

# ELECTRONIC DIAGNOSTICS!

Tracing and fixing faults in electronic engine management systems

**Number 59: Finally we've got round to covering a Mini!** Chris Graham reports on some of the problems likely to afflict this pint-sized box of tricks.

Thanks mainly to tightening safety regulations, Mini, as we know it, is into its final year of production and, engine-wise has reached perhaps the limit of its technological potential. The heart of the motor is still the trusty old A Series engine albeit festooned with many of the most up-to-date additions which Rover has to offer.

Frank Massey, our guiding light on all things electronic, and proprietor of

## POSSIBLE FAULTS

1. Earth contacts
2. CAS failure
3. Fuel injectors

Preston-based Fuel Injection Services (Tel: 01772 201597), is not the greatest Mini fan in the UK but was, nevertheless, keen to have a closer look at the gleaming new Cooper we presented for his expert consideration.

The electronic brains behind the latest Mini Cooper is the most recent version of MEMS (Modular Engine Management System), denoted simply as MEMS 2J. Added to this, Rover have finally broken away from the, at times, asthmatic single-point fuel injection system, and developed a variation on the multipoint theme. Frank would actually classify this as 'dualpoint' rather than multipoint, simply because there are only two fuel injectors.

# ENGINE MANAGEMENT

This version of MEMS arrived early in 1997 and so it's still early days to be specific about problems.

The system is essentially straightforward and features DIS ignition, making use of the 'wasted spark' approach to firing the plugs. This represents a big improvement as Minis historically suffered from the old-fashioned distributor's forward location at the front of the engine.

The component layout, with regard to engine management, is pretty much conventional. The two injectors are fed from a single fuel rail with a pressure regulator at one end. Other major components include: a water temperature sensor built into the

thermostat housing; an idle control stepper motor; a charcoal canister and purge valve for dealing with tank fumes.

An ambient air temperature sensor in the air intake manifold; an inertia switch found under the bonnet on the n/s rear bulkhead; the aforementioned dual ignition coil which is driven directly by the ECU; a MAP sensor mounted on the inlet manifold – no rubber hose to worry about.

There is a throttle position sensor; a crank angle sensor, at the back of the bell housing; a camshaft sensor and a four-wire Lambda sensor, running 'closed loop' control on the exhaust emissions.

The fuel pump is mounted within the

petrol tank which, in effect, is in the boot. The main relays take the form of a single, multi-function unit (MFU) which combines four relays in the one component. It includes a main relay, a fuel pump relay, an oxygen sensor relay and a starter relay. Because of its construction, the MFU can only be changed as one unit.

There is a 16-pin J1962 diagnostic socket found under the dashboard. This provides access to fault codes, enables live data to be recorded and allows actuators to be driven for testing purposes. There is also a full vehicle immobiliser fitted. This is an integral system and should never be overlooked as a possible cause of trouble.

Multipoint generally refers to a set-up with one injector per cylinder. In this case, each injector is mounted in a Siamese port and features two outlet nozzles aligned at about 30° to each other. However, all other attributes you would expect to find with a full-blown multipoint system are present here.

Generally, Frank is impressed with the quality of the installation, although he admits that space is at a premium. The ECU is easy to get at, being located at the front of the engine bay on the o/s inner wing. Its socket is positioned on the underside of the unit but, despite this precaution, Frank still thinks that water ingress might be a problem in the future.

## PREPARATION

The first rule to remember when dealing with this engine is that its design is an old one and so often the cause of faults can be mechanical in nature. The A Series unit still relies on mechanical pushrods, rocker shaft and rockers. Don't assume that just because this application appears to bristle with electronic control systems, that every problem will be ECU, wiring or sensor-related.

Mechanical adjustments are still vital and all settings should be checked to eliminate the obvious before wading into complex electronic diagnostics. For example, errors in the setting of the tappets can have a very significant effect on the switching of the Lambda sensor.

The air cleaner is very easy to remove and check, so always do this as part of your routine preparation procedure. The ambient air temperature sensor is no longer found within this housing, so this simplifies the checking operation.

The engine features a very simple down-draught throttle body, made largely of plastic. Frank believes that this may well be in an attempt to reduce the risk of icing-up. Carefully wash this out using a good quality carburettor cleaner spray.

## NEED TRAINING?

Frank Massey runs regular courses at his well-equipped Preston workshop; everything from basic engine management introductions to full-blown, 'hands on', system-specific tuition. Call 01772 201597 for details.

The spark plugs are simplicity itself to access and check. As always, remove them all and inspect each carefully for signs of abnormal appearance – unusual discoloration or oiling etc. Check the gaps and that the plugs themselves are the right type. Also, watch out for 'corona rings' around the base of the ceramic body sections.

These will take the form of obvious brownish yellow staining and provide conclusive evidence that electrical tracking is occurring down the plug lead. The DIS ignition used on this car means that it's running a high powered HT system – up to 60,000V – and so problems with the leads will dramatically promote the likelihood of tracking. Remember, as well, that the leads face towards the front of the car and so will catch any road dirt or moisture going. Remove the leads and wash them. Check each carefully for cracks and splits and make sure all are clean and dry before re-fitting.

Incidentally, the brand new car we photographed here sported a set of

leads which were covered in a 'beautifying' lacquer. Frank says that, as time passes, this type of product ages and alters character to create a wonderfully effective electrical conductivity path – not the best prospect in the world! Consequently, he would far rather see plug leads left untreated, clean and dry. His advice is to remove such treatments and, if you can't, then scrap the leads and buy a new set. They won't break the bank but will ensure reliable service.

Finally, run a fault code check as part of your basic preparation procedure. Extract any stored faults using a code reader, note them and then clear the lot. Drive the car and check which, if any, return. Remember that some may well have been induced by nothing more suspicious than a mechanic disconnecting sockets during some previous service or repair operations. Any which do return should be treated as faults and marked down for further investigation.

## MINI MINUSES

The problem we face here is that this version of the Mini is still a relatively new car and so faults are comparatively rare. But Frank's extensive experience with the marque over the years, together with his knowledge of the

