

SUBARU Cam

This article is a true description of an AECS technical help desk problem and how it was solved.

Vehicle
 2001 Subaru Legacy twin turbo.

Problem presented to the Helpdesk

Sometimes the problem presented to the help desk is not so difficult at all. It is often the story behind the fault presented which is difficult to understand. It is not comprehensible to us at AECS why it can take a sometimes-long series of events before a simple problem is found and repaired.

In this help desk case we dealt with some time ago the car was presented with a persistent cam shaft sensor fault code. The first garage who owned a scan tool replaced the sensor with a second hand sensor. The check engine light stayed on and the fault code did not disappear. The sensor was replaced for a new one, with the same outcome.

Auto sparky

The car was passed on to the auto sparky, who proceeded with pulling two new wires between the cam sensor and ECU, after again a new sensor was tried. No effect, the fault code stayed and the check engine light stayed on. The sparky told the garage that it could be the cam timing, which was checked and found to be correct. Please do the maths.

ATS scope owner

The vehicle then got passed on to a diagnostician who owns an ATS scope. The diagnostician recorded the cam and

ATS Scope
 ATS 5000

This months super special: \$3,200 +gst

Automotive Electronic Control Systems **AECS**
 Training, Equipment and Data for Automotive Diagnostic Specialists

Equipment

AECS Ltd is NZ's Automotive equipment provider. Our staff will support you to get the most out of your equipment.

Herbert Leijen

ECOTECHNICS
 Aircon service!
 Get into AC this season with AECS.
 \$5,960 +gst

Trans flush
 \$3,200 +gst

LAUNCH Diagon

wireless scantool

Best price event!
 \$4,750 +gst
 For the full set

Talks to 42 ECU's
 On this car!

The LAUNCH Diagon can:
 - record data graphs,
 - print A4 and docket,
 - display via a PC,
 - code ECU's,
 - code Key's,
 - code common rail injectors+pump learn
 It has fabulous brand and system coverage.

AECS Training

Ph: 06 8749 077 Fx: 06 8749 078 E: info@aeccs.net www.aeccc.net
 We deliver exciting automotive training throughout New Zealand!

VTEQ Testlane: \$33,000 +gst Brake testers from: \$17,000 +gst **VTEQ**

Trucks, busses and cars.
 High quality and durable.
 Nation wide service.
VTEQ
 AECS Equipment

ATS5000 50Mhz Scope with Laptop and case

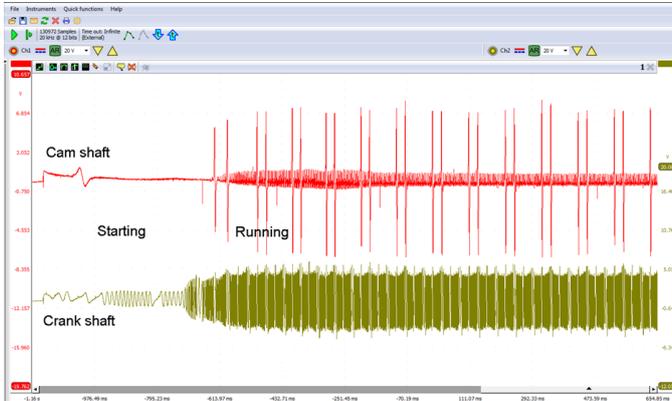
From \$3,200 +gst

ATS SCOPES

This months super special!
 Enjoy our perfect NZ\$ exchange rate!!

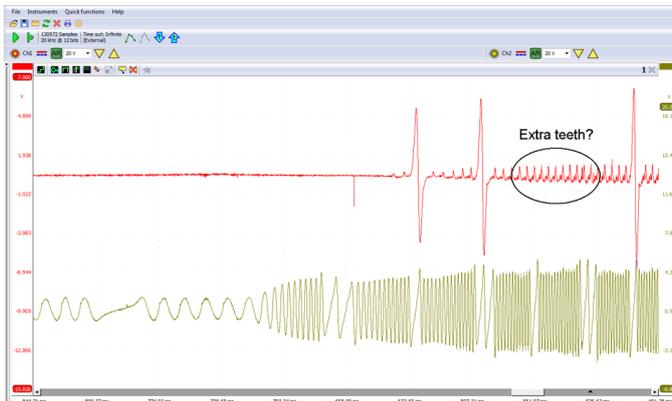
crankshaft signals, to see if the signals were correct and in phase.

The diagnostician has a lot of Subaru experience and mailed the pattern to the help desk, as he did not recognise the signal as a common Subaru set up.



(Picture 1) ATS 5000 scope recording made when the engine started and fired up.

The recording needed to be zoomed in to fully see if there were any problems in the signal or if the phase offset was fluctuating.



(Picture 2) Zoomed in on the transition between winding over and firing up.

Scrolling through the pattern no phase offset was found indicating for example a loose timing belt, but zooming in we did see extra pulses between the pulses of the tone wheel. These pulses were not familiar to the diagnostician.

The pulses were substantial as the peaks are at 1.1 V and the troughs are at -0.2V

We also noted that the signal was very clean before the camshaft came up to speed (winding over).

We expected to find a bad earth on the camshaft sensor as the crankshaft sensor was clean, so this was recorded during starting: see picture 3



(Picture 3)

The earth of the sensor was clean, so back to the drawing board.

Arm and Fire

Any technician who has attended the AED training course will know from looking at the signal that the arm and fire levels of the ECU are well exceeded by the extra pulses between the teeth of the camshaft tone wheel. But why?

CAT-401 Transmission Flush



The CAT-401 auto transmission changer can complete the flush and fluid exchange in 20 minutes for transmissions, torque converters & radiators.

- ▶ LCD display with clear instructions.
- ▶ Easy and quick flush with adjustable volume
- ▶ Easy topping up or reducing oil level per 0.1ltr via LCD display.
- ▶ Oil pressure and colour indicators.
- ▶ 2 weight scales built in (new + old oil)
- ▶ Machine easy to fill and drain.

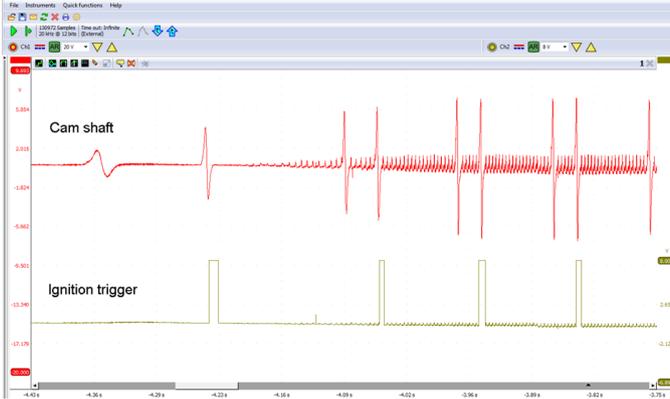
Ring **AECS** for further features & specifications

Authorised Launch Distributor

Induced noise

We suspected induced noise from a high current source; the best is to start by dual channelling the bad signal with all your high current sources, one by one.

To start we scoped the cam sensor signal vs. the ignition coils trigger.



(Picture 4) ATS scope recording of camshaft sensor vs. ignition trigger.

There was no correlation between the ignition system and the noise on the camshaft sensor, the coil was already switched before the induced noise climbed high enough to go past the arm and fire point in the ECU.

Next smart move of the diagnostician was to remove the fan belt disabling the alternator. I must honestly say that I would not have done that just yet. I would have done a recording of the cam vs. injectors or gearbox solenoids first. Alternators do not often give trouble.

Smooth

This instantly made the pattern smooth! The alternator was removed and a new rectifier was fitted. The diagnostician sent me the recorded pattern after the alternator was fixed.

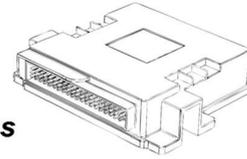
Did you know?

That there is a

comprehensive scope training being held in Auckland on 20th & 21st November for our valued ATS scope users. Become an expert user! Ring Christine for further information.

Ph:+64-6-874-9077

**Automotive
Electronic
Control
Systems**



**AECS
Equipment**

www.aecs.net

Ph:+64 (6) 874 9077

**Jumper Leads -
case 1**

\$189 + gst



Contains 118 special jumper wires and alligator clips. Plugs between wiring harness and component. Saves having to probe the wire or connector.



**Scope Leads -
case 2**

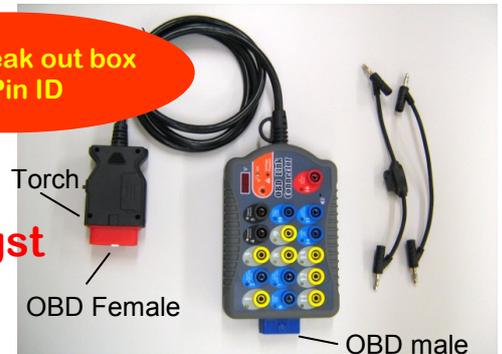
\$199 + gst

Contains **80** leads, **16** break out / test probes and **airbag simulators**.

For example plugs between sensor and ECU, or between clock spring and airbag.

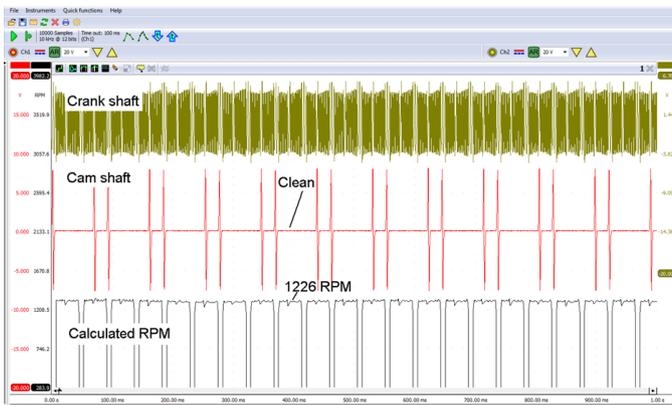
**OBD break out box
+ Pin ID**

\$208 + gst



OBD breakout box and communication pin identifier.

- ▶ extension lead for scan tool.
- ▶ LED's identify communication protocol.
- ▶ LED window shows supply voltage.
- ▶ Handy torch in Female connector.
- ▶ Easy to diagnose CAN data bus with scope.



(Picture 5) 2 channel ATS scope recording of crank shaft sensor vs. cam shaft sensor after repair.

Fixed!

Usually I promote to measure ignition vs. injection as a first port of call. In this case this was not warranted as the engine ran fine. The car went to the garage because the check engine light was on.

It must be noted that the battery voltage was measured before the repair with a multimeter at a perfect 14.61Volt.

A simple alternator job did the trick!

Conclusion

The whole job took only about 2 hrs. labour including the removal of the alternator.

The irritating thing is how to explain this to the garage who passed the job on to the diagnostician. They simply did not understand how the alternator could be responsible for setting a camshaft sensor fault code.

Anyone who has attended the AECS AED course would understand the explanation.

Anyone with an ATS dual channel scope could have found this fault.

Training, support and proper recording equipment was the key to a speedy resolution of this job.

Herbert

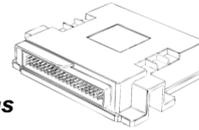
For **AECS Ltd:**
H.P. Leijen
(trainer/research)
E-Mail: hpleijen@aecs.net

Did you know?

That

Some of the information discussed in this article is studied further in AED. Next AED courses are in October 2012 and March 2013. see www.aecs.net

Automotive
Electronic
Control
Systems



AECS
Training

Learn new skills...

*...to get ahead
in the industry!*



Next courses coming up in:

NEW PLYMOUTH, PALMERSTON NORTH

NEW PLYMOUTH:

AED: 23rd & 24th Oct 2012

Automotive Electronic Diagnostics

This training is highly recommended by many technicians. It will give you a solid grounding for Automotive Electronic Diagnostics

PALMERSTON NORTH

AIRCON: 25th & 26th October 2012

Air-conditioning Training

Detailed Air-conditioning training course that can be used with all types of Air-conditioning equipment and suits all levels of expertise.

AUCKLAND:

ATS: 20th & 21st November 2012

Comprehensive scope training to get the most from your ATS scope.

AUCKLAND:

DMS1-3: 22nd & 23rd November 2012

Diesel Management Systems

A full understanding of common rail diesel technology including sensors, actuators and CAN data bus communication.

For enquires or to register for any one of these seminars contact **AECS:**

Ph: +64 (6) 874 9077

Fax: +64 (6) 874 9078

E- Mail: christine@aecs.net