

Suzuki Zoom Zoom!

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

Vehicle

Early 2000 Suzuki Vitara V6.

Problem presented to the Helpdesk

Sometimes diagnostic problems are not that complex. Following is a case which took a very short time to diagnose and repair, as a result of a logic way of working through the case.

The case presented to the AECS help desk was a Suzuki V6 with a slight misfire under load on one cylinder only. No fault codes were present.

The vehicle had been given to the garage requesting AECS assistance, by another garage who replaced the spark plugs and coils to no avail. The spark plug was arcing when it was held on the rocker cover...

The first measurement carried out was ignition trigger vs injection, which showed a very short spark duration on coil number one. On top of that, in the same pattern a very short coil charge duration was seen. This indicated a possible crank cam shaft signal problem.

The second recording was sent to the AECS help desk. Partially zoomed in it started to show something strange:



Picture 1: Ignition trigger vs crankshaft sensor pattern zoomed in on two revolutions, as recorded with the ATIS 5000 scope.

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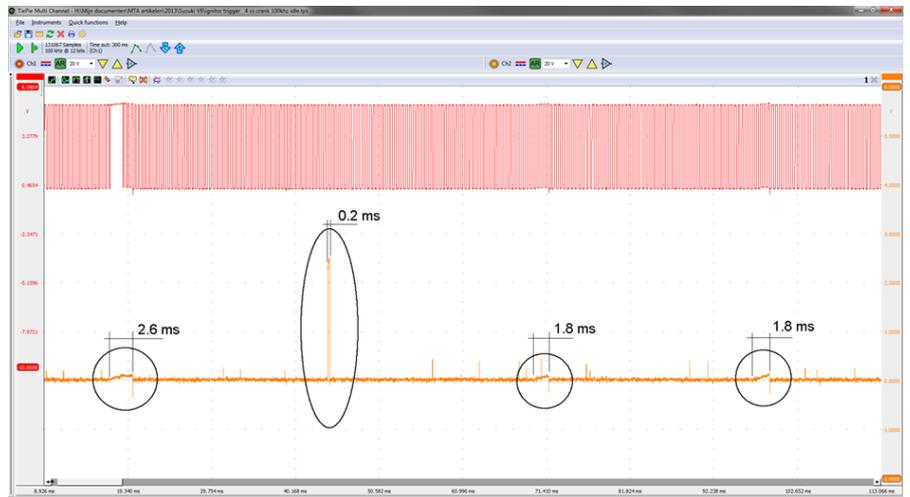
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Picture 2: Ignition trigger vs crankshaft sensor pattern zoomed in further

The most striking in this pattern is the coil 1 ignition trigger trace. The trace shows not only the trigger to coil #1 but also reveals the current loading of the other coils.

Background

When the trigger of a coil is high, current flows through the primary coil 'charging' the coil's core with magnetic fields. The current loads up the earth shared by all coils. When the ignition trigger is not active, the voltage will sit on zero volts, or equal to the coil's earth connection.

When the earth has a bad connection, the earth voltage at all coils will rise as a result of this bad connection when any of the coils are triggered. In addition, the voltage on the trigger wire will rise when any of the other coils are activated.

When current flows through an igni-

tion coil, its iron core charges up with magnetic fields slowly. In simple terms; the longer a coil is triggered the 'fuller' the coil's core is with magnetic fields (energy), until saturation point is reached.

Measurement

When measured in detail the time duration of the trigger of coil #1, shows a charge time of a ridiculous short 0.2 msec., if that is compared with the earth loading of the other coils (= also the charge time) of 2.6 and 1.8 msec, it becomes evident that there is a serious calculation error going on in the ECU.

Calculation errors usually occur when crank and or cam shaft sensor errors occur.

Zoom further

Zooming in further to look at the crank shaft pattern in a little more

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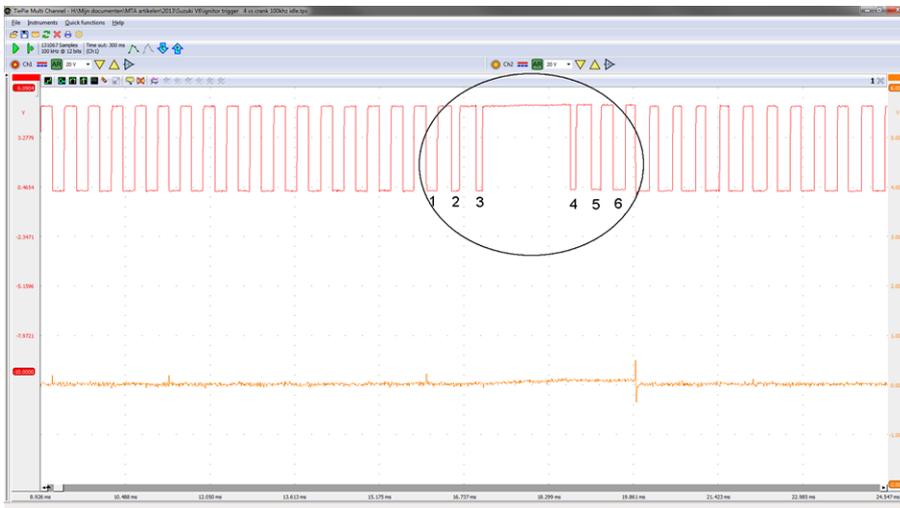
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Picture 3: Ignition trigger vs crankshaft sensor pattern zoomed in further yet again.

detail, we found some irregularities around the 'reference' pattern.

I numbered the pulses on the crankshaft pattern, each low represents a tooth for a Hall sensor or a slot in a light sensor disk. We were not sure what system the car had. However, one thing I do know about machining, is that it can be unnecessarily expensive to have teeth or gaps of uneven width machined close to the reference pattern.

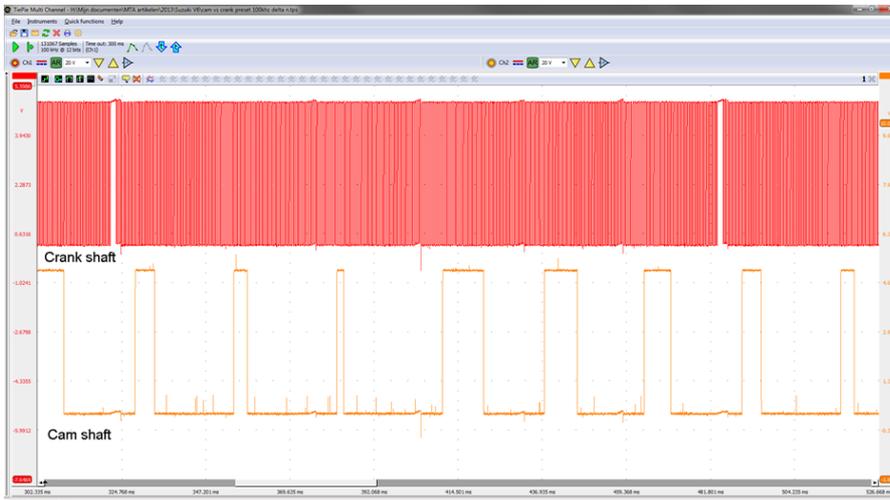
Yes, it is possible but it simply makes no sense to me, you only

have to think about tool changes and uneven tool wear in an automated machining shop.

Pulse 1 and 6 look like the rest of the pulses, 2 and 5 are slightly narrower (which is very strange) and 3 and 4 are of a different width yet again.

Calculation error

We asked the diagnostician to record in detail the crank and cam position sensor signals.



Picture 4: ATS scope cam/crank recording

It is clear to see the reference mark every 2 revolutions and the cylinder individual pulses (varying in width). However, we saw

that the reference mark occurred every full cycle of the engine (720 degrees). That did also not make sense to us at all! If it were a crankshaft sensor, it would have a reference mark every revolution not

Look at the tone wheel
We asked the diagnostician to physically look at the tone wheel as this whole thing made no sense. He sent us a picture with a smiley face in the e-mail.

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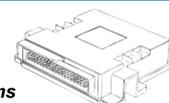
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Why Not!

Great, that sorted the issue! Twink was used as a mark, to put things together at some stage, why not!

The twink had blocked a portion of the holes in the tone wheel disk, not allowing light through the slots causing the ECU calculation error.

The short coil charge time reduced the magnetic energy stored in the coil. Low energy in the coil reduces the spark duration to, just enough for

idle, but causing the misfire under load.

Conclusion

The garage that worked on this problem vehicle for another garage has technical support from AECS and owns an ATS scope.

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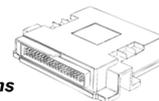


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