



Beaten BT

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

Vehicle

2011 Mazda 3Ltr 4cyl common rail Turbo Diesel WE-C



2011 Mazda BT50 (picture source internet)

Problem presented to the Technical Help Desk

This vehicle has been serviced a couple of weeks ago, oil, oil filter was changed, and the fuel filter was replaced on this vehicle. The vehicle had been running fine when it left the workshop, in our opinion it has also been running fine for the customer for at least a few days.

The customer rang a few days after the service that the car had stalled on the side of the road at night and that the roadside rescue guy filled the tank with a bit extra Diesel and bled the system after which the vehicle went well again.

We have now experienced a few times surging and stalling, even though the tank was not low on fuel. Some days it just surges and has a loss of power which restores by itself.

To us the story sounds like a fuelling problem. We could not make the vehicle surge or stall when we drove it ourselves.

The fault codes logged are fuel pressure exceeding/not achieved target pressure.

Can you point us in the right direction please?

Aeration?

The filter fitted on the vehicle was an aftermarket filter. We at the help desk have experienced many problems with sharp edges inside filters, creating vacuum bubbles in the fuel (aeration) which could cause fuelling issues especially when the fuel is hot. We advised to fit a genuine fuel filter.

The vehicle was returned to the customer with a new filter, however the problem persisted.

Scope / datalogger

This vehicle had to be connected to an oscilloscope as clearly we were beyond the reach of scantool diagnostics.

The car was passed on to a local workshop that did have an AECS ATS scope and had technical support.

Because the fault was very intermittent, we decided to setup the scope via the Quick setup button in DATA LOGGING mode.

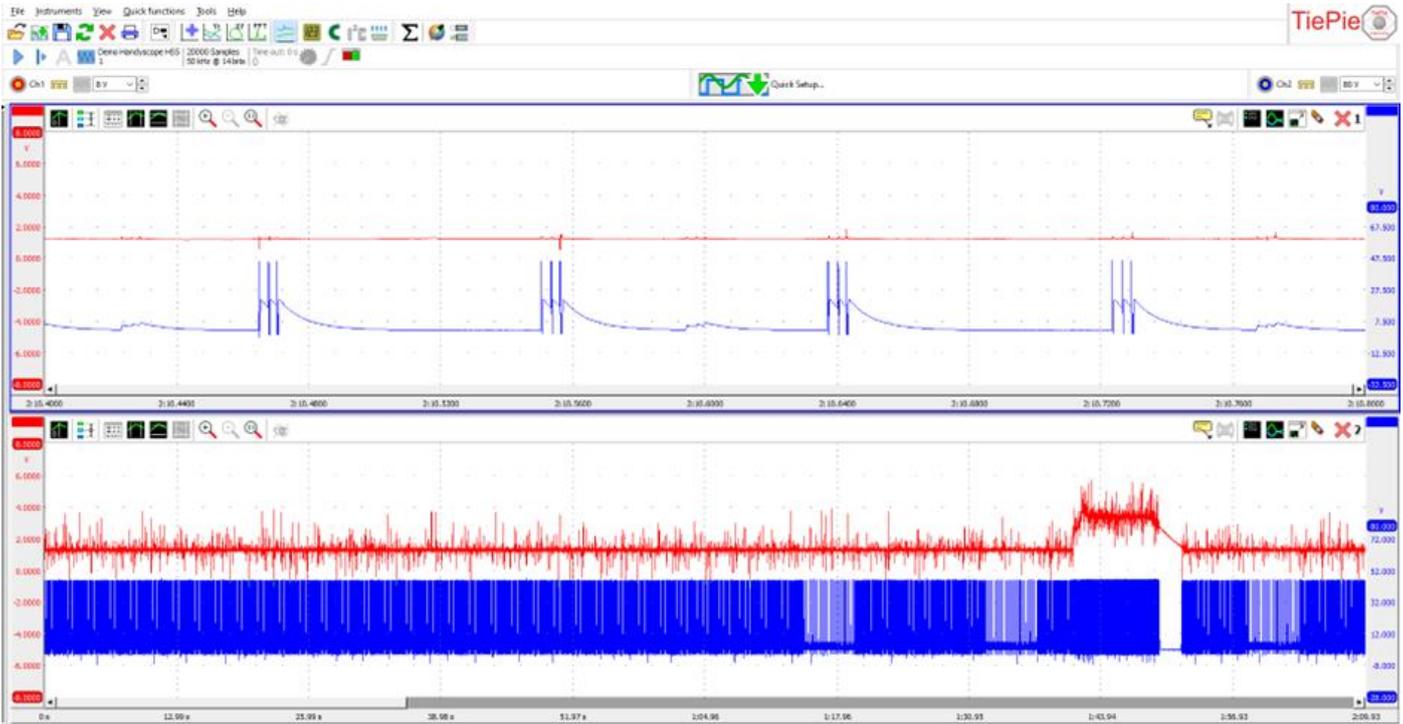
The data logger of the ATS scope seamlessly laces the scope recordings (top screen) into one huge recording (bottom screen) which can be days or even weeks long (depending on hard drive space).

Where to start

So where do you start in such a case? On almost all common rail diesel running faults I want to see injector nr1 vs rail pressure in one recording. The exception are the brand new 6 wire LIN bus injector systems of Denso.

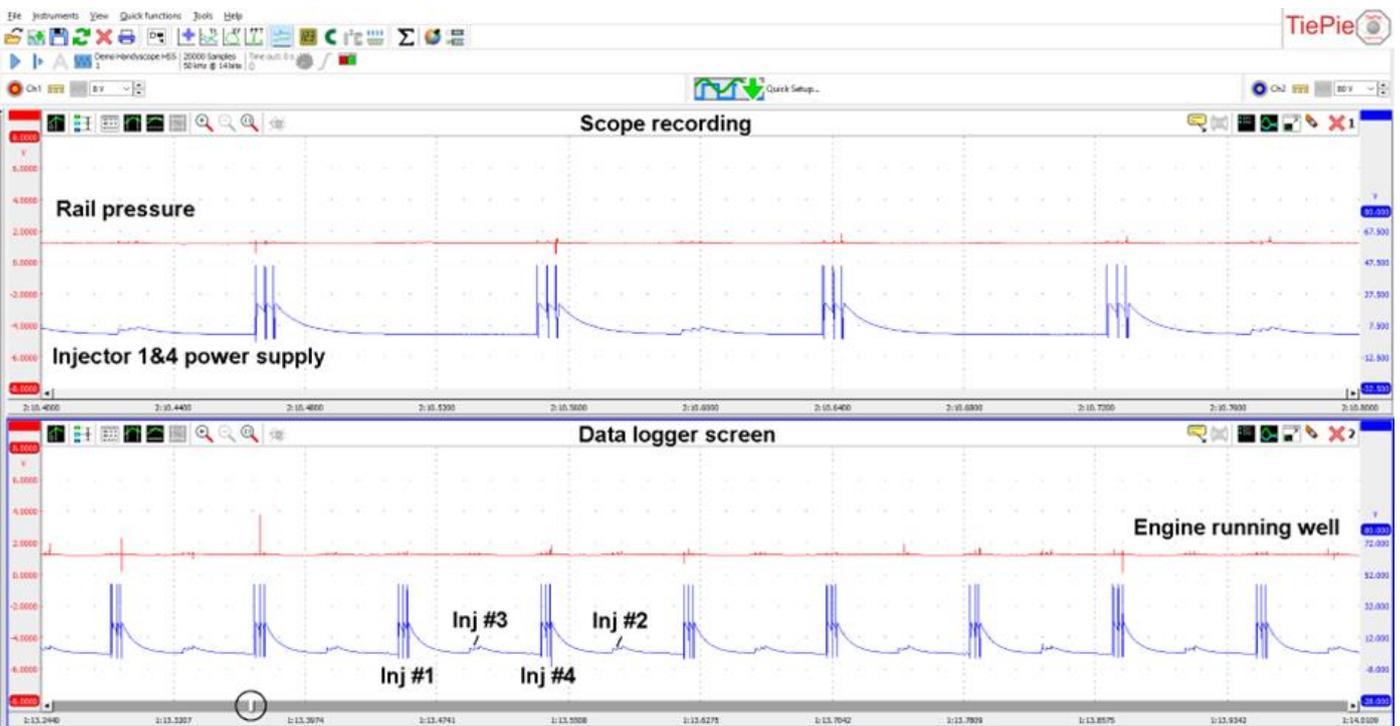


The following recording was made in the workshop, when the engine was idling with a slight misfire coming and going.



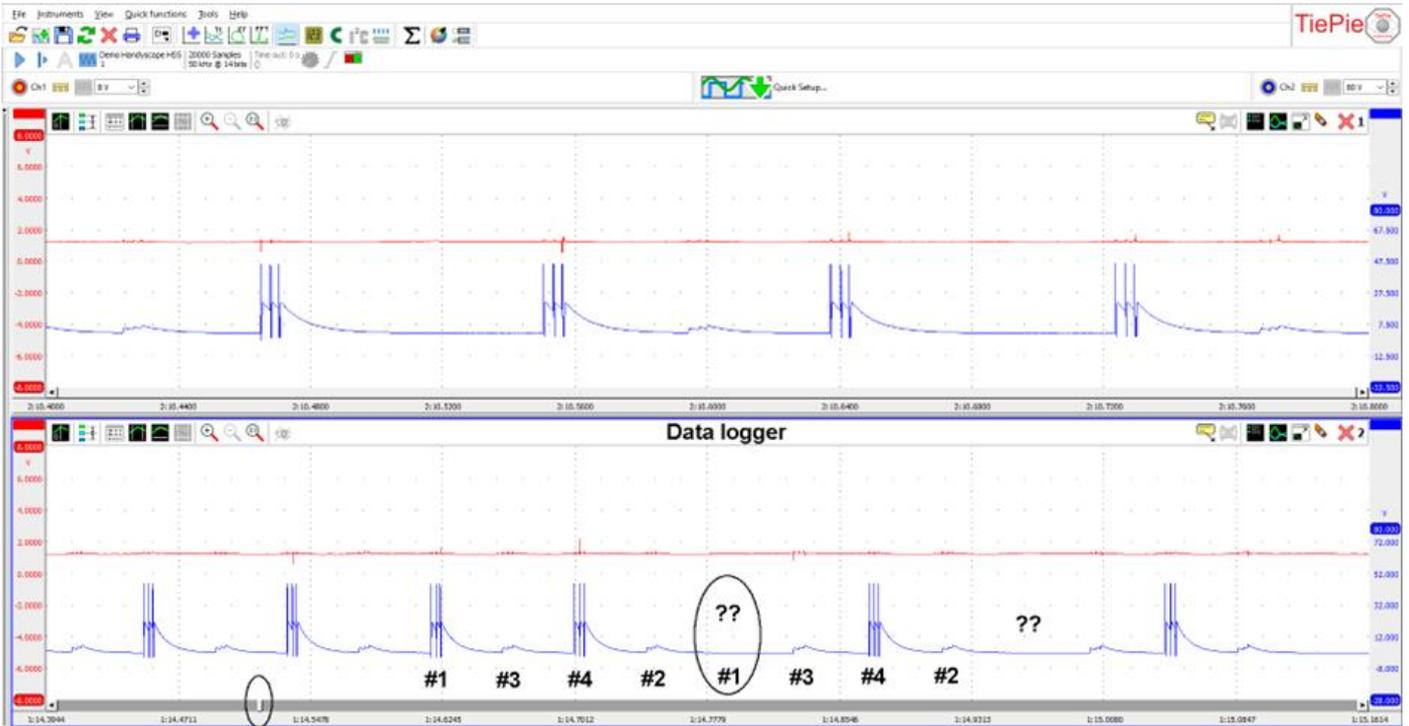
ATS 500XM data logger recording of injection vs rail pressure

The bottom screen can be zoomed in and analysed, first for reference a recording where the car was idling while running nicely.



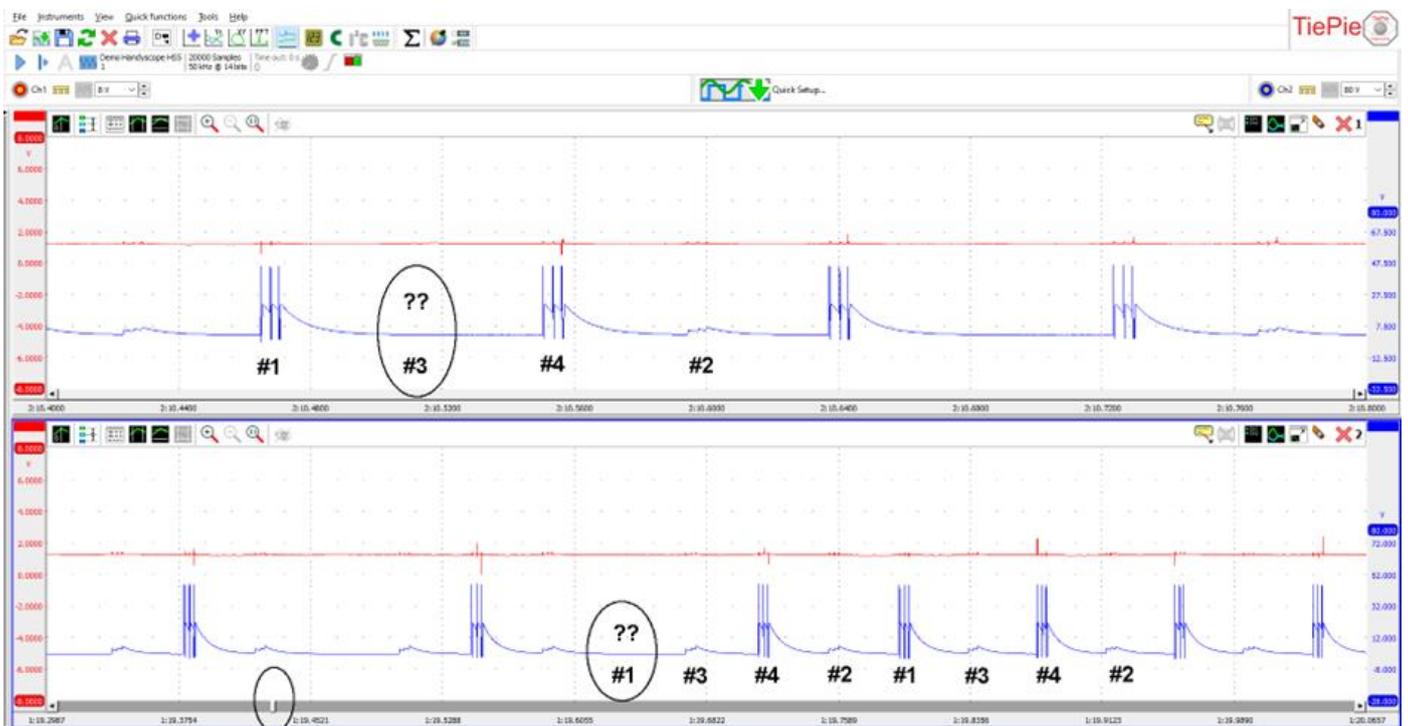
Same recording but zoomed in on a section where the engine was running fine

When scrolling through the data logger recording we stumbled upon a few patches where things were not so well.



Clearly visible in the data logger screen, is that the injector #1 signal disappears, and in the following section of the same recording (below) it reappears again.

However also look in the oscilloscope (top) screen where the #3 injector signal has disappeared.



Worthy?

So what information could we learn from this simple single data logger recording with the 2 channel ATS scope?

We had randomly an injector cutting out electronically, this had 100% nothing to do with the fuel filter or aeration we expected in the beginning. Remember that is what it sounded like.



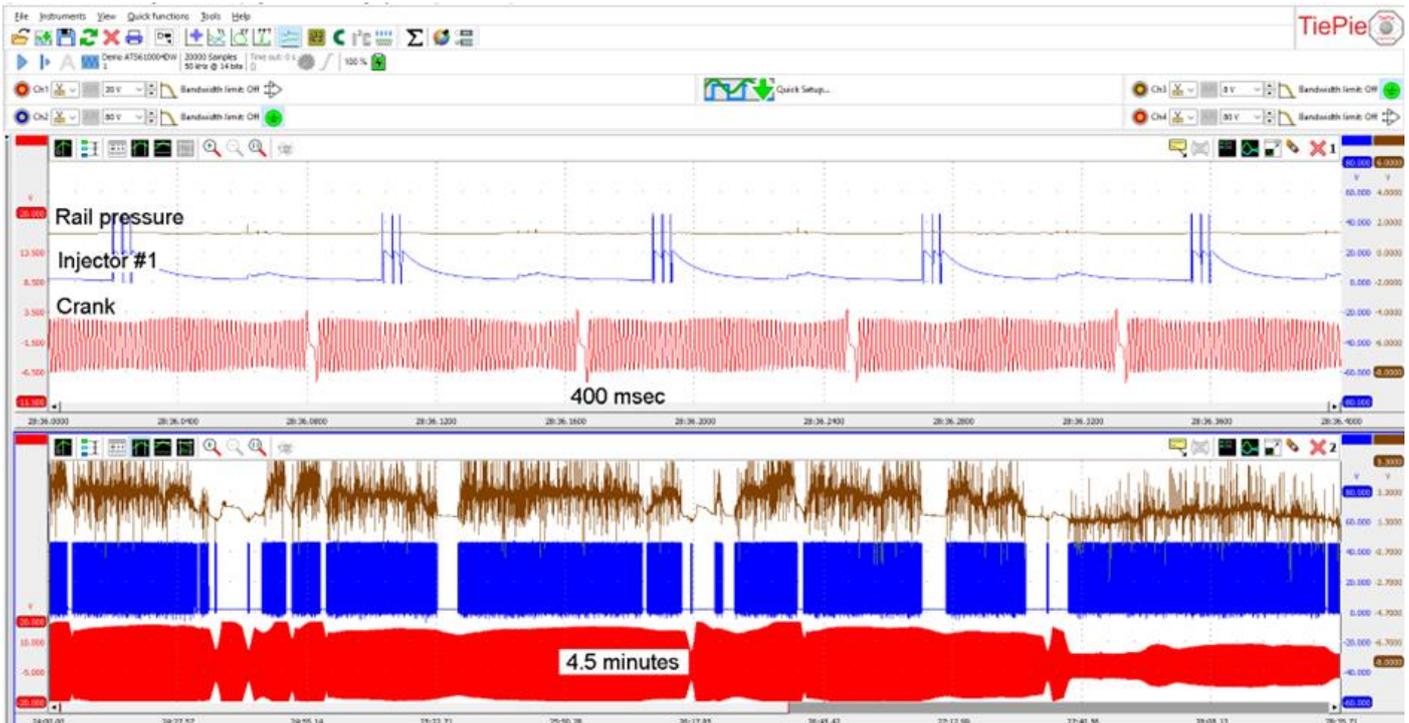
The injectors cutting out randomly can only ever be a small number of things, like

- 1) Power supply to the ECU
- 2) ECU failure
- 3) Crank shaft sensor signal not arriving at the ECU intermittently.

The power supply to the ECU possibility was immediately thrown out as the 5V to the rail pressure sensor remained present, we learn in the AED training how that 5V supply chip also powers up the CPU (processor). If the 5V (or earth) was faulty we should have seen that in the rail pressure sensor signal. ECU faulty... nah they simply hardly fail, that will be the last of our thoughts.

Rental

Let's have a look at the crank sensor signal to see if the input to the ECU is constantly present.



Rented ATS 6004XM scope, offset/differential scope recording

We needed to hook up to the crank sensor's signal wire, injector1 and the rail pressure sensor, for which we needed the ATS 6004 scope. ATS scope owners can rent and extra scope(s) if they need more than the channels they have on the screen, in this case only the 4 channel scope was used.

Running good...

Wouldn't you know it, with the scope connected the car ran absolutely fine. Extensive recordings were made all with no misfire at all.

Frustration set in, as where do you go next? A bit of lateral thinking determined that the sensor's wiring on top of the bell housing must have been disturbed by the scope leads and probes hanging off the wiring. In simple terms the probes have maybe moved the wiring around enough to 'un-do' an intermittent short to ground.

A simple decision was made to order a new sensor and just to put it in.

Loose

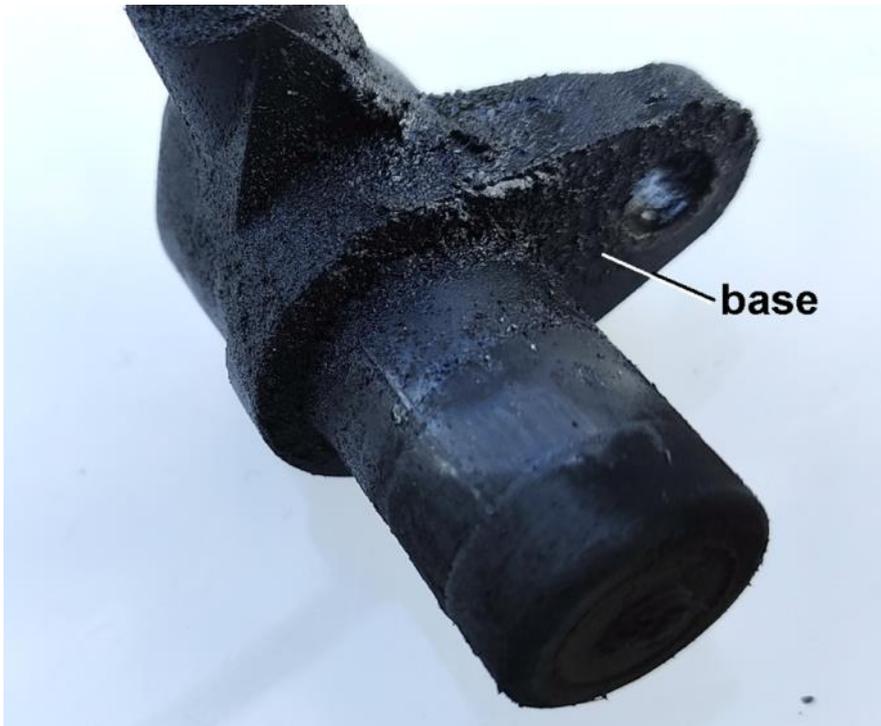
When fitting the sensor the technician noticed that the bolt holding the old sensor in the bell housing was loose, ready to fall out!



Location crank sensor

We took the old sensor out to see if the wiring was damaged or if the sensor loose in the bell housing was the actual problem.

The wiring was perfect, not a mark, however the base of the sensor was dirty and had clearly been bouncing up and down in the bell housing



Sensor with dirt on the base and wear marks, indicating that it was not 'home' in the base for a longer period of time.

Beaten!

The sensor got replaced, since it was already purchased, securely fastened. The Mazda has been driving well for weeks now.



Conclusion

Yes, this job took too long, for what it was. No, the service and filter change had nothing to do with the fault. Could it perhaps be that this misfire was the reason to get the vehicle serviced?

The first workshop could not have found the fault with simply just a scantool, that would have been just luck if they stumbled across the loose sensor.

The second workshop did not need to have the rental scope, as simply taking the ATS500XM channel 1 lead off the rail pressure sensor and hooking it up to the crank shaft sensor, would have revealed the fault already.

Also, the time 'wasted' driving around waiting for the fault to re-occur was with the beauty of hindsight, not needed.

However please realise that when you start a job like this you never really know where it takes you. This is also the reason why you cannot quote on diagnostics. The use of the scope, technical support from AECS and sound thinking skills solved the job in the end.

Thank you!

So what equipment was used?

To solve this case this professional diagnostician used:

- 1) An ATS 500XM scope kit.
- 2) An updated Launch Auscan3.
- 3) AECS Training
- 4) AECS technical support.

*ATS 6004XM Wifi
4CH differential/offset scope
\$5,875+gst*



*LAUNCH Auscan3
Professional scanner
\$4,999+gst*

Herbert Leijen
Director **AECS** Ltd

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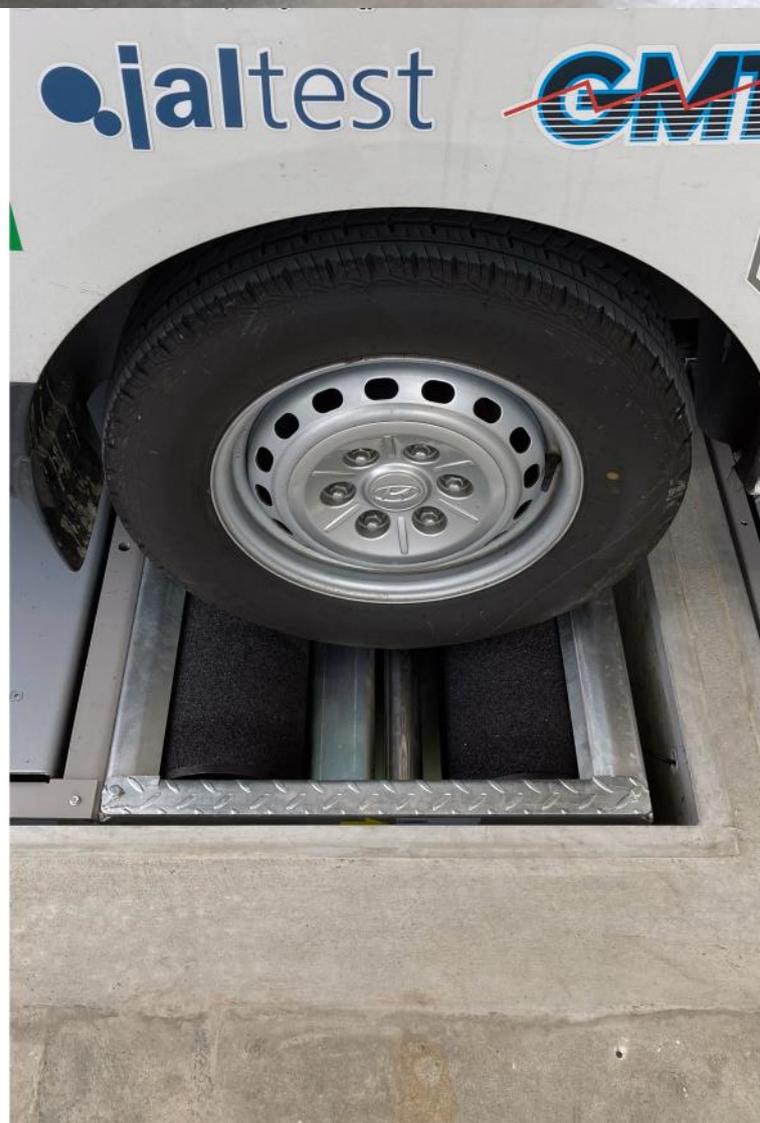
STT10e car brake tester uses the best and proven mechanical engineering solutions that makes the STT10e unbeatable, it is designed for all types of braking systems on all types of vehicles.

AECS safety testing technology software is easy to understand and accurate.

The STT10e is New Zealand WoF Gazetted and NZTA Approved.

Quick specs:

- 8KN per wheel brake force
- 4x4 testing
- 4T axle load
- 3KW straight drive ABM (European) motor and gearbox with auto brake.
- Test axle width 800mm - 2200mm
- High precision, high grip, low wear corundum rollers. Wet >0.6 Dry >0.85.
- Roller alignment to prevent drag and (camber) pull, influencing brake force readings
- Hot dipped galvanized frame
- German industrial electronics
- NZ designed software
- Installed and maintained by AECS (nationwide, since 2003)



New Product, have a look at the latest:



SO HERE IS THE DEAL:

The brand new EUROTAB 3 as a kit including:

- Wireless passthru VCI 12V/24V.
- 4 Ch oscilloscope (02-2).
- TSGUN, TPMS wireless tool.
- 4 dual frequency universal Tyre valves.
- BST360 battery test tool.
- 3 Years software updates.
- 12 months Haynes Pro.
- AECS tech support (12/5).

total: \$13,575+gst

We can deliver including:

- Xprog immobiliser programmer
total: \$14,999+gst
- ADAS kit (rental options avail.)
\$ on request

Have a full walk through in this truly remarkable tool on our web page: www.aecs.net
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