



## Programmable Management Mania - Part 2

The second instalment of our overview of all of the programmable engine management systems on the market.

*By Michael Knowling*

**AutoSpeed's list of the commercially available engine management computers, their features and what they'll suit. They're all combined fuel and ignition systems since that's really the only way to go if you're after the optimal result. Here is Part Two.**

Autronic have two full engine management systems: the SMC and the SM2. Both share the same set-up software and do all the same basic and advanced functions such as anti-lag, closed-loop fuel control and data logging. Traction Control is available only on the SM2, which has a 52 pin socket. The more compact SMC has a 36 pin socket.

## THE PLAYERS

### Autronic



### *Fuel Features*

The Autronic units both accommodate up to 32 rpm and 16 load sites that may be chosen at random intervals - giving up to 512 adjustment points. They both come with eight injector drivers for fully sequential injection on up to eight cylinder engines. For more than 8 cylinders, semi-sequential injection is possible. All injector types are catered for (0.9 to 16 ohm) with the optional high current drivers.

A "unique calibration strategy" allows accurate control of fuel delivery under both acceleration and deceleration. Both units have fine (0.1%) adjustment of base fuel delivery and there is individual cylinder tuning of  $\pm 61\%$ . Operators have a choice of MAP, Throttle Position or throttle/intake pressure as a primary input. A MAP sensor reaching up to 450 kPa is available as an option. Both have closed loop (feedback) idle speed control and exhaust oxygen sensor input for sensing the air/fuel ratio. SMC and SM2 also incorporate narrow band Lambda Sensor circuitry as standard equipment. There is a fuel pump safety shut-off also included.

### *Ignition Features*

Both SMC and SM2 units come with four ignition drivers. They can manage single coil distributor, twin coil distributor or multi coil distributorless ignition configurations on most engines. Precise spark advance control strategy is available for both static and dynamic operating conditions. The ignition table automatically mirrors the selected load points as entered into the fuel section. Timing is selectable in 0.25-degree increments over a range of 0 to 50 degrees crank-angle.

There are calibrations for over-run, cranking, idle, coolant temperature and altitude variables. Both systems have knock-control software that allows for the connection of Autronic's remote adjusting unit and combustion knock detection unit.

### *Other Features*

Both units have an engine rpm range of up to 30,000 (for 4 cylinders), 16,000rpm (5-8 cylinders) and 15,000 (10-16 cylinders). They are suitable for forced induction and normally aspirated engines, with either multi-point or throttle-body injection. Two-stroke, rotary and those engines having uneven firing sequences are also accommodated.

Both have adaptive learning (with memory) to minimise the number of user setups required and to provide optimal control of air/fuel ratio, boost pressure and idle stability. Both the SMC and SM2 contain user-configurable data logging sampled at 50 times/sec.

Included is a built-in rev limiter using a combination of fuel and spark control. There are calibrations for over-boost protection, auxiliary speed measurement, overall gearing constants, cooling fan control adjustments, air conditioner control adjustments and automatic idle speed stabilisation control adjustment. Selectable spark and fuel delivery strategy under abnormal engine operating conditions and comprehensive limp-home functions increase engine safety. Both also have a diagnostic/error indicator with memory for detection of intermittent fault conditions.

SMC and SM2 both have many varying types of user defined outputs, including closed-loop boost pressure control with temperature dependent calibration characteristics. The SM2 even has multiple calibration curves via a switched input or road speed sensing. Both systems have anti-lag functions built in. The SM2 better the SMC by also having up to 11 auxiliary output functions, measurement and correction for exhaust back pressure and fully coordinated air-conditioner operation.

### Injec



Injec's EM2 computer controls both fuel and ignition parameters. The EM3 additionally has more features, making it the "race" version.

#### *Fuel Features*

These systems can fire up to 16 injectors, have adjustable cranking mixtures, cold-running enrichment, acceleration pump enrichment and switching temps. They can be mapped up to 10 psi - 30 psi with the "high boost" option - and they are also capable of auxiliary injector switching. The EM3 has a high 40 amp current capability for to suit a range of injectors and a spanable MAP sensor input in 1 kPa increments.

#### *Ignition Features*

A "soft" rev limit function can be set anywhere up to the 16,000 rpm limit. Both have acceleration retard, spark advance and retard and switching temps. Both can be mapped up to 30 psi and be adapted to work with Hall Effect, photo-optic or magnetic inductive triggers. The EM3 can be used with multiple coil set-ups.

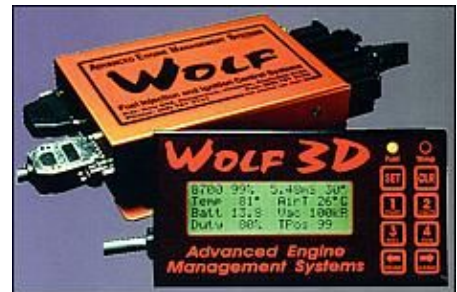
#### *Other Features*

The systems are configurable for 4/6/8 cylinder, rotary, normally aspirated and forced induction engines.

There are outputs for AC switching, warning lights, fuel pump relay control and cooling fans. EM2 and EM3 can come with an optional keypad and backlit LCD screen that displays live information in English, and has a buzzer for any faults. Legible messages are also given when there is a problem. A security code also protects the program from unauthorised adjustment.

The kits come with an in-built vacuum/boost sensor, air and coolant temperature sensor, 20 and 16 pin plugs and pins and a comprehensive instruction manual. The EM3 gets a programmable shift light output, additional warning codes, real time programming and improved user operation. A 12-month guarantee backs them both up with fast repairs/replacement.

### Wolf



The Wolf 3D Version 2 is the latest engine management offering from this Melbourne-based company.

### *Fuel Features*

Fuel is adjustable in 128 points per map with 16 rpm and 8 load increments, and full interpolation gives over 65,000 useable points. There are current-limited injector drivers capable of running almost any injector and injector staging to allow big injectors to be run while keeping a smooth idle. It has acceleration enrichment, automatic air temp and pressure (ie ram air) compensation, special adjustment modes for "fast map" set up and injector cut-off for clean deceleration. An adjustable rev limiter (fuel-cut) is built in. It can also give closed loop for stoichiometric fuelling at part throttle and cruise conditions.

### *Ignition Features*

Ignition control is adjustable over a 45 degree range and it has the ability to run direct fire or coil igniter ignition systems. It can accommodate either single coil (with dizzy), multi-coil, and has adjustable split timing for rotaries.

### *Other Features*

It is suitable for rotaries and 1-12 cylinder engines, forced induction or normally aspirated. The system features a remote and removable hand-controller with a full backlit LCD screen displaying real-time information. A bar graph can be used to display air/fuel ratio, fuel and ignition maps and a 4-digit PIN security can lock out all fuel and ignition maps

There's an adjustable over temperature warning light, electric engine fan control, and an in-built turbo timer. Two data logging functions give the minimum and maximum of the following parameters: rpm, load, ignition timing, input signal, injector time, duty cycle, throttle position, water and air temp, voltage and max boost. One other major feature is a mapped logging of the oxygen sensor over any preset area.

The kit includes the ECU, wiring loom, memory cartridge, temperature sensors, controller relay, fuses and instruction manual. Plus each system has a memory cartridge, which enables loading and saving of complete fuel and ignition maps.

### **Electromotive**



The TEC (Total Engine Control) 1 and 2 are this US company's combined fuel and ignition computers.

### *Fuel Features*

The TEC systems come with an exhaust sensor for closed loop fuel control and a full complement of cold start, warm-up, acceleration and idle control adjustment. They can be used with either high or low resistance injectors. Also, the TEC needs only two inputs to establish the base fuel curve as its design is based on thermodynamically linear fuel delivery. HELP screens are available on every calibration parameter. TEC 2 has batch fired, phase sequential and true sequential injection options. It also has an open or closed loop option and selectable speed-density or mass airflow inputs.

### *Ignition Features*

Ignition uses a fully adjustable 3D spark timing curve using RPM vs engine load (MAP). There is a full range of spark advance control with  $\pm 0.25$  degree resolution from 40 to 12,000 rpm. The ignition system incorporates programmable dual rev limiters (ideal for launch control and engine protection), a blinking "check engine" light for instant diagnostics, an electronic tachometer drive output and adaptive knock control to suppress engine pinging. They are completely set up with an advanced high-energy direct fire system, using primarily standard GM-type sensors. TEC2 can accommodate odd-fire applications also. The TEC-1 and 2 series of engine control units consist of a Direct Fire Unit which holds the coils, and a TEC controller which holds the injector drive circuits and control logic.

### *Other Features*

Both are designed to suit rotaries, 4, 6, 8, 12 cylinders and 4 cylinders with twin spark plugs, multi or throttle-body, naturally aspirated or forced induction and nitrous. But contact Electromotive for details on four cylinder, odd-fire, two-stroke and other unusual engine configurations. Both TEC-1 and 2 are PC programmable and have a general purpose output for modulating a wastegate or other solenoid controlled systems. TEC 2 software allows data logging and graphic display of the most important engine parameters. Numerous special software tuning programs are also available to suit different applications and engine configurations.

The kits include the fuel and ignition controller, magnetic sensor and choice of trigger wheel, MAP sensor, coolant temperature sensor, manifold air temperature sensor, heated exhaust gas oxygen sensor and all sensor hookup cables.

### **EFI Technology srl**



Based in Italy, this company has four PC programmable full management computers: Euro 1, Euro 96, MT-501 and the top-shelf Euro 98. Anyone interested in the Formula 1 level Euro 98 model should contact their nearest EFI technology srl distributor for its tailor-made details. However, all of these systems feature the capability for full automatic self-mapping of the fuel injection section.

### *Fuel Features*

The Euro 1 has a 24x16 (user-defined) breakpoint basic fuel table, 4 injector drivers operating semi-sequentially, 8 high impedance injector drive capacity and fuel injection correction of  $\pm 100\%$ . There is a programmable fuel cut-off for deceleration, fuel-cut engine speed limiter, accelerator enrichment/lean out and lambda control with self-learning capability. Crank settings are programmable, as is fuel injection phase and phase rate. The Euro 96 has all this but has 6 fully sequential operating injector drivers and the capacity for 12 drivers. It also has a programmable injector minimum time-off in cycle. The MT-501 gets 8 sequential injector drivers and multiple high impedance injector drive capacity.

### *Ignition Features*

The ignition has a 24x16 breakpoint spark advance table from 0-64 degrees and in 0.25 degrees resolution. It has 2 ignition drivers, direct fire capability, advance correction from  $\pm 32$  degrees in 0.25 degree steps, crank settings and idle speed control. It also has spark advance delay correction at high engine speeds. The Euro 96 has 3 ignition drivers and a programmable ignition-cut rev limiter. The 501 uses 8 ignition drivers and a knock control system that is also self mapping.

### *Other Features*

The Euro 1 is a semi-sequential system for 4 cylinder engines with full lambda control, boost pressure and idle speed in closed loop regulation. The Euro 96 is for 4,5 and 6 cylinder engines and is now available with traction control - some direct substitutions for certain cars available, such as Porsche, Seat and Golf GTi. The MT-501 is a 32-bit full feature system for 4 and 8 cylinder engines, and comes with full lambda and knock control. The top-line Euro 98 is a 32-bit ECU based on the very latest technology and is aimed at upper-level motorsport.

Other features of the systems include boost control, EGR valve control, variable intake capability, shift light and engine rpm outputs. Diagnostic systems are also built-in. Euro 96 gets water injection control, an anti-lag system, traction control and additional switched outputs. This and all higher-grade models come with a CAN line for high-speed interference free communication between digital dash systems etc.

A comprehensive manual is supplied in the deal.

### **APEXi**



The Japanese high-performance company APEXi makes an assortment of programmable plug-in computers for many high-performance Japanese vehicles. These ECUs are specific to each vehicle, and use all of the standard input sensors, output actuators and wiring loom.

Known as the "Power FC", the system allows tuning of fuel and ignition timing maps, airflow meter signal adjustment, boost control accelerator enrichment compensation, ignition cranking, fuel adjustment, water temperature correction and rev limit control. This is all done via a back-lit LCD handset which connects into the new ECU, and it can be left on "monitor" mode to view real-time water temp, oil temp/pressure, rpm, airflow, air/fuel ratio etc. The Power FC comes pre-programmed to suit a "typical" application, giving a starting point program.

The programmable ECU is literally plug-in compatible with the early S14 Nissan 200SX, Nissan Skyline R32 and R33 GT-R and Toyota MR2 Turbo.

### **Haltech E6GM**



Haltech's E6GM is a plug-in replacement computer for cars using the Delco system of factory management - mainly Australian Holdens. As it is a plug-in, no wiring or harness changes need to be made, and it uses all factory sensors in its operation. Once installed, a laptop PC is loaded with the supplied software, giving full access to programming the ECU. The system can be switched from one setting to another (ie economy-power mode), there is full data logging and also optional fuel and ignition trim knobs to make speedy changes. The ECU is the now-superseded E6 unit that was used as an individually marketed system, so it has exactly the same features. This means you can adjust 3 ranges of acceleration enrichment, cold start prime, warm-up enrichment, fuel cut adjustment on deceleration, idle air control, set an rpm limit and various other parameters on top the main fuel and ignition maps.

### **Kalmaker**

Kalmaker is a software program for Delco-equipped Holden (and some Chevrolet) cars, allowing changes to be made directly to the factory software. Unfortunately, the company that distributed this product (EFI Direct) has ceased selling it. This system allows for full tuning of the factory Delco system's complex management software - including various tuning parameters not found on many aftermarket programmable systems.

The workshops in Australia already equipped with this software and able to tailor-tune your car are:

Injection Perfection NSW  
+61 2 9791 3122

Sam's Performance NSW  
+61 2 9772 3105

Gossies Dyno Centre NSW  
+61 2 4352 1733

COME Engines VIC  
+61 3 9571 9605

Dyno Dynamics VIC  
+61 3 9739 5966

AJC Auto VIC  
+61 3 9792 3566

Amberley Auto VIC  
+61 3 9793 1616

Blue Chip Tuning VIC  
+61 3 9364 1895

Chip Torque QLD  
+61 7 5596 4204

Bob Hawkins Car Connection QLD  
+61 77 714 601

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**Footnote: If you are aware of any other combined fuel/ignition ECUs, email [Michael](mailto:Michael)**

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