

Don't always believe the code

A diagnostic tool can give a fault code that sounds very precise about where the fault lies, but the important thing to remember, is that the tool can only give out the information it receives from the vehicle's ECU. A.D.S reminds us that the information you're getting depends on how intelligent the ECU is.

When we get a trouble code, most of the time this code is only pointing us in the general area of the fault, it is not a final and thorough answer.

A 2003 Toyota Avensis 2.0 D4D came in to our garage with the engine management light on. It was running poorly and lacked power. A diagnostic scan and code reading showed the following fault code: P0340 camshaft position sensor. The code could be cleared, but would come back after the engine was restarted. The next step was to do a quick visual check around the cam sensor area, to see if there was anything obvious, but everything looked fine and the cam sensor looked to be new. The next step was to check the signal from the cam sensor itself. For this test we used the GMT0/ATIS oscilloscope, which has built-in brand specific data with technical information, connection help, automatic set up and sample wave forms. The cam sensor on this car is 2 pin inductive coil type, that transmits an AC signal to the ECU. At idle, there was a good signal and it matched the waveform displayed in the ATIS software.

This proved that the cam sensor was working properly and the trigger points on the cam sprocket were intact and were not damaged or missing. This also proved that the wiring from the sensor back to the ECU was not shorted to ground or any other wiring, but it did not prove if there was an open circuit. The best way to check for an open circuit, is to scope the sensor signal at the input point on the ECU. Because the ECU on this car is mounted inside, behind the glove box, we decided to leave this test till later, if needed.

The cam and crank signal were checked together. This was very easy to do with the GMT0 scope, as there is a option to do a combo test. When you select combo test, it opens up the scope with everything set up and ready to go, and also shows real life connection pictures of which wires to connect to on the sensor. It also has a known good

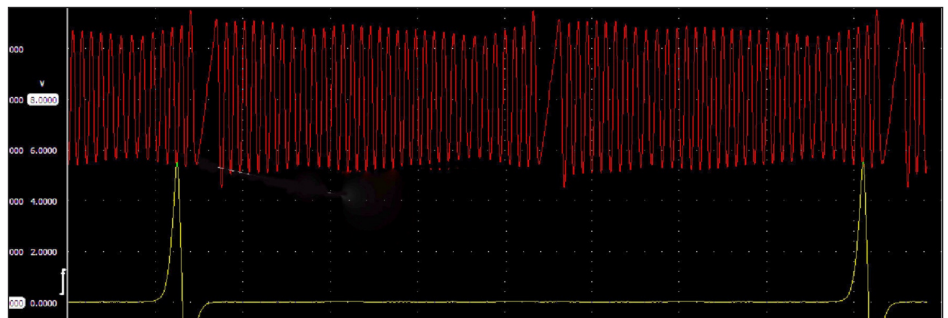


Fig 1. The crankshaft (red wave) and the camshaft (yellow wave) were not synchronised because the timing belt had jumped a tooth. The yellow peak is shifted to the left.

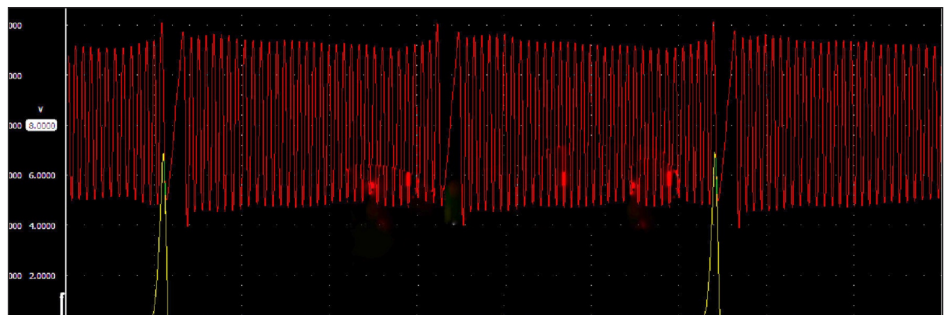


Fig 2. The crank and camshafts were synchronised after the timing belt was replaced. Note the location of the camshaft sensor peak is in the proper location now

reference displayed on the screen, so you can superimpose or use the cursors, to compare the reference wave form with the one you are checking. With this test you can examine the cam timing.

As you can clearly see in the waveform in figure 1 on this page, the valve timing or the pick up positions on the crank and camshafts are out of sync. With this information, we know that the problem is a mechanical fault and we can proceed with removing the timing covers to check for a problem, knowing that the fault is definitely in this area. After removing the covers and lining up the TDC mark, we could clearly see that the cam timing had jumped a tooth. After fitting a new timing belt kit, the fault code was cleared and stayed out and the engine ran perfectly.

This proves that the ECU on this car cannot determine the difference between a cam sensor fault or a cam/crank synchronisation fault. Some modern systems can pick up a fault code telling you that it is a crank/cam synchronisation fault, and in some cases, in the data stream, you can view crank/cam synchronisation while cranking. But with this and many other cars, it is back to the case of how intelligent the car ECU is.

Having the GMT0/ATIS scope to check this car greatly helped avoid guess work and replacing parts that may not have been needed. When we did decide to remove the timing covers to check further, we were confident that we were going in the right direction.

