Despite recent advances in new car technology, programmable stand-alone management systems are still 'the go' in mild to wild modified engines. There is simply no other approach to run bigger injectors, a multi-spark ignition, control boost, phase nitrous and more. Aftermarket chips and interceptors generally can't cut it in 'the big league'.

In this buyers' guide we'll be taking a look at the specs of today's programmable management systems. First up, we'll cover full engine management computers - units that can control fuel and ignition, not just one or the other.

Looking Beyond the On-Paper Specs

Don't fall into the trap of thinking that a top-line programmable ECU will guarantee you a sweet running engine. A thorough tune is essential for any programmable system to perform well. Each system's full potential can be reached only through extensive tuning on a dynamometer followed by an on-road (or on-track) test. We must stress this point because it's all too easy to spend a wad of cash on a programmable management system and have little left over to invest in tuning. This will invariably lead to a poor end result.

Warning: aftermarket programmable management systems are generally illegal for street use.

The PLAYERS

Microtech

At present, Microtech offers a 'wire in' LT8/LTX8 fuel/ignition computer that can be tuned via laptop or a remote handset.
Fuel Features
The 16-bit LT8/LTX8 is equipped with four injector drivers that can give sequential injection on a 4-cylinder engine or grouped injection on other engines up to 12-cylinders. This unit can run up to four high-impedance injectors per driver.
The main fuelling table is tuneable at 16 load sites and at 500 rpm intervals to a maximum of 9000 rpm. Its internal MAP sensor can read up to 25 psi of boost. It also includes adjustable acceleration enrichment, WOT adjustment, water and air temp correction, cold start and "after start" correction and an auxiliary input correction. Closed-loop mixture control is also accommodated.
Ignition Features
On the ignition side of the LT8/LTX8 there are four output channels, with the LTX8 featuring an in-built igniter. The ignition can be arranged with twin distributor set-ups or direct fire on 4-cylinder engines. Ignition timing is in sixteen 500 rpm intervals from 500-8000 rpm and is adjustable over a 45-degree range. Both water and air temp compensation is adjustable, it has an adjustable acceleration advance facility as well as hard and soft rev limiting.
Other Features
The LT8/LTX8's 'other features' include an overboost limiter, a spare input and output channel and an optional fifth pulse-width modulated output. This means you can run anti-lag, VTEC switching, boost control, etc. Extensive diagnostic functions and data logging are also featured and a set of base maps is also supplied in most instances. Options include a wide-band oxygen sensor input, external 3 Bar MAP sensor and more.
Note that a new range of extra sophisticated MicroTech units is to be released in late 2003.

MoTeC

MoTeC has three series of engine management computers available - the M4, M48 and M800. The M4 and M48 come in two off-the-shelf guises known as the Clubman and Pro. Note that both the M4 and M48 Clubman versions come "software locked". These locks can later be disabled (for a fee) to open various previously inaccessible functions. Unlocking all of the functions brings a Clubman spec computer to full Pro spec - there is no physical difference between the two.
The top-line series is the M800, which can also be unlocked to full M880 spec if required. All MoTeC ECUs use a current-tech 32-bit Motorola processor and are PC programmable only.

Fuel Features
Accurate to within 0.00001 seconds, MoTeC M4s can provide sequential fuel injection in 4-cylinder applications. The M4 Clubman uses a 220 point main table (over 20 rpm sites and 11 load sites) and can be upgraded to Pro level with a full 840 point main table (over 40 rpm sites and 21 load sites). Rpm and load sites are user definable. Adjustable coolant temp, air temp, battery voltage and map compensation is available in all M4 specs along with X percent +/- trim. The M4 Clubman's Advanced Tuning option (standard in the M4 Pro) adds individual cylinder trim with individual tables, cold start, injector dead time compensation, acceleration and deceleration clamp, decay and sensitivity, hi/lo injector balance, hi/lo end of injection and two auxiliary compensations. Closed-loop mixture control can be employed and there is a wideband oxygen sensor option.
The M48 Clubman has the ability to provide sequential injection for up to 8-cylinders. The M48 Clubman uses the same 220 point 20x11 main table and all the same fuel specs as the M4 equivalent. Again, the Advance Tuning option provides a massive 840 point main table if needed (this comes standard in the M48 Pro). The rest of the M48's fuel features and upgrades are the same as the M4's.
The top-line MoTeC M800 comes with 8 injector drivers as well as QuickLambda (MoTeC's auto fuel adjustment system which aids tuning). It also has the 840 point main table and all the features listed in the lesser models as standard.
Ignition Features
With up to four ignition outputs and accuracy to 0.25 degrees, the M4 uses the same number of tuning points as the fuel table - the base Clubman offers 220 points, but can be upgraded to the 850 point Pro level. Rpm and load sites are, again, user definable. Standard features include X percent +/- trim and adjustable coolant temp, air temp and map compensations. The Advance Tuning Upgrade and Pro M4 add individual cylinder trim with individual tables, odd fire engine capability and two auxiliary compensations. A versatile ignition interface allows connection to most OE systems. It can cater for 1 - 12-cylinder engines up to 15,000 rpm.
The M48 Clubman has only 2 ignition outputs, but up to 8 coils can be driven using the MoTeC Ignition Expander. The M48 Clubman is essentially the same as the M4 equivalent - it has all of the same standard features and options. It is also rated at up to 15,000 rpm. Note that the M48 Pro comes standard with up to four ignition outputs. The M800 varies by having up to 6 ignition outputs.
Other Features
All MoTeC ECUs have the ability to control turbo boost complete with coolant and air temp compensations - even better tuning resolution and an auxiliary compensation available with Advance Tuning upgrade or any Pro version. Ground speed limiting, shift light, tacho output and diagnostics are available on the M4 Clubman, but the Advanced Options brings a host of other special features - traction/launch control, flat shifting, hi/lo alarms, gear detection, dual rev limit, adjustable rev limit characteristics, nitrous enrich/retard and more. Optional telemetry link and data logging.
The M800 has an array of spare outputs that can also control electronic throttle(s) and infinite variable cam timing (such as BMW's double VANOS and the Ford XR6T's VCT). The M800 can also be upgraded to M880 spec to provide a larger logging memory and a military standard wiring plug.

Haltech

The latest release from Haltech is the E6X management system. The E6X is based on the same platform as the proven (and now superseded) E6K unit and offers every feature developed for it - plus a couple more...
Fuel Features
IBM programmable, the E6X features up to 4 fuel channels or 4 ignition channels ("internal toggle" in Haltech speak), can control 8 low impedance or 16 high impedance injectors - note that an additional driver can be added if required. Closed loop mixture control can also be accommodated.
Ignition Features
Ignition timing is adjustable in a 22/17 table (as per fuel adjustment) and various ignition pick-ups can be catered for. And can control direct fire and waste park systems. The E6X's rev limit is up to 16,000 rpm. It is suitable for triggering by signals from Hall effect sensors, Haltech dual Hall effect sensors, or optical type sensors.
Other Features
The E6X can control an engine with 2 to 12 cylinders, a Mazda engine with two rotors in NA or forced induction form. There are 4 pulse width modulated outputs that can be used to control boost, nitrous, anti-lag, VTEC, shift-light, intake manifold switching and more. An internal barometric pressure sensor, flatshift, data logging to laptop, dual mapping and tacho output and an auxiliary input. The kit includes the ECU, all typical sensors, a flying lead loom, relays and an instruction manual. Up to 65 psi boost catered for.

SDS

The fourth generation EM-4 E/MSD and EM-4 F are combined fuel and ignition ECUs from SDS (Simple Digital Systems). The EM-4 E/MSD works on 4, 6 and 8-cylinder engines with a dizzy and an aftermarket "spark box" such as MSD or Crane. The EM-4 F is designed for 4 and 6-cylinder engines and provides distributorless ignition control. Note that throttle body type injection systems cannot be accommodated.

Fuel Features

The EM4s offer complete control of port type injectors on 2, 3, 4, 5, 6 and 8 cylinder engines plus twin-rotor Mazdas. Fuel values are fully programmable and a load signal is derived from a MAP sensor. It can be configured to drive low or high impedance injectors with triggering times down to 1.5 milliseconds for a good idle with very large injectors fitted. A mixture trim knob allows a full + or - 50% change in pulse width from the programmed values. Closed-loop mixtures are also supported.

Ignition Features

An rpm range up to 9750 is available with the EM4 E/MSD. As the name implies, the system is configured to trigger an MSD-6A directly from the ECU.

The standard rev range for the EM4 F - which is designed to run direct-fire ignition - is also up to 9750 rpm, but an upgrade to 15000 rpm is available. 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. Note that spark control is not available for engines with an odd number of cylinders. Knock sensing is, however, available as an option on both models.

Other Features

Tuned by a LCD handset, the EM4s include an rpm switch (great for a shift light), supercharger relay, AC compensation output and boost control (boost pressures up to 30 psi can be accommodated). Three gauge modes permit real-time monitoring and full diagnostics of all sensor inputs to the ECU. A backlit LCD option is also available. Note that the manufacturer claims their systems to be the easiest system to install and tune.

EMS

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

Fuel Features

The QI-4 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. The unit's maximum rpm capacity is 15,000.

Other Features

It is suitable for naturally 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 (VTEC etc) and anti-lag. There is also a further four user selectable output channels - these can be used for boost control, thermo fans, nitrous, tacho output warning light, AC control, water/methanol injection, injector control, shift light etc. Data logging is also now available.

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 is protected by PIN security and the software of each QI-4 can also be updated to the latest specifications.

GEMS

General Engine Management Systems Ltd currently offers two universal stand-alone programmable ECUs - the EM20 (designed for four-cylinder sequential injection engines) and the top-line Multi-series (which is capable of sequential 12-cylinder injection).

Fuel Features

The EM20 allows the tuner to - via an IBM-compatible laptop - alter fuel injection timing and gives closed-loop mixture control. Mapping can be TPS and/or MAP based and a fuel pump relay drive. Decel fuel cut-off, throttle trigger acceleration enrichment and deceleration enleanment, cylinder specific fuel trim and can control upper and lower level injectors.

The Multi-series computer can provide sequential injection for 12 cylinders or 6-cylinder sequential injection with upper and lower injectors. Twin oxygen sensors can also be employed for closed-loop mixture feedback.

Ignition Features

Although intended for four-cylinder sequential injection, the EM20 has two ignition output channels that can also provide spark for a three-cylinder distributorless engine or a six-cylinder with a distributor. Sync and crank sensors can be a combination of Hall Effect, variable reluctance or optical sensor. Knock sensing is another important feature.

The Multi-series boasts twin knock control inputs with a "determination of knocking cylinder(s)" system. Six ignition amplifier outputs.

Other Features

Can be used on naturally or boosted engines between 2 to 8 cylinders. Other inputs are for battery voltage, coolant temp, ambient air temp and barometric compensation (on naturally aspirated engines). Outputs include wastegate control, anti-lag, launch control, VTEC system switching, tachometer output, radiator fan and idle speed. The rev limit can be cut using fuel and/or ignition.

The Multi-series also features internal logging, twin wastegate control and a CAN interface. An array of outputs also enable gearbox and chassis control (active differentials, suspension etc).

Stay tuned for more!

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