Programmable Management Mania, Part 1

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

By Michael Knowling

In this special we'll show you some of the many aftermarket programmable engine management computers that have appeared on the market. And by "engine management" we mean full fuel and ignition control, not just one or the other. The unit has to have full engine control built into its ECU.

Note that without proper emissions testing, most (all?) of these systems aren't technically legal for road use - but that doesn't seem to stop too many people from putting them in their road cars! And each of these systems' full potential can be reached only through extensive tuning on a dynamometer (preferably an engine dyno). We stress this point because it is easy to fork out lots of money on a programmable system and still end up with a poor running engine if it isn't well set up and tuned.

THE PLAYERS

Microtech

The Microtech MT series programmable ECUs come with advanced digital fuel control with sequential firing, and advanced ignition control with multi-coil applications.

Fuel Features

There are sixteen load points from 30"Hg to 20psi via an in-built MAP sensor, with eight load points at idle from 30"Hg to 00"Hg. Mapping is in 500rpm intervals between 500 and 8000 rpm. It includes adjustable acceleration enrichment, WOT adjustment, water and air temp correction (both with 16 adjustment points between -25 degrees and 124 degrees Celsius). Cranking enrichment is adjustable in 16 stages for easy starting, hot or cold.

Ignition Features

Ignition timing is in sixteen 500rpm intervals from 500-8000 rpm and is adjustable over a 45 degree range. Timing is adjusted according to load in 16 stages from 30"Hg to 20 psi. Both water and air temp compensation is adjustable in sixteen stages from -25 to 124 degrees Celsius. It also has an adjustable acceleration advance facility.

Other Features

This system is designed to suit 4, 6, 8 cylinders and rotaries. Fine-tuning of the system can be carried out using an external handset. This handset features real time information and has a data logging facility. It also comes fitted with a "factory programmed chip that will allow you to start the engine as soon as the MT has been installed". It is compatible with OEM sensors and crank angle sensors, na and forced induction engines. It has high RFI and voltage transient protection; there is a programmable auxiliary output, air/fuel ratio readout, twin memory maps, diagnostic output test, an intelligent easy-to-use handset with a back-lit LCD. It comes with a 12-month warranty and is easy to install.

MoTeC

Australia's MoTeC has three series of engine management computers available: the M4, M48 and M8. The M4 is produced with three different software programs: the Standard, Clubman and Pro. The M48 comes in Clubman and Pro configurations. The M8 Pro is the sole version of the top-line M8. Each version has numerous set-up options, and all use current 32 bit computer technology. They are all PC-only programmable.

Fuel Features

All M4s use a 220 point main table with 20 rpm sites and 11 load sites, except the Clubman with its advanced tuning option and the Pro, having 840 different points spanned over 40 rpm and 21 load sites. These higher spec units also give odd or even fire, individual cylinder trim with individual tables, hi/lo injector balance, hi/lo end of injection, adjustable MAP compensation, two auxiliary compensations, injector dead time compensation, deceleration clamp, decay and sensitivity.

The M48 Clubman uses the same 220 point 20x11 main table and all the same fuel specs as the M4. The up-spec M48 Pro and M48 Clubman with the advanced tuning option also have the same functions as the equivalent M4s and get the big 840 point main table. The top M8 gets the 840 point main table with its 40 rpm sites and 21 load sites, and all the features listed in the lesser models all as standard. This includes individual cylinder trim, hi/lo injector balance and two auxiliary compensations.

Ignition Features

The ignition of the M4 uses a 220 point main table, ± 50% overall trim and engine and air temperature compensations. The Pro and advance tuning optioned Clubman offers an 840 (40 rpm and 21 load) point main table, ± 50% individual cylinder trim and individual cylinder tables (3D). Adjustable MAP compensation, acceleration advance - clamp, delay and sens, two auxiliary compensations, gearchange ignition cut, dwell time, and odd fire engine capability are also included in the Pro and optioned-up Clubman.

The M48 gets a 220 point main table, with the Pro and the optional advanced tuning package bumping this up to again 840 points. The rest of the M48's ignition features are the same as the M4's. The M8 has an 840 point main table as standard with individual trim, odd fire capability and all the capabilities of the previous models.

Other Features

All M4s have turbo boost control, traction control, warning alarms, dual rpm limit, nitrous enrich/retard, AC request, diagnostics and numerous outputs for fans, idle speed control etc. The Clubman with advanced tuning and the Pro have a larger main table, extra compensations, gear detection, road speed limiting, and programmable sensor calibrations.

The basic M4 Standard has options of 3D mapping, advanced tuning (more reference points, traction control, definable sensors etc), ignition control, sequential injection and wideband temperature compensated lambda input. The Clubman has the optional advanced tuning, 512kB internal data logging and a wideband temperature compensated lambda input. The Pro has this data logging facility as standard but still has the lambda option. It is even possible to gradually upgrade from Standard to Pro specs with the extra software.

The M48 can control engines of up to 8 cylinders sequentially, or 12 cylinders in group-fire mode. Traction control, nitrous control, road speed limiting, dual rpm limiting and other functions are all standard. The non fuel and ignition related options are gear change ignition cut and overrun boost enhancement. Boost control and other general outputs are also the same as the M4s. The M48 Clubman gets the lot except there is still the option of advanced tuning, data logging and wideband temperature compensated lambda input. The ultimate Pro version gets the 512KB data logging as standard but the option of the lambda input remains.

Finally, the top-line M8 gives sequential injection and individual cylinder tuning for up to 8 cylinders. It has the most inputs and outputs in the MoTeC range and the highest internal map memory to give optimum configurability. It has full boost control, comprehensive "special functions" and a myriad of auxiliary functions. Options are data logging and dual wideband temperature compensated lambda inputs.

All units have a 1-year warranty. For further information on this and other MoTeC units, please refer to their listed website.

SDS

The SDS (Simple Digital Systems) EM-2 E and EM-2 F are combined fuel and ignition ECUs, while the "F" has distributorless ignition control.

Fuel Features

The EM-2 E and F can go to 18,000 rpm in 250 rpm increments and there is automatic enrichment during cranking and warm-up. Closed loop can be used with 5 adjustment points influencing the main 64-point manifold pressure map. The ECU monitors TPS for acceleration enrichment and the system allows for 3 different mixture variations under these conditions. A mixture trim knob gives a further ± 50% change in base pulse width. The system is suitable for port-type injection only but can run high or low impedance injectors.

Ignition Features

Both systems can use a crank trigger and a Hall Effect sensor as inputs to the ECU. Timing can be adjusted in crankshaft degrees every 250 rpm through 64 different manifold pressures, and boost retard can also be entered in 1-degree steps. Both deliver a high intensity, long duration spark. An optional rpm switch is also available.

Other Features

The "E" is compatible with 4, 6 and 8 cylinder engines, while the "F" is suitable for 4s, 6s and twin rotor engines. There is optional knock control, V-TEC control, fast idle, high range MAP sensors and extra fuel pump relays etc. The manufacturer claims it to be the easiest system to set up, and you don't need a PC as it uses a detachable handset with a LCD display. Tuning via this handset can be done with the engine off or on. Both systems have a boost limiting function as well.

The ECU comes in a CNC-machined aluminium billet box that is gold anodised. The kit includes the ECU and handset programmer, injector driver, air temp sensor, water temp or CHT sensor, main wiring harness/injector harness, fuel trim control, crank sensor, timing magnets, coil/amp unit and a comprehensive manual. A 180-day warranty on parts and labour is also part of the package.

Haltech

The Haltech E6S/E6S-8 and E10 are this company's fuel and ignition computers. The E10 isn't released yet, but it is very near.

Fuel Features

The E6S has 22/17 fuel maps depending on the rpm range and increments set and there are 32 bars on each map. Injector firing can be throttle body, sequential, multi-point or staged. It has settings for cold prime, zero throttle, full throttle, injector phasing, throttle pump and injector trim (sequential only). There are fuel correction maps for coolant and air temperature and battery voltage. The E10 also has auto barometric compensation.

Ignition Features

The system's maximum operating range is 16,000 rpm with increments in 500/1000 rpm. There are 22/17 maps for each of these rev ranges. Ignition correction is made through coolant and air temperature. Triggering can be through inductive magnetic, ignition crank, Hall Effect or optical sensor. System configurations can be either single or twin dizzy, direct fire or waste spark. The E10 also has the option of programmable ignition waveform.

Other Features

The E6S/E6-8 can control 1-6, 8, 10, 12 cylinders, 1-2 rotors normally aspirated or forced induction engines. A comprehensive data-logging system is also incorporated. They come with a variable number of injector driver outputs (E6S has 4, E6S-8 and E10 has 8), fuel pump relay control, idle air control, ignition output and two special purpose outputs (the E10 has three). Included is the ECU, main wiring loom, injector wiring loom, 2 power relays, air and coolant temp sensors, throttle position sensor, ignition module (extra for E10), communication cable, programming software, and instruction manual. The MAP sensor is extra.

EMS

The EMS QI-4 is the sole EMS combined fuel and ignition computer.

Fuel Features

It uses three fuel plots every 500 rpm from 0 to 12500 rpm and seventy-eight points need to be user-set, but the ECU will then calculate over 65,000 points. Two separate sets of maps can be stored for increased flexibility. A staged injector function can be set to bring on another bank of injectors, there's acceleration enrichment/duration adjustment, adjustable warm-up settings and cold-start enrichment, fuel and ignition trimming (as a percentage) plus fuel cut or enrichment on deceleration. There are 8 injector drivers, a fuel pump control (with a safety cut) and idle control included.

Ignition Features

Ignition timing is adjustable from 0-51 degrees advance in 0.2 degree increments, and there's adjustable dwell control, an adjustable igniter triggering edge for different modules as well as 4 ignition outputs for sequential ignition timing. A rev limit can be set anywhere in the rev range in 50 rpm increments.

Other Features

It is suitable for normally aspirated, forced induction, 2-stroke, 4-stroke, 1-16 cylinder and rotary engines. Throttle body or multipoint injection is possible. It also comes with an in-built turbo timer, cam control (V-TEC etc) and anti-lag. Each output has 12 options - eg boost control, thermo fans, NOS, tacho output warning light, AC control, water/methanol injection, injector control, shift light etc.

Inputs are from a built-in map sensor, air temp sensor, barometric compensation, internal battery sensing and compensation, water temp sensor, TPS, selectable Hall, magnetic or optical trigger circuit, and selectable Hall, magnetic or optical on the synchronisation circuit. Adjustments are made via a hand-held real-time "intelligent interface" with a four-line backlit information display. The system comes with a colour-coded wiring loom with fuses, relays and plugs, service and back up, instruction manual.

GEMS

General Engine Management Systems Ltd have many management computers. There's the GEMS Multi 3, Multi Si, EM20, EM10, Mini ECS, GEMS II and GEMS IIs "advanced" management systems, plus the Mini Zeta and Mini EMS "standard" units.

Fuel Features

The Multi 3 (the top version) features 3D fueling (sequential) and idle control. It has 20 injector drivers, 17 load steps, and a maximum of 17,500 rpm. The Multi Si has 3D sequential injection and can manage two injectors per cylinder. The ECS has the same 3D sequential fueling system but comes with closed loop emission control and idle speed control. GEMS II has 3D fueling (non-sequential) and two injectors per cylinder. GEMS IIs is good for up to 4 cylinders through the same 3D system. In the standard series, the Mini Zeta has 3D fuel (non-sequential) control with 11 load steps and a maximum of up to 11,200 rpm. The Mini EMS is otherwise the same but has a maximum of 10,000 rpm.

Ignition Features

The Multi 3 (the top version) features 3D ignition control, knock control and distributorless ignition capability. It has 6 ignition drives, 17 load steps, and a maximum of 17,500rpm. The Multi Si and ECS have 3D ignition control, distributorless ignition capability and can fire twin spark plugs. The GEMS II also has 3D ignition, and the ability to manage distributorless ignition and twin plugs. GEMS IIs is good for up to 4 cylinders through the same ignition system as the other models, but comes with distributorless ignition capability.In the standard series, the Mini Zeta has 3D fuel ignition control with 11 load steps, a distributorless ignition function and a maximum capability of 4 cylinders at up to 11,200rpm. The Mini EMS is minus the distributorless ignition option and has a maximum of 10,000rpm.

Other Features

The Multi 3 features anti-lag and emission control and is suitable for up to 12 cylinders. The Multi Si has boost control, traction control, variable intake length direct programming via a serial link, a military-spec loom connector and the ability to run up to 12 cylinders. The ECS has the Si's serial link direct programming and can cope with eight cylinders. GEMS II has boost control, military connector, direct programming and is able to manage up to 12 cylinders. GEMS IIs is suitable for 4 cylinders and gets a military connector and the common serial link programming. In the standard series, the Mini Zeta has a serial link input.

Next week: more of them!

Contacts:

Microtech
+61 2 9808 5233

MoTeC
+61 3 9761 5050
http://www.motec.com.au/ecu.htm

SDS
+1 403 274 0154
http://www.sdsefi.com/index.html

Haltech
+61 2 9525 2400
http://www.haltech.com.au/

EMS
+61 2 9892 3148
http://www.pem.com.au/enginemanagement.htm

GEMS
gems@gems.co.uk
or http://www.gems.co.uk/

Programmable Management Mania, Part 2
Programmable Management Mania, Part 3

TERMS AND CONDITIONS OF USE:

**This material is licensed for the sole personal use of
the AutoSpeed Registered User identified as:
dude in a mirage**

- The user identified above, and within this document, acknowledges that all text and graphics herein are the intellectual property of Web Publications Pty Ltd and are the subject of international copyright law.
  Reproduction or redistribution of this material in any form is prohibited without the express written permission of Web Publications Pty Ltd.
- Any breach of these terms and conditions may result in suspension or cancellation of the users AutoSpeed account and legal action.

www.autospeed.com