stepper' or 'solenoid'. From a performance perspective, each is as good as the other.

Typically, you use what comes on the engine. Two- and three-wire solenoids are easily controlled if the ECU has the ability, but only a handful of ECUs can control stepper-idle systems (four or six wire).

As the name suggests the ECU 'steps' the air valve open (or closed) one step at a time. Modern engines, such as the LS1, have stepper-idle standard from the factory. So, to fit an ECU lacking the ability to accommodate such a feature would result a significant downgrade in idle quality.

Q: You hear many of the higher-end ECU companies mentioning 'responsive inlet-air-temp sensors'. In a real-world situation, how important are they to the performance of a modern modified vehicle?

A: A responsive inlet-temp sensor is critical for strong all-round performance and drivability in an injected turbocharged or supercharged vehicle. The inlet temperatures change dramatically and frequently under normal driving conditions.

The accurate measurement of such temperatures becomes crucial in such a situation. The temperature of the air entering the engine has a massive effect on the fuel mixtures required by the engine.

Naturally aspirated cars have a more linear inlet temperature curve essentially reflective of ambient air temperature. As such, they do not benefit from the inclusion of a responsive inlet temperature sensor as heavily.

Q: Firmware is another term that arises commonly. Where does that fit into the scheme of things?

A: Firmware is the software that the ECU microprocessor runs. Sufficiently capable firmware is extremely important to the tuneability and reliability of the computer. It can make an ECU either a pleasure to own or a complete pain.

Q: The consensus is that only aftermarket computers with a closed-loop O₂ (oxygen sensor) can pass an emissions test. If true, why is this?

A: This is true. A computer with closed-loop O₂ control will use its given feedback to gently 'rock' the air/fuel ratios on either side of the ideal stoichiometric mixture.

This activates the catalytic converter, which allows it to work as it was designed.

Q: If you had to give one crucial piece of advice to Commodore owners choosing an aftermarket computer, what would it be?

A: You really need to do your homework. Often, when reading the given specification sheet for many brands of computer, it is easy to get carried away with all the amazing features and functions they offer.

What many of these sheets neglect to mention is that the computer has a limited number of user-definable inputs and outputs. So, rarely is it able to use many of these functions at once.

For example, a computer may hypothetically possess 16 drives, which sounds like plenty. Problems begin to arise, however, when the user wishes to run eight injectors and eight coils sequentially.

This leaves them with no drives left for idle-speed control, air conditioning, nitrous control – essentially any of those tricky functions you bought it for in the first place!

When purchasing an aftermarket management system, you need to sit down and list all the features you need. Then, purchase a computer that can do it all at once. Anything else could result in a frustrating compromise.



The Nissan engines in VL Commodores require an aftermarket ECU to reach their full potential

EMS ENGINE MANAGEMENT SYSTEMS

www.fuel-injection.com

The Stinger and 8860 have existed as the key figures in EMS's portfolio for the last few years now. They have proved themselves in a wide range of performance and competition environments.

The top-of-the-line 8860 product boasts an incredible resolution with increments of just 1rpm. This means the computer has the potential to power your vehicle with smoothness that is rare in aftermarket ECUs.

Following the success of the top-shelf 8860, EMS has now released a 4860 and 6860 to suit four- and six-cylinder powered rides respectively.

The 6860 would make the perfect computer for your seriously modified V6 or RB30ET, and the humble 'Stinger' is ideal for more basic set-ups. It works well regardless of the number of

cylinders that call your engine bay home.

Priced slightly above the Haltech and Microtech units, but below premium Motec and Autronic systems, EMS products offer unequalled value. While a top-of-the-line system may be unaffordable, a little more cash grabs a couple of extra features over the entry-level units.

For example, the closed-loop lambda control and a pin-code-activated security system.



The exciting new EMS 6860 is the perfect unit for six-cylinder Commodore drivers. It has the incredible power of the top-of-the-line 8860 without a computer featuring eight injector output drives.

Just like its 8860 and 4860 peers, the 6860 features 15 user-programmable inputs. It also has eight user-definable outputs and dual lambda sensor inputs.

Like the 8860, the 6860 features closed-loop lambda control. This is a valuable addition to any street-registered vehicle boasting aftermarket engine management.



THE LONG ARM OF THE LAW

We sit down with John Varetimidis, RTA consultant engineer, and discuss laws and engineering regulations regarding management systems in Australian passenger vehicles.

Q: What are the legalities concerning the remapping of a factory computer?

A: Provided the vehicle is still able to pass emissions, it is fine. Even if software has been developed to 'crack' a factory computer, they are still considered to be non-programmable and therefore legal.

Q: What legalities surround the modification or removal of factory sensors, or the addition of new ones?

A: The removal of factory sensors is only usually done for one reason, which is to replace the factory computer with an aftermarket one. Not only is this illegal, so is the actual removal of the sensors.

Doing so is considered downgrading, and no downgrading is legal as it directly affects emissions.

Q: Some aftermarket computers can pass emissions. Is there any way to make an aftermarket computer legal?

A: No. The concern is not so much the emission output of a vehicle fitted with an aftermarket computer, it's the tuneability.

The problem from the EPA's point of view is that someone could tune their car to pass emissions. Then, get home, hook up the laptop and re-tune it to suit their application. This completely stuffs up emissions again.

It defeats the purpose of the system. If you could lock it out using some kind of seal that cannot be tampered with, you may be able to do it. Although, it's not something that's really been done yet.

The other major concern with regard to aftermarket computers and legalities is that the EPA guidelines say they are not legal full stop. No ifs, buts or maybes.

Q: In your experience, have vehicles fitted with aftermarket computers been able to pass engineer certificates?

A: No, they have not. Unless the vehicle itself is pre-emissions, then they are not legal unless the computer can be set up so it is not tuneable.

Q: What is your opinion regarding computers? What should the average Commodore owner look out for when they are considering the jump across to aftermarket?

A: The average modified car owner should definitely take it as a serious decision. The installation of an aftermarket computer can often mean many of the factory sensors are no longer used.

This results in a whole host of compromises being made as far as cold start, idle etc are concerned. I would recommend using an ECU that runs with all sensors in-built.



WHAT ON EARTH IS THE DIFFERENCE BETWEEN OPEN- AND CLOSED-LOOP OPERATION?

'Open loop' and 'closed loop' are used to describe methods of operation used in many types of everyday electronic systems – not just automotive management units.

Open-loop systems run without any kind of feedback, monitoring or correction process. They have a pre-programmed cycle of duties to perform and they will perform the included commands regardless of changes in variables, or any other changes whatsoever for that matter.

A great example of an open-loop system is a common household cake mixer. If the mixer is set to 50-percent power, it turns at a pre-set speed then slows when dough is added. The machine is not capable of compensating for the extra load the dough places on it.

Many of the more basic aftermarket ECUs perform duties such as idle control in the same way. So, the vehicle may run very slow/rough when you kick it over on a cold morning and/or idle too high at operating temperature.

Closed loop-style set-ups have continuous control systems monitoring the results of the ECU's processes, and they make corrections or adjustments to maintain the desired results.

A perfect example of a closed-loop system is modern-day cruise control in passenger vehicles. When you set the speed to 80km/h, the module adjusts throttle position to accommodate ascent and descents as the load on the engine changes.

The cruise unit receives feedback from the wheel speed of the vehicle and makes adjustments accordingly.

An aftermarket ECU with closed-loop AFR control will monitor fuel mixtures through a lambda probe or similar device mounted in the exhaust. It uses feedback from the sensor to adjust air/fuel ratios, and ensures the engine continues to run with a stoichiometric mixture at cruise.

This also translates into smoother idling and cold start. The management system is able to detect differences in engine temperatures and adjust not only fuel mixtures, but also the all-important idle speed accordingly.



LINK

<http://www.linkecu.com/>

Based in New Zealand, the Link computer is probably the best thing to come from the land of the curious shepherd since Russell Crowe himself.

The high-quality Linkplus G3 boasts the ability to sequentially control eight coils, eight injectors and still manages to provide 24 user-definable inputs. The power of the Link cannot be denied.

It is popular with highly modified RB30ET and Holden 5L set-ups, and also among some in the LS1 racing crowd (especially in the US). Many would still argue that 24 programmable inputs is overkill for the majority of applications short of a full-house V8 Supercar.

This opinion may at first appear to have merit, but before drawing such conclusions, we urge readers to consider the input requirements of a modern modified Commodore.

These can include such demands as knock control, warning lights, stepper idle, multiple pumps, engine fans,

motorsport features, air conditioning, nitrous and turbocharger boost – just to name a few.

Combine these with many car owners now wishing to keep their vehicles legal, pass emissions and earn that mystical engineer's certificate (Link's closed-loop lambda allows this, which is a function many competitors do not include).

The value of a quality computer such as the Link becomes immediately obvious.

Link also offers the LEM G3 for the more budget-conscious Commodore owner. It provides the power to run up to four coils.

This allows the LEM G3 to run as a four-coil wasted-spark system for cars blessed with eight cylinders. Or, run it as a similar three-coil set-up for those touting a V6.

A plug-in adapter is also available for six-cylinder VL owners wishing to run an LEM G3. This dramatically cuts down on installation time, as well as costs.



KALMAKER

<http://www.kalmaker.com.au/>
Kalmaker has been remapping AC Delco control units since 1988. The use of its software presents a highly viable alternative to installing an aftermarket system for those who drive Commodores that are AC Delco equipped.

The Delco computer is considered as one of the best factory units around, and it cost GM millions of dollars to develop. So, why not give it a fighting chance at keeping its place under your vehicle's kick panel?

There are a whole host of benefits to sticking with the Delco (or even installing one, as Kalmaker has done to numerous other vehicles). This includes reliability,

price, idle quality and just how easy the things are to tune.

Kalmaker works a bit differently to a typical ECU set-up. Instead of buying an off-the-shelf aftermarket computer, wiring it up and having it tuned professionally, you purchase an entire 'kit'.

These packages, such as the 'Kalmaker Street Pro 3' kit, contain everything you need to get started. It's simply a matter of grabbing the nearest laptop, loading the software, hooking up the included Real Time ECM and you are ready to tinker. It is surprisingly easy.

There are a whole host of satisfied Commodore owners who made the Kalmaker decision, so it's definitely worth a look if you are hotting up your Holden eight or Buick six.

IT'S ALL IN THE TUNE

One of the most important things to remember when considering which aftermarket ECU to go with is the tune. Rather than the computer itself, that is most important.

We are not saying the choice of computer is irrelevant. Obviously, there are massive differences in capabilities, tuneability and functions ranging across the management-system market.

However, don't just go out, buy an ECU and wander down to your local dyno-equipped workshop. You can't just 'hope' they will wire up and tune the thing in exchange for the hard earned wad of cash in your wallet.

Instead, you need to consider who is going to tune your car and what they are most comfortable using.

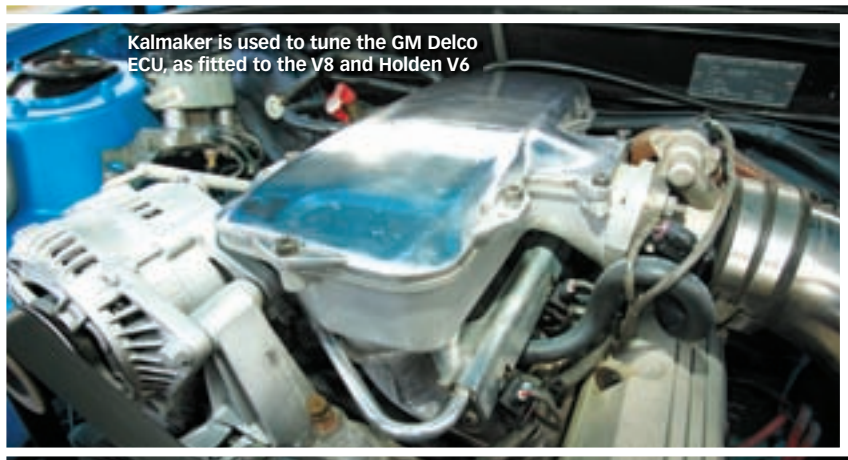
For example, there is little point spending big money on an Autronic SMC if your desired local tuner only fiddles with Microtech. If the best

workshop in your area will only touch MoTeC, forget saving your pennies by picking up that second-hand Wolf or MT-8 off eBay.

Say you've decided there is only one ECU for you (or perhaps you already own one, and swapping over to suit a tuner is not financially viable). You should make sure someone possessing a serious amount of experience with that particular computer tunes it.

This is one aspect of a car build where (above all others), second best or 'she'll be right' will not do. Dodgy tunes crack ringlands and melt pistons far before increased performance or hard driving does.

For a complete list of recommended tuners, head to the website of your particular choice of computer. Check out the listed approved dealers - no doubt you will leave with your nose in the right direction.



Kalmaker is used to tune the GM Delco ECU, as fitted to the V8 and Holden V6



MICROTECH

<http://www.microtech-efi.com>
Microtech is the most widely used ECU in the modified car scene, and it is particularly popular in the drag-racing scene. With its low price and ease of tuning, it's no wonder the Microtech is a standout favourite among tuners and drag racers Australia wide.

The LT-series Microtechs used in recent years are leaps and bounds above the older MT units, and the most recent models are fully upgradeable. The

models possessing such an ability are denoted with an 'S' at the end of their model designation.

These have proven instantly successful. Punters realise the value in a unit that effectively cannot be out of date.

When it comes to Commodores and Microtechs, the sheer amount (and quality) of tuners means you could do far worse than picking up an LT-12s for your ride. Many Microtech-powered drag cars move in the 6sec and 7sec zones.

TUNING IS ONE ASPECT OF A CAR BUILD WHERE, ABOVE ALL OTHERS, SECOND BEST OR 'SHE'LL BE RIGHT' WILL NOT DO



A good aftermarket ECU will allow the individual coils to be controlled for optimum ignition timing

WOLF

<http://www.wolfems.com/>
Wolf's latest v500 is a killer bit of gear. It has propelled the company up with the established big guns in the aftermarket computer industry.

It boasts all the latest features and a few neat tricks. For example, in-built car security and a self-diagnostic system in the event of sensor malfunction.

There is no wonder the Wolf is looking like a more popular option than ever. Two of the coolest features regarding

the Wolf products both revolve around the area of installation.

This is often a major downside of going aftermarket as far as ECU systems are concerned. Wolf offers a complete loom package for RB30, 3.8L and injected Holden V8s. However, there is a bonus if your Commodore has a previous Wolf (such as a 3D) installed already.

You can buy an adapter allowing your new v500 to run from the previously installed loom - brilliant!

