Fault finding with an oscilloscope

When a 2006 Opel Vivaro with the 1.9 F9Q engine was towed into the workshop, the customer was expecting a quick "plug-in" to fix the fault. As everyone in the trade knows, this is rarely the case, and this van was no exception. A.D.S recounts the steps needed to get this Opel running again, and how an oscilloscope was key to finding the root cause of the fault.

The Vivaro was intermittently stopping and not restarting, unless the vehicle was left to cool down for about 2 hours. Once restarted, it would run again for up to ten minutes.

Initial Check

A Vedis 2 diagnostic system scanner was connected to the Vivaro, but many attempts to connect to the engine control module failed. An attempt to communicate with the ABS and airbag systems showed no problem and that communication was ok. The fact that the vehicle was running proved that the engine ECU was being powered up, so we suspected a fault in the link between the engine ECU and the DLC. We used a tool called the DLC CAN Test Box to check all power supplies, earths, CAN-bus and K-line signals to the OBD connector.

Continuity Test

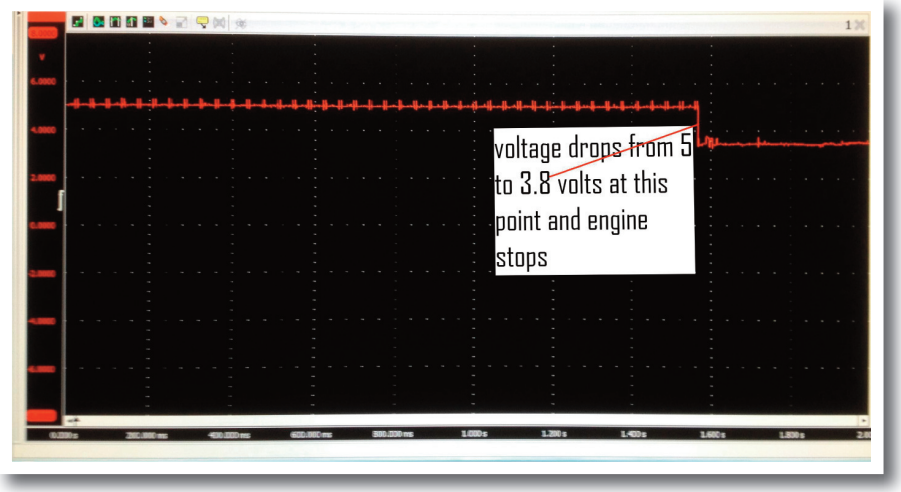
A wiring diagram showed that pin 7 in the diagnostic socket was the diagnostic link to the engine ECU. After stripping down the ECU covers to gain access to the ECU connector plugs, a quick continuity test showed an open circuit between DLC pin 7 and the engine ECU. Running an external wire to DLC pin 7 proved that communication was fine. After some wire tracing, a broken wire underneath the fuse box was found and repaired. An easy repair once the fault was found.

Half way there

The broken wire was not causing the van to stop, but at least we could now check the fault codes and read live data. The faults showing were P1620 Sensor 1 voltage supply low input (Fig 2) accompanied by P0191 fuel rail pressure sensor, P0100 Mass air flow sensor, P0105 boost pressure sensor circuit and P0120 accelerator pedal position. These faults were all present when the van stopped and would not clear until the van was left to cool down, when the engine would start and run fine again.

Signal Scope

It is almost impossible that all of these sensors could be going faulty at once, and seeing the P1620 fault suggested a voltage supply fault. Fig 1 shows the oscilloscope trace of the 5 volt supply to the fuel rail pressure sensor. It captures the moment the engine stops and shows the 5 volt supply being dragged down to 3.8 volts. When tested on the other sensors, for which the faults were present, the same results were found. The next step was to disconnect the fuel rail, air mass, boost pressure and pedal position sensors, in turn with the scope still connected to see if the voltage returned to 5 volts. Even with all of these sensors disconnected, the supply voltage still remained at 3.8 volts.



Voltage supply to some sensors dropped from 5v to 3.8v whenever the engine stopped

> " P10FA, but the real fault code is P1620 (A) Sensor Voltage Supply Low Input "

More Research

At this stage we were down to either another sensor being faulty, causing the voltage drop without logging a fault, or a wiring or engine control unit fault. Before going stripping wiring looms or inspecting the ECU, the OE manufacturer's information and wiring diagram was consulted.

It was discovered that the same 5 volt supply from the ECU powered the position sensor for the EGR valve. Disconnecting this sensor caused the supply voltage to immediately rise back to 5 volts, and the engine started straight away.

Conclusion

Strangely, no fault code had been logged for the EGR valve, but a short in the EGR valve position sensor was causing the voltage for all these sensors to drop. The voltage drop at the fuel rail pressure sensor was the cause for the engine stopping.

The EGR valve was obviously being affected by heat, as the fault only occurred after the engine was running for a long time. A replacement EGR valve was fitted, an easy fix in the end, but getting to the fault was the hard part. An oscilloscope and OE information proved invaluable in this case, saving a lot of time and trouble replacing the wrong parts in an attempt to fix the problem.

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