

Sly Sylphy

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

Vehicle
 2002 Nissan Sylphy (Bluebird) 2.0 Ltr direct injected.
 (QR20 (DD) Engine)

Problem presented to the Helpdesk

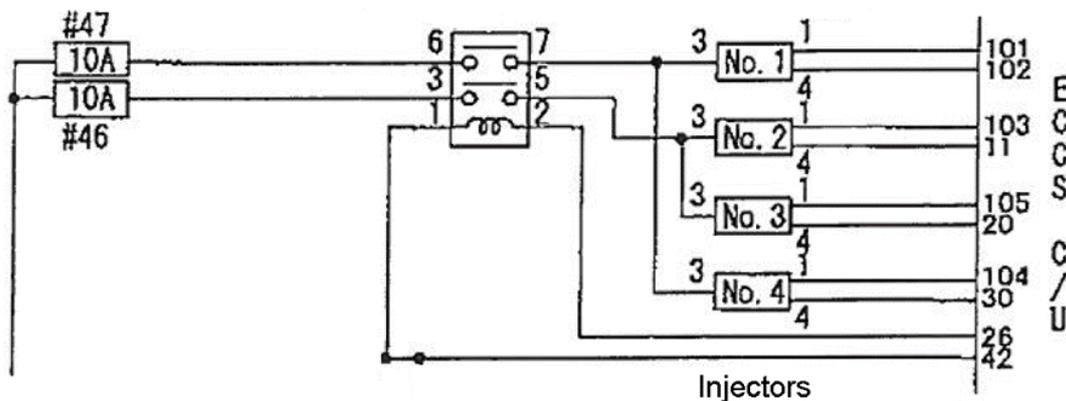
This car has been hesitating on acceleration, pinks under load and the engine check light comes on intermittently. We checked for fault codes, the fault codes logged so far are:

- P0120-Throttle position sensor circuit.
- P0605-ECM
- P1320-Ignition signal-Primary
- P0400-EGR system

Because the codes, except P1320 (a non OBD code), did not really relate to the drivability problems the car had, the diagnostician decided to measure the injector signals at the ECU on all four injector.

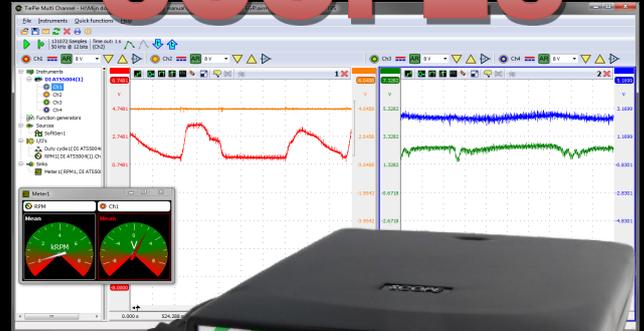
3 Wire injectors

The injectors used in these Nissan engines are of the 3 wire type. As discussed in the EMS 1-3 training, the injectors have 2 coils. One coil with a very low resistance to open the injector very quickly and one 'normal' coil to hold the injector open.



In this wiring diagram, the 4 three wire injectors can be seen.

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EMS1-3 Engine Management

Herbert has recently added a video in Html format to the EMS13 training course content page on the AECS website. The video can be viewed on PC, android and I phones. We would like to hear your feedback. We are planning to make more visual training demonstration videos for the other training courses

To view



EMS1-3
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We set up our Facebook page in 2013 and with real time experiences with new equipment and training. Some of these events are not written about in our newsletter. If you want to check out what we are doing behind the scenes visit our page and follow us.
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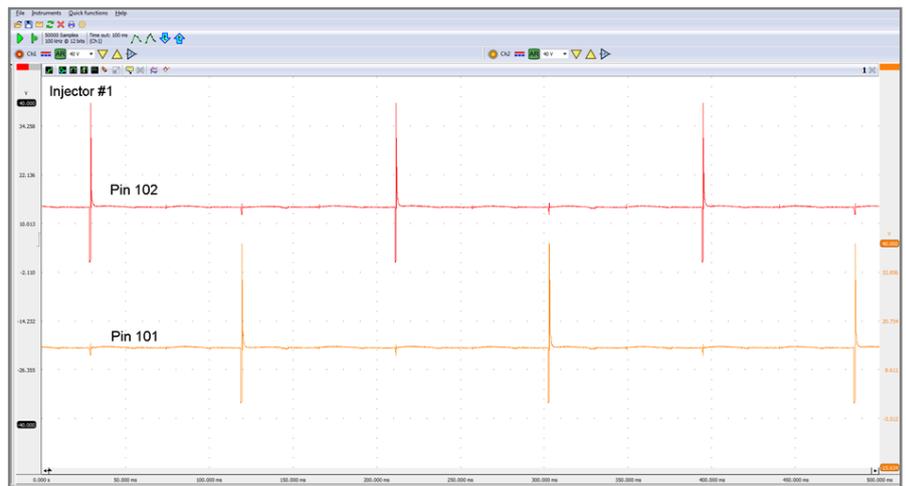


A lot goes wrong with those direct injection injectors, any garage can vouch for that. I show for example during the EMS 1-3 pictures made with a microscope of the swirl channels inside the injector, of an ultrasonically cleaned and flushed injector. The channels still full with carbon, formed as a result of the high heat and pressure the fuel is exposed to inside the injector.

This first measurement (Picture 1) the diagnostician made revealed that the number 1 injector scope pattern looked very different to the rest of the injectors.

Measuring

The dual channel measurement made with the ATS scope showed immediately that there was a problem with how the ECU was 'driving' the injectors, specifically number one.



Picture 1: ATS scope recording on injector 1

Please note: Clicking on the scope patterns in this newsletter will blow the picture up to a large detailed format.

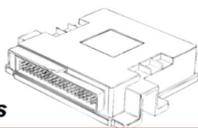


Picture 2 : ATS scope recording on injector 2

The injectors 3 and 4 recording looked the same as the recording on injector #2. (Picture 2)

ECU faulty?

This left us at the AECS helpdesk puzzled. We had never seen that before. Both coils of one injector need to be activated at the same time! Not with a 180 degree offset as recorded at injector #1. This looked to us like as if the ECU was 'confused'. If you combine that with the fault code P0605 (ECM), anyone would start to lean towards a 'magic fault' (=ECU fault).



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Electronic fault finding

Think

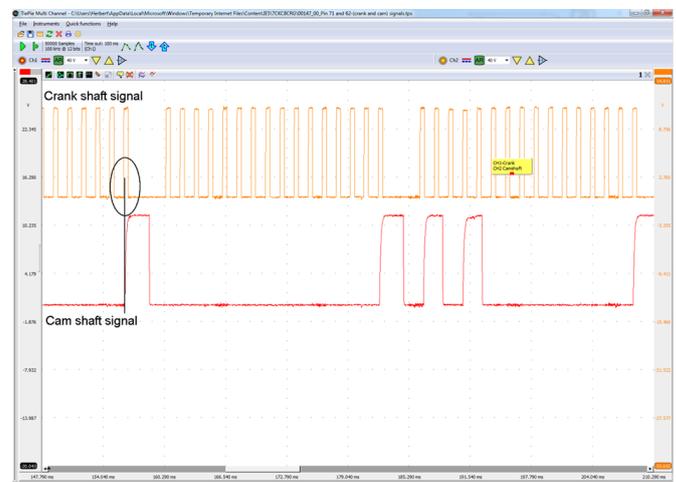
Just a little bit of thinking tells you that the ECU IS capable of switching both coils of injector #1 would you not agree. That tells me straight away that there cannot be too much wrong with the ECU. It is still possibly faulty, do not get me wrong but before we get another ECU we certainly need to check another few items!

What the recording did tell us is that the injector #1 was injecting 2 times per 2 revolutions, instead of once. This would certainly make the engine run incorrect to say the least.

Firstly; when the injection should take place during the compression stroke (stratified injection mode), not enough fuel will be injected, as only one coil activated the injector.

Secondly, injection will also take place during the exhaust stroke. Since there is no pressure to speak of inside the combustion chamber during the exhaust stroke, the piston rings will not seal. A lot of that injected fuel will end up in the sump making the mixture richer for all cylinders (through the PCV). In addition, a lot of that fuel will go down the EGR channel, back into the intake manifold.

Later during this job, it was found that a lot of fuel was present in the sump, because of a leaking fuel pump seal.



Picture 3 : ATS 5000 scope recording of cam vs crank.

So is the ECU faulty?

An ECU cannot command the injection or ignition properly when its input signals are incorrect. The main input signals for injection is crank shaft/cam shaft activity. If the engine is not turning, the ECU does not know that injection has to take place, it is as simple as that.

If there is something wrong with injection or ignition phasing, it is usually a result of ECU calculation trouble, where it does not see the rising or falling slope of one of the sensor signals when expected. On top of that, many Nissan chain driven engines

suffer from silent chain stretch. Again, any garage can vouch for that.

A logical next step is to record cam vs crank signal. (Picture 3)

At first glance, this signal is wrong! The rising slope of the single pulse of the cam should not coincide with the last teeth before the ref point of the crank shaft.

I have seen so many before. However, this seems to always give ignition faults, never seen injection faults like this. To make sure I even looked up a pattern recorded on another Nissan, not a QR20 (DD) Engine. (Picture 4)

I said without too much further thought that he had to replace his timing chain and guides, and thought that this would be the end of it.

Sting

The sting is as always in the detail! This is why we use high sample rate scopes..

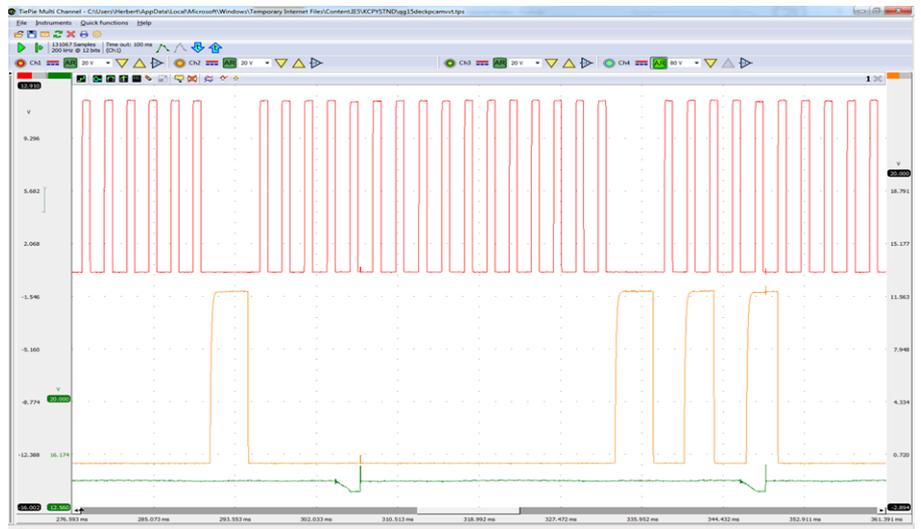
The remark of the diagnostician after the cam chain replacement job was; "it runs sweet but the cam crank pattern is very different from what I expected"

Advance

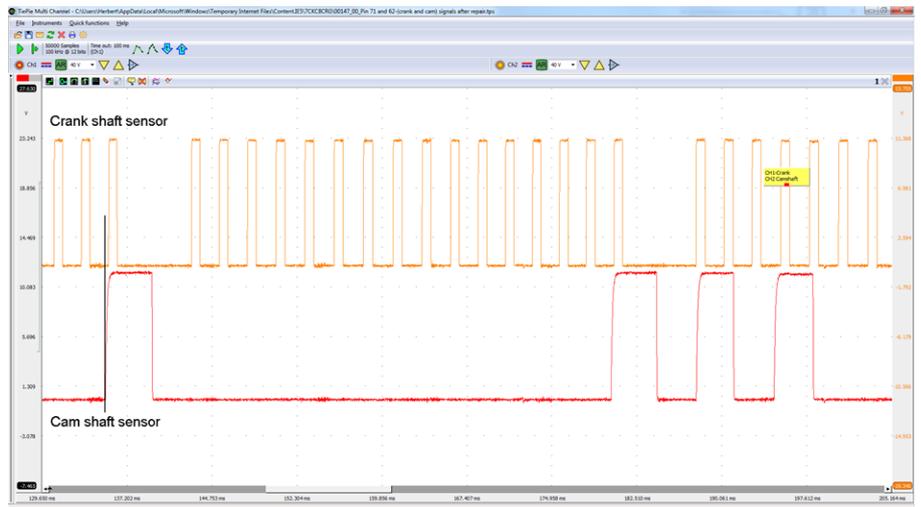
Of course, when I saw the pattern, (Picture 5) we disrespectfully asked the diagnostician "are you sure the marks line up?" However, even before the question was expressed we realised that the cam had to advance with new chain and guides, something it obviously did.

Conclusion

The car is fixed, it runs perfectly now. No more fault codes. Yes, the problem was the timing chain and not the ECU. However, this case has taught us here at the AECS helpdesk that we have to be more careful with comparing known good patterns with problem patterns, no complacency allowed!



Picture 4 : ATS scope recording on a random good Nissan



Picture 5 : ATS scope recording of cam vs crank after repair.

The compare signals HAVE to be of the same engine.

Again, the sting is as always in the detail. Detail which can be achieved with good quality equipment like the ATS scope.



Herbert

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