Missing Nissan

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

Vehicle

2005 Nissan Tiida, MR18DE 1.8 ltr Petrol.



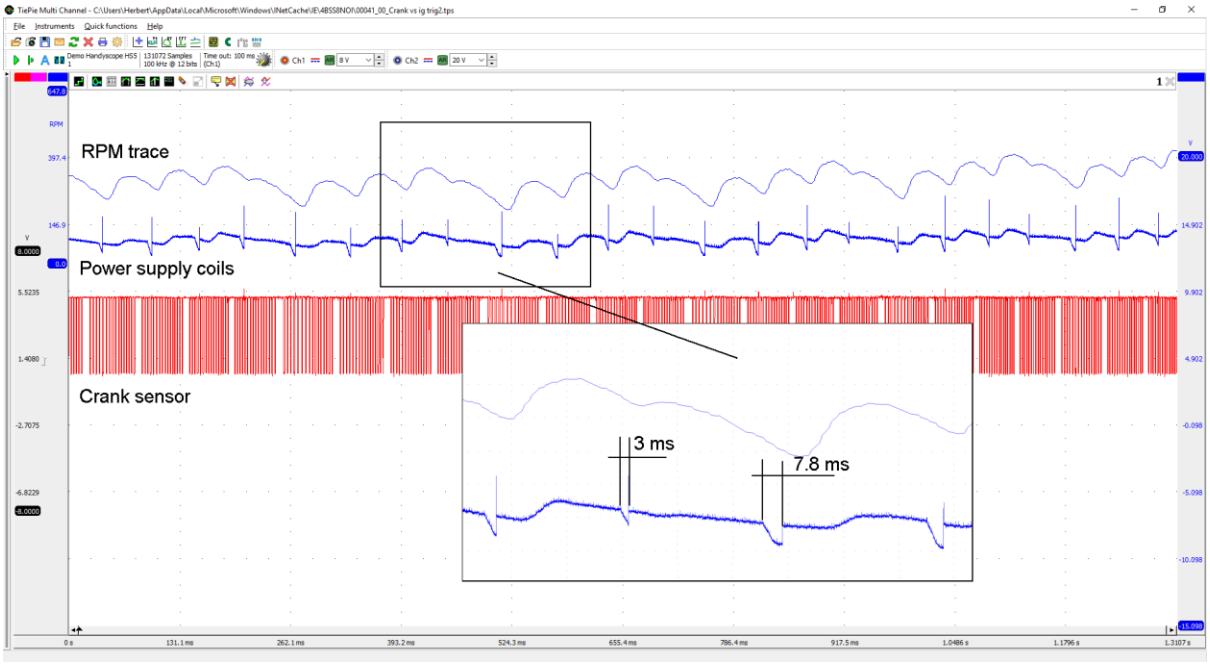
Picture sourced from internet

Problem presented to the Helpdesk

This Nissan Tiida was driven into our workshop, with as complaint a lack of power. It presented itself with a terrible misfire.
The workshop involved has AECS equipment and technical support.
The essence of this article is how to quickly and accurately diagnose which cylinder is misfiring or if it is a random misfire. This knowledge has a major impact on diagnostic approach and speed.

Measure

The first measurement made was crank shaft sensor vs ignition trigger while the engine was running and misfiring. Accidently the power supply of the coil was measured vs crank, with some interesting facts.



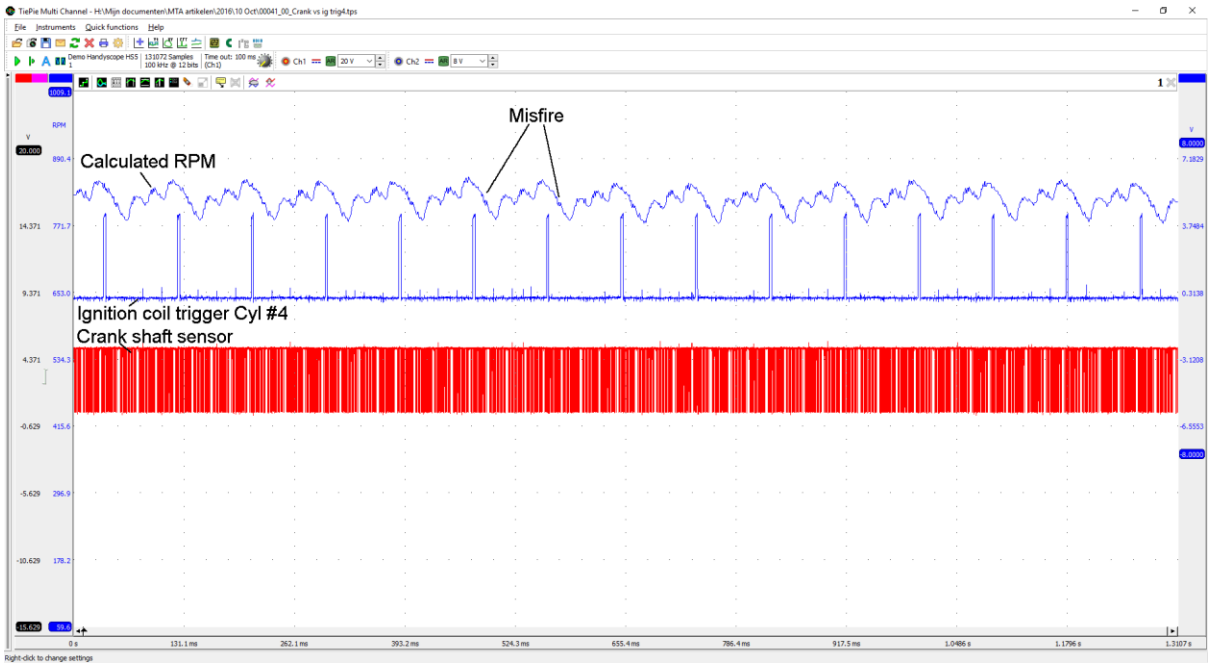
ATS scope recording of Coil power supply vs crank shaft sensor.

The RPM pattern live calculated from the crank shaft sensor showed clearly a misfire every 4th beat.
The coil's power supply showed that there was a bad connection between the battery and the coils, dipping the power supply each time a coil was activated. It is easy to measure the coil activation time from that pattern, you just measure how long each dip lasts.

The outcome was that the coil just before the misfire was only activated 3 milliseconds, as opposed to the working coil at 7.8msec. Is 3 msec perhaps not enough energy in the coil to ignite the mixture?

Cam chain?
Could the ECU drive the coils incorrect as a result of a crank/cam relation fault? Some Nissan engines do have cam chain stretch issues.
A cam vs crank recording was made and no chain stretch of significance was detected, we look for more than 2 degree cam/crank phase variation (chain slap) as an indicator that the tensioner has ran out of stroke. We came later to the conclusion that the battery voltage variations caused the erratic coil charge durations.

Ignition trigger
Time to find out which cylinder was misfiring, and compare the coil trigger time with the findings in our first measurement.

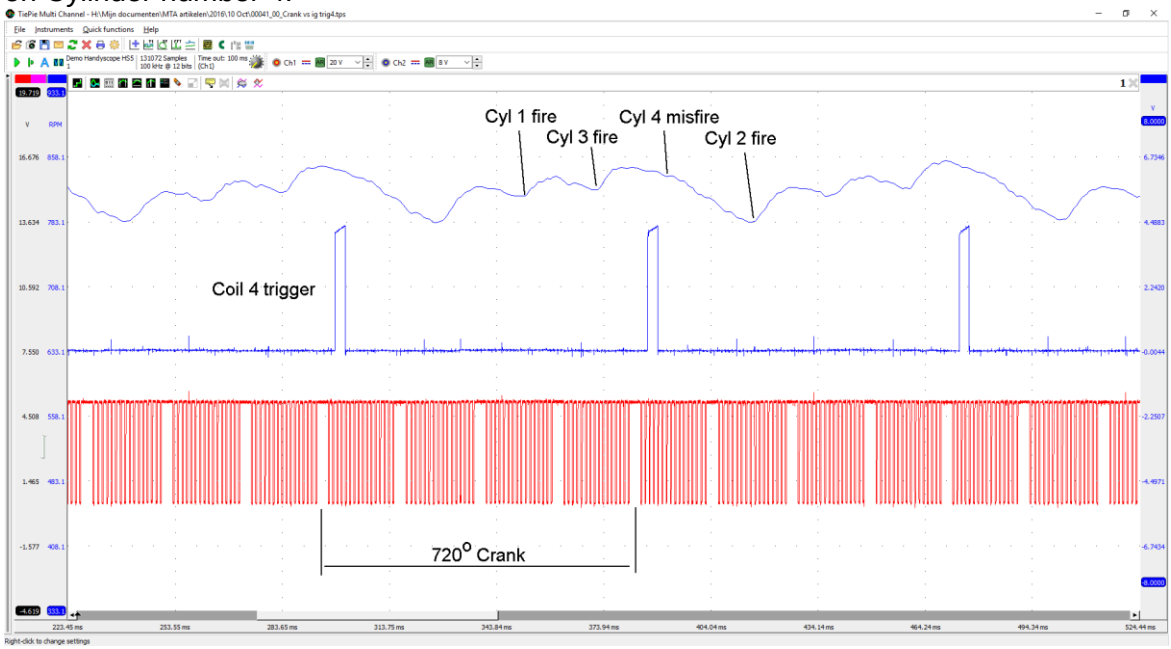


ATS 500XM scope recording of Ignition trigger vs Crank sensor, with a live calculated RPM trace indicating the crank shaft speed changes (Delta N) at idle.

In which direction shall we go?
Even to the untrained eye it is clear, that the misfire was happening on one cylinder continuously. Since the Channel 2 lead was connected to ignition trigger of coil 4, it was also immediately clear that the misfire happened on Cylinder 4 alone.
Let's look at the pattern in detail just to learn a little.

Zoomed in you can see the crank shaft speeding up after ignition of Cylinder 1,3 and 2. You can also see that the compression is slowing the crank shaft down after each 'speed up' (power stroke) event. This indicates, most importantly, that the compression of Cylinder 4 is there (more about this later). You can also see that the overall engine is being dragged down by the two successive compressions of Cylinder 4 and 2. The firing cylinders are making up for it (RPM line trending up), to achieve 'target idle speed'. Reason for such a misfire is nine

out of ten times an ignition problem, so it makes sense to me to investigate the spark quality on Cylinder number 4.



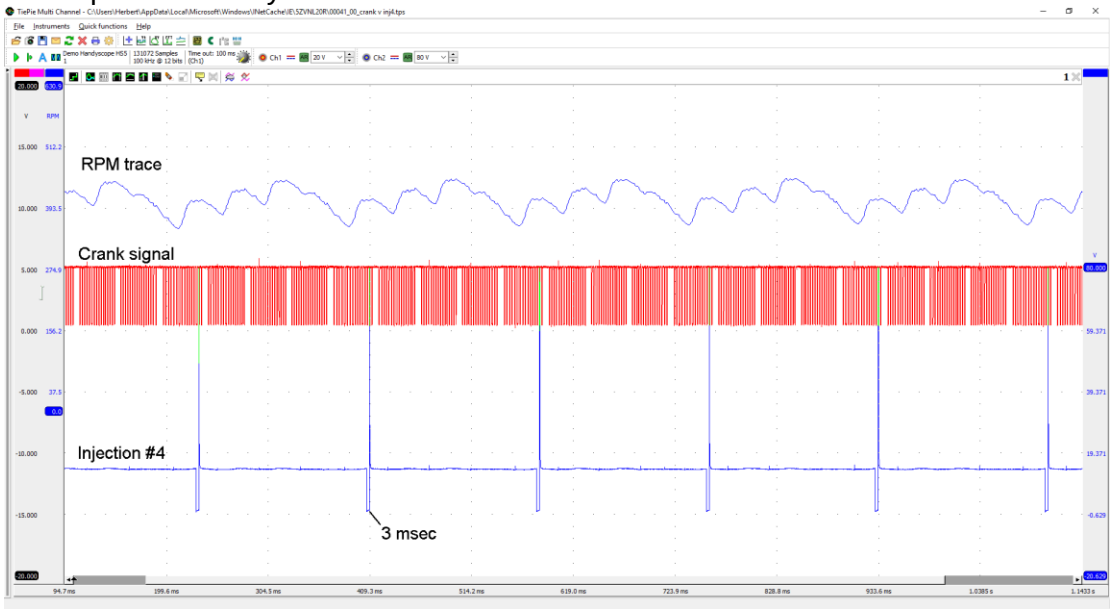
Scope recording of Ignition trigger vs Crank sensor zoomed in.

Spark

The primary spark pattern cannot be recorded on these COP coils as the coil has got an ignitor build in. We deal with the construction and how to properly measure and diagnose the spark quality in the AECS EMS 1-1 training.
The diagnostician decided to swap the coil instead of measuring the spark quality. While having the coils out he found that the spark plug gap was around 1.7 mm. He replaced the sparkplugs and swapped coil 1 and 4.
He reported that the engine ran a lot better, power was back but still a misfire at idle on Cylinder 4!

Fuel

Better look at crank vs Injection to see if the injection was present and to see if the duration was equal to other cylinders.

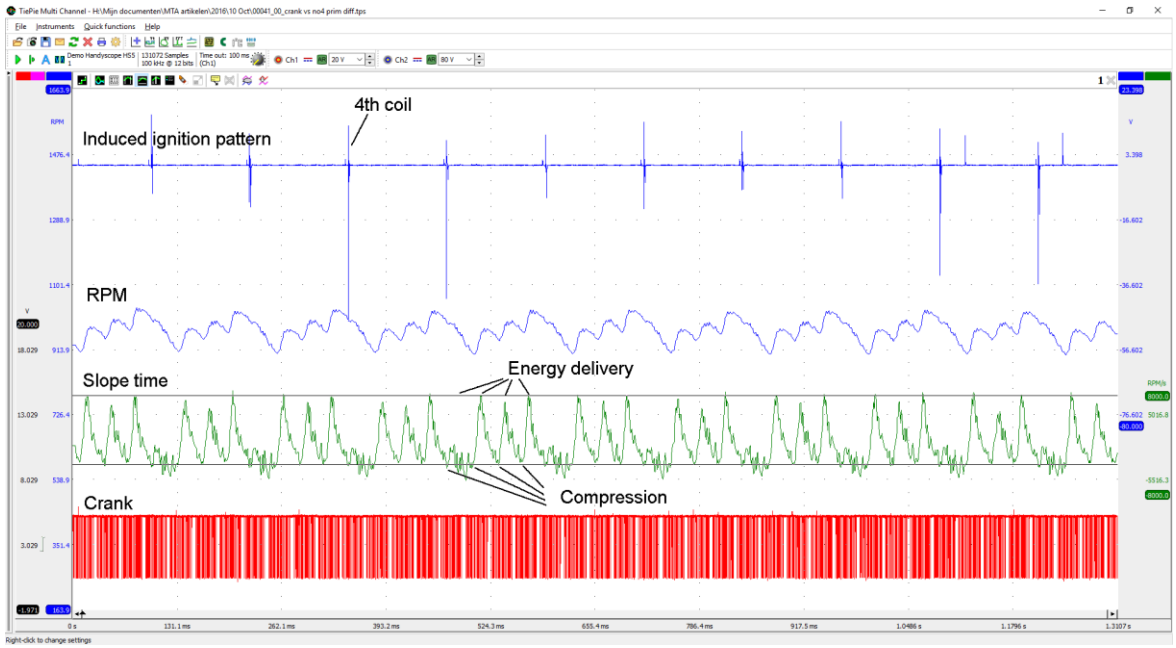


RPM vs injection recording.

The injection duration on all cylinders was the same at idle when the engine was misfiring… Hmm that did not help!

Back to drawing board

Better start again as we might have missed something. We wanted to see ignition quality on cylinder 4 almost right from the beginning.
We had to measure the induced ignition pattern, to see the spark quality. The coils were removed and a wrap wire was placed around the coil stalk.
The following pattern was recorded:



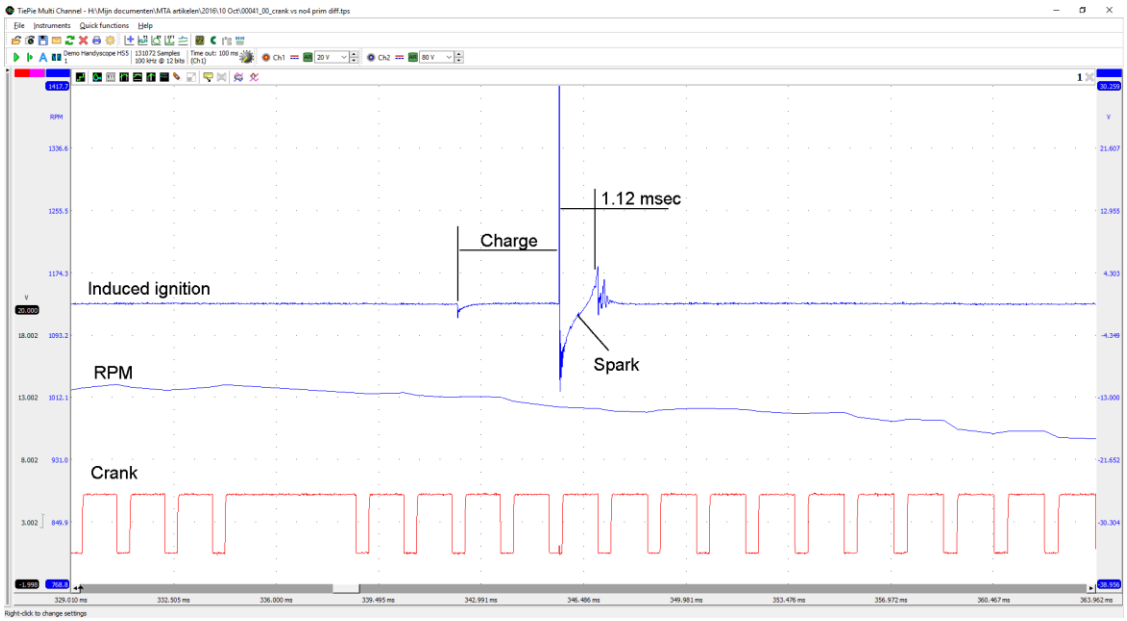
Induced ignition vs Crank recording on 2 channel ATS 500XM scope.

The above pattern needs a little explanation please read in detail if you like to learn.
The crank signal is first used to transform into a Delta N (RPM) pattern, then the RPM pattern is measured for speed changes. The highest speed changes (steepest slope in the RPM line) are just after combustion and just before the end of compression.
The peaks of the Slope line indicate the intensity of energy delivery after combustion and the troughs of the Slope line show the energy required to achieve compression, no matter what the RPM is.

In the slope line of the above pattern, is clearly visible that the compression on each cylinder is virtually the same, so the misfire is not a compression problem. To verify this a compression test was done by the diagnostician. They were all equal.
It is also visible that the energy delivery is not present in Cylinder 4 (slope peak just after coil 4 fires).

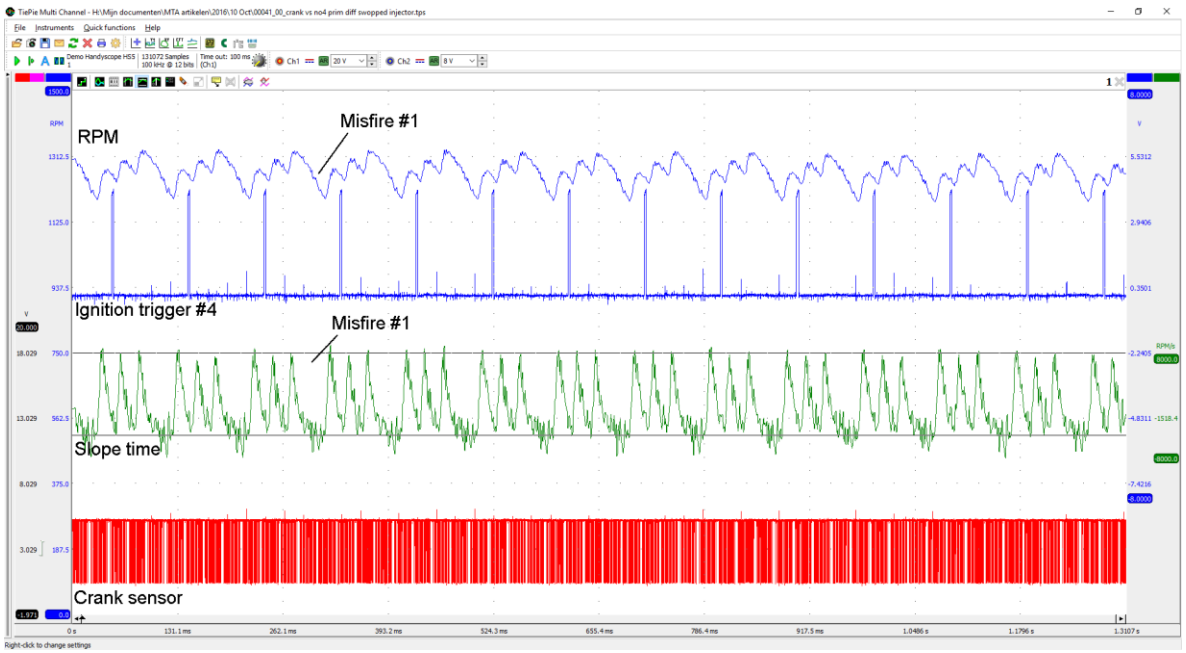
Spark again?

Let's zoom in and look at the ignition quality:
Zooming in on the spark duration in the same recording showed a spark duration of 1.12msec. That is not a great spark but certainly not cause for misfire!



Induced ignition vs Crank recording zoomed in.

So what next?
So we had compression, we had acceptable ignition and we had injection. The coils had already been swapped, time now to swap the injectors from #1 to #4.



Ignition trigger 4 vs crank recording after injector 1 and 4 have been swapped.

Bingo!
Even though the engine sounded exactly the same after the injector swap, the misfire moved to cylinder 1 (with the injector). This clearly indicated an issue with injector #4.
A second hand injector was fitted which made the engine run perfectly!

Tail end
After about four days of running the car was presented back to the workshop, running on three cylinders again.

A quick 2 minute measurement, using as scope preset the recording above, indicated that it was Cylinder 2 this time which was misfiring. Before the diagnostician ordered one more injector he advised the customer that it was better to replace all as it was very likely that the rest of the injectors would fail too.

Water
The diagnostician, out of his own curiosity, started hunting for why the two injectors had failed, as it is not normal for injectors to play up like this.
He took a fuel sample and found a large quantity of water in the tank.
The customer was advised of costs of injector replacement and tank removal/refit.

Conclusion
The write up of this fault took actually longer than finding the fault. It is just the thinking behind the diagnostics, we as a technical equipment provider and trainers, like to explain to our customers and prospect customers. I guess it is our passion!

Overall an efficient job, good for workshop turnover and credibility! An ATS scope an experienced diagnostician and a little of AECS tech support, made this job quick and profitable.

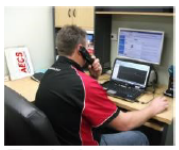

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Technical support

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

MYTH BUSTING

- "AECS equipment is expensive."
  We have made multiple price adjustments as a result of the strong dollar this year. We ARE competitive, but please compare apples with apples.
- "Its does not matter where you buy your equipment."
  For the AECS team it DOES matter! We all take great pride in the work we do and love the products we distribute. We go to great lengths to make sure our equipment is cared for in the best possible manner, so you get the most in return.
- "A scope is a scope."
  Every time I hear from a customer that some sales dude uttered those words, I am speechless. Simple, there is no scope with the ability of the ATS scope out there.
- "The Boys at AECS make things unnecessarily difficult."
  We like simple! We will take the shortest route to a resolution, always. Time is money, for you and for us. However the technology you work with is not simple anymore.
- "AECS only does scopes."
  Please look at our ever changing online product catalogue, you will like it!
- "AECS training is designed to sell equipment."
  Fact is that during training we sell our automotive research; 'how does it work, what fails often, how do you quickly and efficiently find a fault?' For diagnostics you need equipment. We ask that you bring your own equipment to the training.
- "Electronic diagnostics is hard and not profitable"
  You are wrong! Electronics is easy and is the only growth area in your workshop.
- "We figure out our selves how things work, so we don't have to go to training."
  Great! I understand. However how do you make that efficient? Have you ever considered that you don't know what you don't know? A small layout for our training seminars will open up a whole new world and will extend your ability greatly!


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Did you know….?

That some of our competitor equipment sales people are walking around with our technical news letters, showing them to their customers as their own? I guess that copying is a form of flattery!

We are doing more training seminars around NZ (and in Australia again) than ever before, and that most seminars are full or nearly full, which is incredibly appreciated by us. Thank you!

The first 3 of the brand new EMS 1-6 seminars have been completed (booked for special interest groups). This seminar has as focus Air Fuel ratio sensors, Oxygen sensors, modern Catalysts and Emissions. The feedback has been overwhelming and positive.

Most people forget to ask for the training dollars when they buy equipment from us…. We are happy to do the training dollar administration when you ask us to!

Update…..Price roll back!

Due to a very favourable *exchange rate* we are able to pass on the savings and have readjusted most of our pricing. Please note; some of the price changes and new products are not included in our web catalogue yet. Just call!
P.S. This can change back at any time (fx rate).

Scopes
ATS 500 (2 ch+gen) entry model: $1,690
ATS 500 XM (2ch+gen) top end scope: $3,510
ATS 5004d (4 channel): $3,890

Scanners
Launch Pro2 (7" screen): $2,500
Launch Pro3v2 (10.1" screen): $3,350
Launch HD 24V Truck kit: $2,900 (very limited)
Jaltest Truck 1 brand: $6,950
Jaltest Truck all brands: $11,900
Jaltest marine: $7,500

Aircon
Brainbee 6000+: $5,750 (new product intro offer!)
Brainbee Clima 8500: $8,500 (new product intro offer!)

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STT7 (7KN/wheel) car test lane: $ 25,900 (new product!)
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Emission tester
Brainbee AGS688 (4gas petrol): $6,950

Enjoy these low prices before they go up again!

All price exclude GST

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