



Frank Massey, Autoinform

Engine management - Past and future

I have long accepted that nothing stands still for long in this industry. Just when you think you have a grasp of the subject, something is sure to upset it. Nothing illustrates this more than power train diagnostics. Initially called fuel injection, later becoming engine management, now I'm afraid it's a little more complex.

I find myself fortunate to have been there at the beginning, Bosch Jetronic, a 25 pin ECU with, if I recall correctly, only 13 pins occupied. No serial diagnostics, no specific tools. So why fortunate? Consider my reflection of diagnostics back in the late 70's and see if they are still applicable today.

Firstly, you had to understand what the system had to achieve, what components it had at its disposal, what role they played and how they interacted within that system.

The next challenge was measurement values, what to expect under a variety of conditions, and what equipment was required to access this information. This all seems so straight forward, except in those days, it was a little like Columbus sailing across the ocean, he knew it was wet, he needed a boat, he knew which way west was (despite this being blasphemy in the eyes of the Pope) and so set off without a clue as to what was out there.

Hardly a logical diagnostic process. However, I was writing the rule book and did understand the meaning of the phrase - test don't guess. So, what's changed that undermines these basic principles?

I will list them and then explore the ramifications.

1. Accessibility
2. Complexity
3. Test Options
4. Data Extraction
5. Sent Technology

Accessibility

Even the most basic of vehicles now relies on a level of technology that makes accessibility almost impossible. Vehicle manufacturers totally forbid any intrusion within the wiring loom. I'm sure this explains why design and manufacture precludes access as a high priority. However, we are brave, and have the star ship Enterprise at our disposal for our journey of discovery.

The problem is one of integration. Systems don't function in isolation any more, Columbus now has to map the Americas and Australia at the same time. In order to conduct an accurate assessment of

a function, it must be in its natural environment and be observed when functioning normally.

Complexity

This is not

restricted to a physical state, it also includes software, algorithms, predictive response, correction and adaptive action. Systems now change their mode of operation based on environmental influences, effected by a very wide range of changing influences. Cylinder Select or Dynamic Stability comes to mind. I used to say that for a function to occur, it must have a command followed by response. In today's world, the command may be a software decision followed by a constantly changing response. Stratified and homogenous fuelling, infinitely changing camshaft timing and variable valve lift to name just a few.

Test Options

Manufacturers are driven by a non-intrusive process dictated by guided diagnostics. Pre-determined test plans, more often or not, end with a pass or fail result, foregoing any data review. Is this due to a control of process and cost, or a mistrust in their techs? Actual evaluation of circuits, voltage, current or complex profile is getting ever more difficult. Attaching gauges in order to measure pressure and flow is often restricted by sealed transit hoses or internal ducting within castings. Serial data has become so much more powerful and trustworthy, but it does not and will not replace the functions available from an oscilloscope. Specialist mechanical tools and assembly techniques prohibit casual examination, due to cost, or the ever more common single fitment parts.

Data Extraction

Data extraction may lie in a multitude of directions, from physical extraction (camshaft



A VW engine from an earlier, simpler time

timing for example), fuel quantity per stroke via the serial port or fuel pressure rise time via the scope. We are forced to monitor not just a physical value, but how the PCM is adjusting or adapting a value. How do we know the parameters of operation when vehicle manufacturers are removing more and more data in favour of the pass-fail flags from a software automated test profile?

SENT Technology

Rive gauche. Not a walk along the Left Bank, but a completely new protocol for data and diagnostic transmission. Developed specifically for automotive applications, rather than a black-market hooky copy from other engineering developments, Rive Gauche is a single edge nibble transmission, a uni-directional out only data line to the PCM. It is essentially a serial interface, used predominantly with throttle position, air mass and temperatures. The basic unit of time is the tick, with a minimum data unit nibble. Data transmission speeds over fast or slow channels, where bit rate can also vary. In essence, it is very similar to a single channel CAN transmission, where the function includes synchronisation, calibration, CRC and checksum.

How am I to challenge the authenticity of data? For example, sensor error may come from power or ground discrepancies, range error, environment influences, calibration error or simply a genuine condition fault. Its design is, of course, intended to provide automatus diagnostic platform via the serial port, excluding any assessment by a tech. I suspect it will go full circle back to the 70's, when part swapping was the norm for Christopher Columbus frauds.