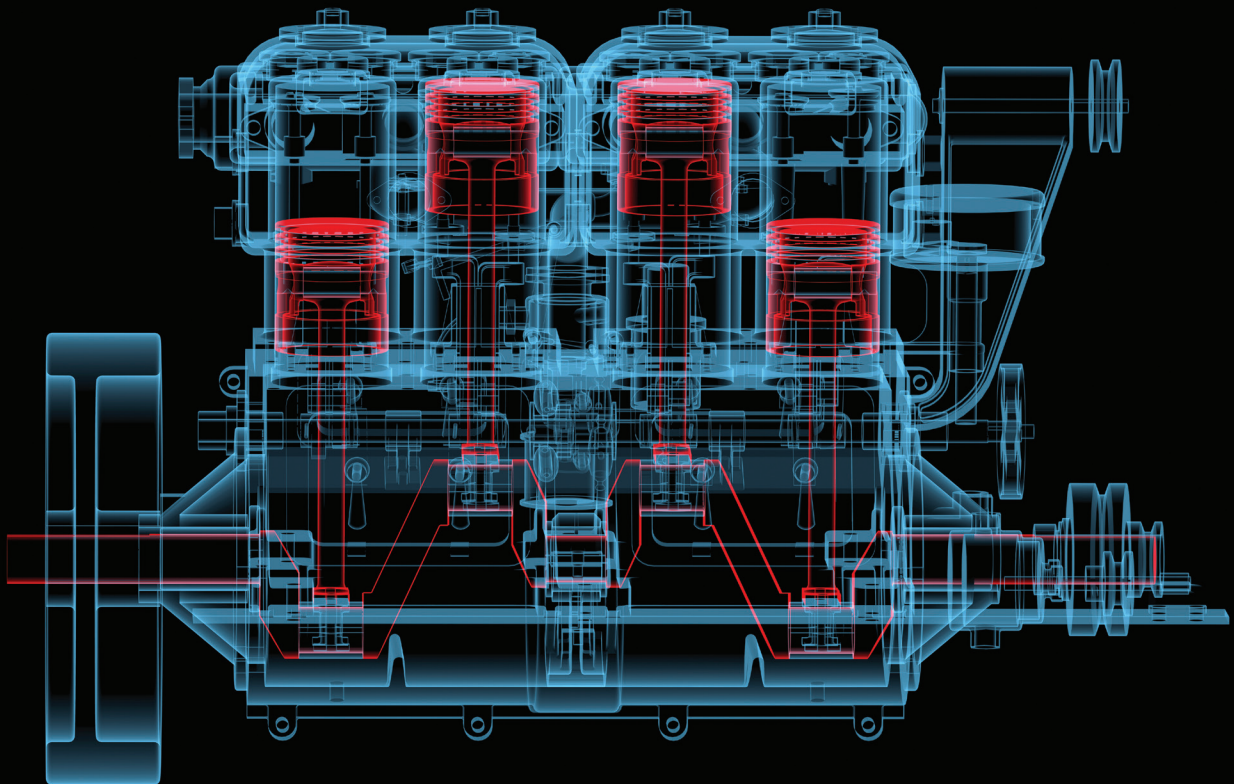


Do you ever wish you could see inside?



With Pico Technology's WPS500X pressure transducer you can diagnose:

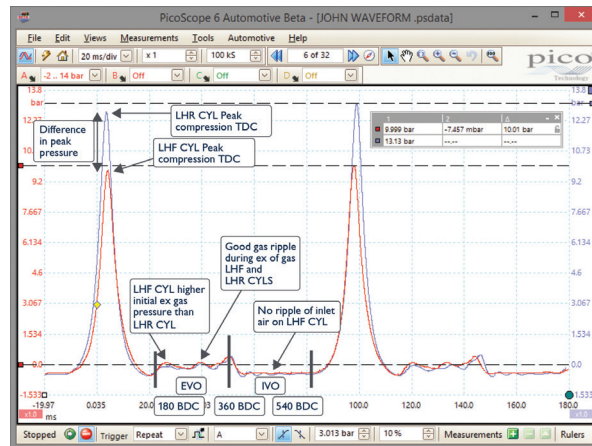
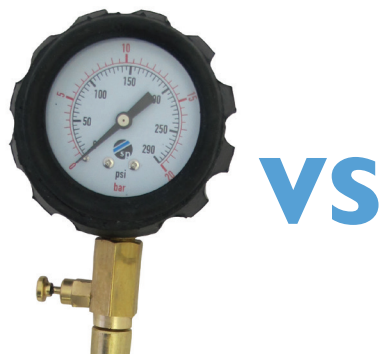
- No start • Loss of power • Misfire • Stalling
- Engine noise • Emissions fault • Backfire

Consider our WPS500X  
pressure transducer as an X-ray  
machine for your engine



# INTRODUCING WPS500X

Pico Technology's automotive pressure transducer combined with your PicoScope is more than just a highly accurate pressure gauge. It allows our automotive software to plot pressure against time, giving you a unique insight into the dynamic operation of your customer's engines and other pressurized vehicle components.



All tests using our pressure transducer eliminate unnecessary dismantling, and with PicoScope every test you undertake you can:

- Save the results you capture into a folder (like any PC file) and back them up into our Waveform Library.
- Share the results with other users (providing a date and time-stamped test procedure for future reference)
- Accurately measure the pressure changes and time taken during each fluctuation
- Compare results with previously saved tests
- Measure even the fastest changes in the rise and fall of pressures

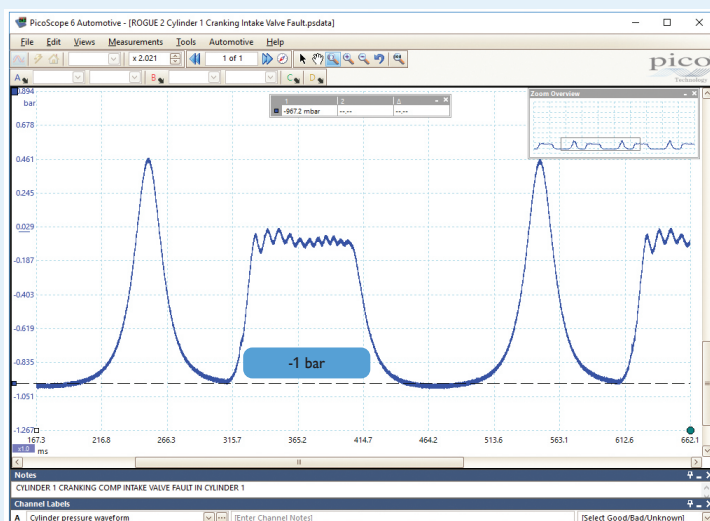
## DIAGNOSING WITH THE WPS500X

The WPS500X allows you to view pressure like never before, to run the following tests and view exactly what's happening before you start stripping down your customer's vehicle or engine.

### Engine does not start

Use our award-winning WPS500X to:

- Measure cylinder compression • Check for correct valve timing
- Locate the area of cylinder pressure leakage • Check for excessive crank case pressure
- Measure fuel pressure in petrol indirect injection • Check for excessive diesel back leakage
- Check for adequate fuel priming pressure (diesel) • Check for injector operation and balance (petrol and diesel)
- Measure intake manifold pressure



### Technician's Notes

#### The engine won't start

Testing with our WPS500X pressure transducer we can see that the compression peaks are very low, and also that there is a prolonged and deep depression/vacuum of -1 bar during the intake stroke.

Also notice that the intake pocket is slightly deeper than the expansion pocket. This waveform clearly shows that there is a problem with the air intake system that may include the manifold or intake port/valve.

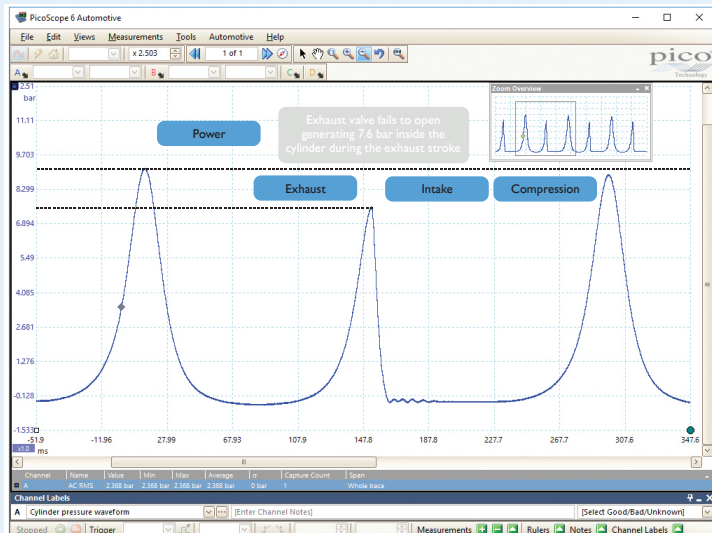
Engine strip-down and further investigation of the intake valve needed.

To understand just how powerful these tests can be, please read on and discover some of our testing solutions using our WPS500X pressure transducer. Remember, as with all PicoScope testing, further help and guidance is available within our automotive software's guided tests.

## Engine misfire

Use our award-winning WPS500X to:

- Test for adequate cylinder compression pressure
- Check for correct valve timing and operation
- Locate area of cylinder pressure leakage into crank case
- Locate area of cylinder pressure leakage into intake manifold
- Locate area of cylinder pressure leakage into exhaust system
- Locate area of cylinder pressure leakage into cooling system
- Pinpoint offending cylinder using ignition or injection events
- Vacuum pump efficiency diesel
- Check for injector operation and balance (petrol and diesel)
- Check for adequate fuel priming pressure (diesel)
- Check for adequate fuel pressure (petrol indirect injection)



## Technician's Notes

**The engine is running uneven and there is a popping noise via the intake**

Testing with our WPS500X pressure transducer we can see that the exhaust part of the waveform shows an excessive build-up of pressure during the exhaust stroke, but then a sharp descent from its peak. This shows there is either a blockage in the exhaust or a problem with the exhaust valve causing a build-up of pressure to over 7 bar, before finally the intake valve opens and the pressure can be released, explaining the popping sound being heard through the intake.

Further investigation of the exhaust system and possible engine strip-down to the exhaust valve needed.

## Lack of engine power

Use our award-winning WPS500X to:

- Test for excessive exhaust system back pressure (petrol catalyst)
- Test for blocked DPF (Diesel Particulate Filter) system
- Check for adequate fuel pressure (petrol)
- Check for the correct level of injector back leakage (diesel)
- Test for adequate cylinder compression pressure (cranking)
- Test for adequate increase in cylinder compression pressure (running)
- Check for adequate intake manifold pressure
- Check for adequate fuel priming pressure (diesel)
- Check for correct turbocharger boost pressure
- Check for injector operation and balance (petrol and diesel)
- Check for excessive crank case pressure (PCV valve operation)
- Vacuum pump efficiency (diesel)
- Monitor EGR (Exhaust Gas Recirculation) valve operation

## Engine emission failure

Use our award-winning WPS500X to:

- Check for applicable fuel pressure (petrol indirect injection)
- Check for injector operation and balance (petrol and diesel)
- Check for excessive crank case pressure (PCV valve operation)
- Monitor EGR valve operation
- Check for adequate intake manifold pressure (air leakage)
- Monitor intake manifold activity relative to intake and exhaust valve overlap/swirl flaps
- Test for excessive exhaust system back pressure (petrol catalyst)
- Test for restriction via DPF system (diesel)
- Vacuum pump efficiency (diesel)

## Engine rattle/noise

Use our award-winning WPS500X to:

- Vacuum pump efficiency (diesel)
- Check for excessive crank case pressure (PCV valve operation)
- Inspect engine oil pressure
- Test for excessive exhaust system back pressure (petrol catalyst)
- Check for injector operation and balance (petrol and diesel)
- Test for restriction via DPF system (diesel)
- Inspect intake manifold for positive pressure loss (petrol and diesel turbo)
- Check for correct valve timing and operation
- Identify timing chain stretch via in cylinder compression pressure waveform
- Check for excessive fuel pressure (petrol indirect injection)
- Test for adequate increase in-cylinder compression pressure (running)
- Monitor intake manifold activity relative to intake and exhaust valve overlap/swirl flaps

## Engine stalling

Use our award-winning WPS500X to:

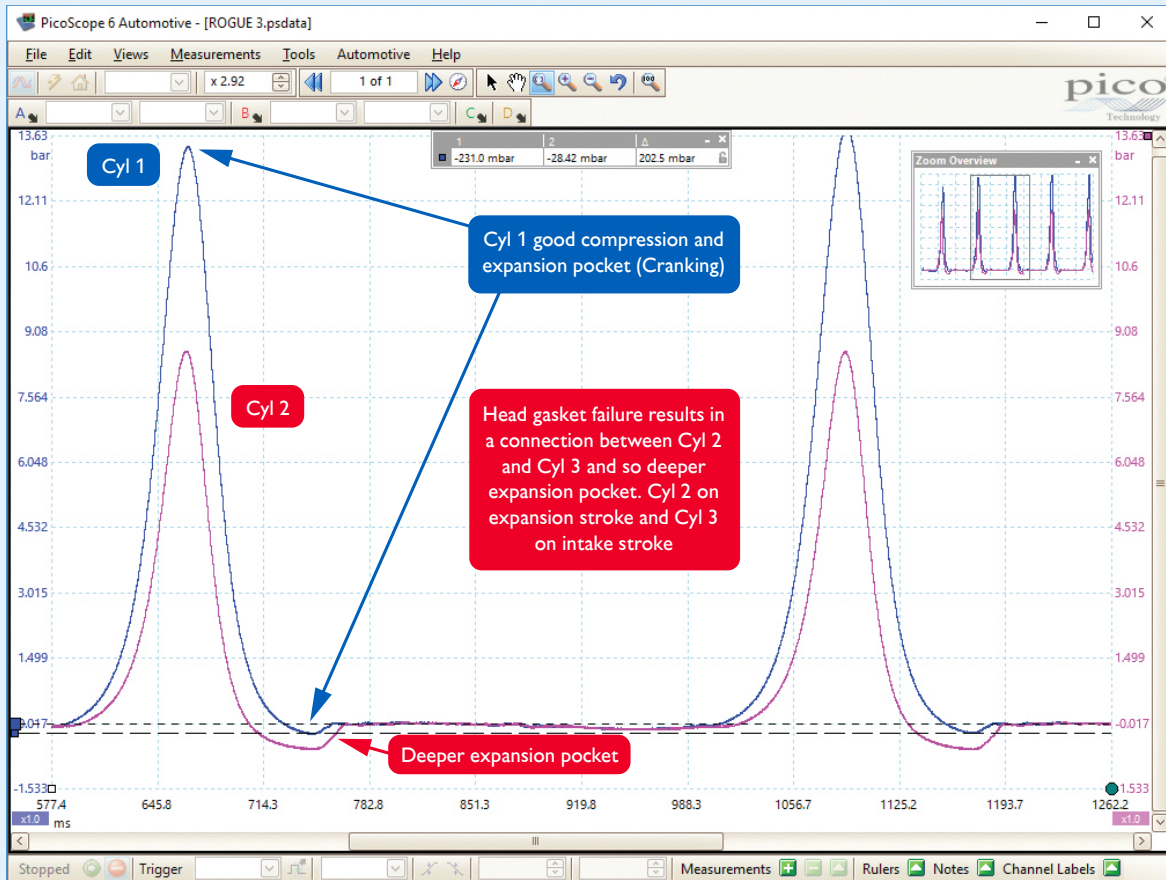
- Check for applicable fuel pressure (petrol indirect injection)
- Check for adequate fuel priming pressure (diesel)
- Check for injector operation and balance (petrol and diesel)
- Check for excessive crank case pressure (PCV valve operation)
- Monitor EGR valve operation
- Check for the correct level of injector back leakage (diesel)
- Check for adequate intake manifold pressure (air leakage)
- Monitor intake manifold activity relative to intake and exhaust valve overlap/swirl flaps
- Vacuum pump efficiency (diesel)



## Engine backfire

Use our award winning WPS500X to:

- Check for correct valve timing and operation
- Check for excessive fuel pressure (petrol-In direct injection)
- Monitor intake manifold activity relative to intake and exhaust valve overlap/swirl flaps
- Monitor EGR valve operation
- Check for adequate intake manifold pressure (Air leakage)
- Check for excessive crank case pressure (PCV valve operation)
- Test for adequate increase in cylinder compression pressure (running)



## Technician's Notes

### Engine fires but doesn't run

In this scenario we have 2 cylinders with low compressions (cylinders 2 and 3). Here, we compared cylinder 2 waveform to the good waveform from cylinder 1 and found not only do we have low compression, but also a deeper expansion pocket! Thinking this scenario through, the expansion pocket is formed as the piston travels down the cylinder on the expansion stroke whilst both valves remain closed. Knowing we have low compression on cylinders 2 and 3 and a deep expansion pocket, our compression loss had to be inside the engine. A blown head gasket between cylinders 2 and 3 resulted in cylinder 2 being exposed to the events in cylinder 3 and vice versa. During the expansion stroke of cylinder 2 we are feeling the effect of the intake stroke from cylinder 3 pulling a vacuum, not only affecting compression but contributing to the depth of our expansion pocket.

In this instance we've had to look at the waveforms from two cylinders to try to work out what is wrong: our waveform from cylinder 2 is showing a deep expansion pocket and indicates a loss of compression. Thinking the scenario through our team had no choice but to start an engine strip-down, and during this they discovered the problem – a tear in the head gasket between cylinders 2 and 3.



Understanding this it's easier to follow what was happening and of course the relationship between cylinders 2 and 3 is important here.

Because we now have joined together events happening in cylinders 2 and 3 we know that during the power stroke of cylinder 2 with both valves shut, we are feeling the effect of the intake stroke from cylinder 3, pulling a vacuum and thus affecting the compression compared to our reference waveform from cylinder 1.

Testing with WPS500X showed clearly the need for further investigation and engine strip-down to resolve the issue.

## PETROL COMPRESSION

**Connect** - Connect the WPS500X Pressure Transducer to PicoScope using the BNC to BNC cables provided. Attach the transducer as you would any compression gauge by removing a spark plug, and disable the fuel system and ignition for the test cylinder.

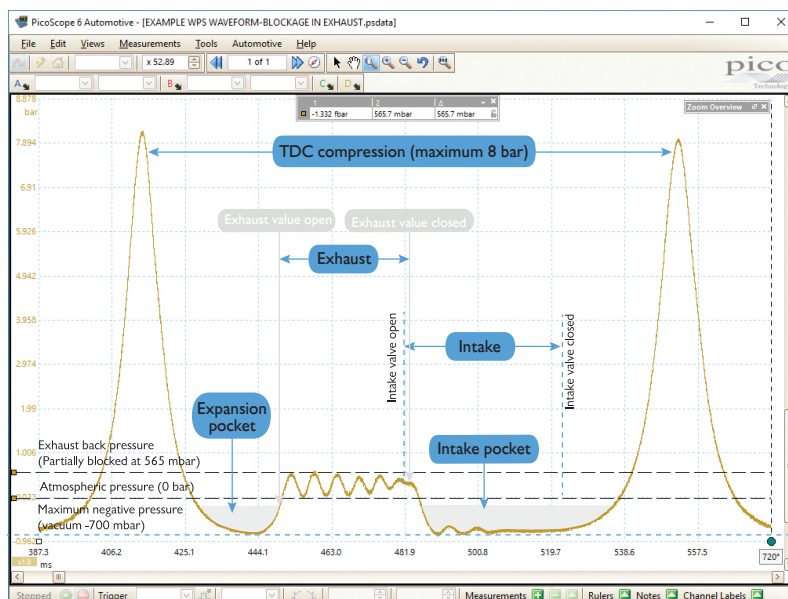
**Run** - Start capturing with PicoScope and run the engine. You may need to adjust the timebase and voltage scales to achieve the best signal display.

**Read** - Once you have captured your waveform you will be able to see every event taking place during the 720° rotation of the engine.

**TDC > Ex Valve Opening > Exhaust Valve Closing > Inlet Valve Opening > Inlet Valve Closing > BDC**

Switching the pressure transducer from one cylinder to the next is an easy way to obtain a direct and valuable comparison and remember, it's no more difficult to attach than a standard compression gauge but reveals so much more.

Reviewing all this information allows you to make a complete and accurate diagnosis on an engine running condition. You can do all this before a time-consuming and expensive engine dismantle is undertaken and what's more, should this be required, it allows you to rapidly locate the area of concern when dismantling begins.



## DIESEL COMPRESSION

**Connect** - Connect the WPS500X Pressure Transducer to PicoScope using the BNC to BNC cables provided. Attach the transducer to your diesel glow plug adaptor using either our WPS500X Adaptor Kit A or WPS500X Adaptor Kit B as required, and disable the diesel fuel injection system.

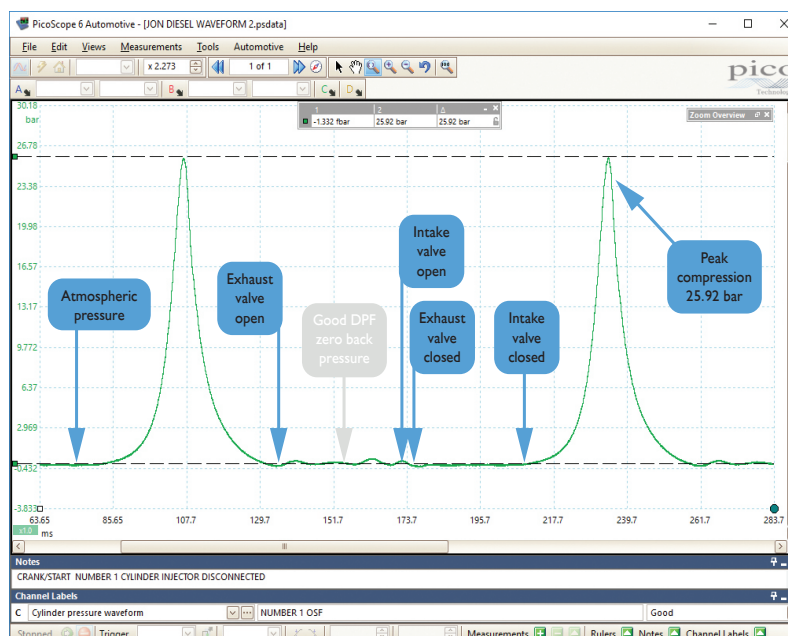
**Run** - Start capturing with PicoScope and crank the engine. You may need to adjust the timebase and voltage scales to achieve the best signal display.

**Read** - Once you have captured your waveform you will be able to see every event taking place during 720° rotation of the engine. We can identify numerous events taking place during the 4 stroke diesel cycle. In particular we can immediately identify the presence of any exhaust back-pressure allowing for DPF evaluation without the need for intrusion into the DPF system.

**TDC > Ex Valve Opening > Exhaust Valve Closing > Inlet Valve Opening > Inlet Valve Closing > BDC**

Switching the pressure transducer from one cylinder to the next is an easy way to obtain a direct comparison and remember, it's no more difficult to attach than a standard gauge, but reveals so much more.

Reviewing all this information allows you to make a complete and accurate diagnosis on an engine-running condition. You can do all this before a time-consuming and expensive engine dismantle is undertaken. If a dismantle is still required after your diagnosis, you have quickly and easily located the area of concern.



# How to test

## OIL PRESSURE

**Connect** - In our example we've used our WPS500X Adaptor Kit A to link the WPS500X transducer to an oil pressure adaptor from an AST test kit. Here we are monitoring engine oil pressure alongside coolant temperature, gas pedal position and engine speed, plotting the response time of the oil pump and the integrity of the lubrication system whilst monitoring the effects of temperature upon oil pressure.

**Run** - Start PicoScope running and start the engine. You may need to adjust the timebase and voltage scales to achieve the best signal display.

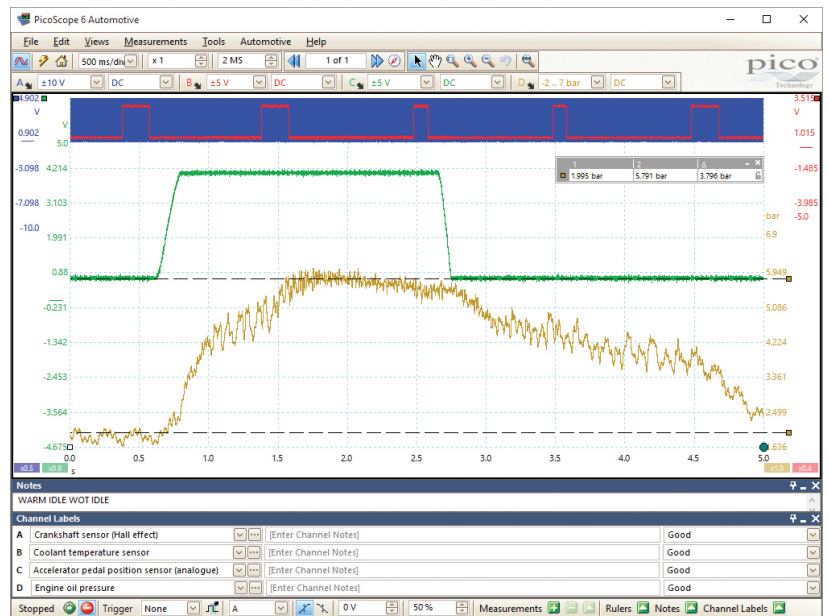
**Read** - Once captured, these waveforms provide evidence of the procedures carried out, as opposed to test results handwritten on a job sheet containing a pressure reading taken at a single point in time.

This waveform contains detailed information regarding the engine oil pressure under the following conditions:

1. Idle speed once warm (1.995 bar)
2. The integrity of the lubrication system in response to WOT
3. High engine speed oil pressure (5.791 bar)

Such test results would be invaluable before and after turbocharger replacement to confirm the lubrication system is serviceable, delivering peace of mind to customers or invaluable evidence for warranty in the event of a turbocharger failure.

To conclude, the example above highlights just one of the major advantages of viewing pressure against time given the accuracy and response of the WPS500X and its numerous automotive applications.



## FUEL PRESSURE TDI

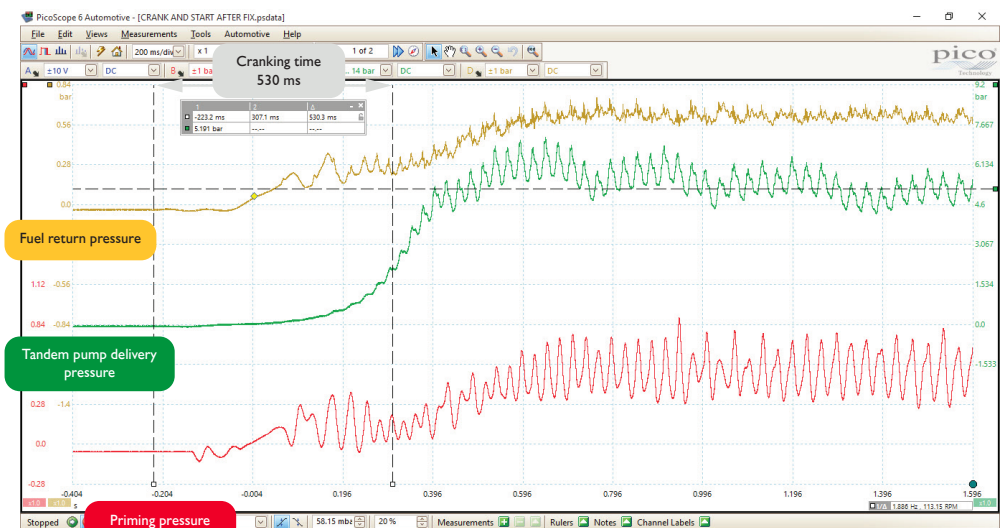
An invaluable test when trying to understand if the injectors are being affected by the fuel pressure delivery systems.

**Connect** - In this case we're going to fit two WPS500X pressure transducers to view both the tandem pump delivery pressure and fuel priming pressure. To test the fuel delivery pressure, we need to connect directly into the tandem pump using our standard WPS500X hose, connected through our WPS500X Adaptor Kit B, via a connector from a Sykes-Pickavant kit. For the second connection we need to break into the fuel line between the fuel filter assembly and the fuel feed hose, leading to the tandem pump, to do this we recommend our range of pressure taps to connect to our WPS500X along with an adapted fuel hose.

**Run** - Start PicoScope running and start the engine. You may need to adjust the timebase and pressure scales to achieve the best signal display.

**Read** - Once captured the waveform should reveal adequate priming pressure and a rapid build-up of tandem pump pressure upon cranking. Poor running caused by low delivery pressures will likely result in a slow build-up of priming pressure over an extended time period. Note cranking time of our example 'good' waveform is only 530 ms.

While our example uses two WPS500X pressure transducers, it is possible to capture the same detail using a single WPS500X, with the reference waveform function and a trigger at ignition, measuring each pressure point individually. Remember also to keep the time frame and operational conditions identical.





## WPS500X PRESSURE TRANSDUCER KIT

The kit contains our WPS500X Automotive Pressure Transducer, together with essential accessories to start capturing pressure data immediately (when used in conjunction with one of our PicoScope Automotive scopes).

Please check the [www.picoauto.com](http://www.picoauto.com) website for details of any new kits and accessories.

PP939 WPS500X KIT IN CARRY CASE £739 €979 \$1155

PQ006 WPS500X KIT IN FOAM TRAY £749 €989 \$1165



## WHAT YOU CAN TEST

- Petrol compression testing (cranking) • Cylinder compression testing (cranking) • Cylinder compression testing (idle) • Cylinder compression testing (WOT snap test) • Intake manifold pressure petrol and diesel • Exhaust gas pressure pulsations
- Exhaust back pressure evaluations • Crankcase pressure pulsations • PCV valve operation when you have high crankcase pressures
- Camshaft timing evaluation (belt, chain and gear driven) • Cylinder head valve sealing integrity

## WPS500X ESSENTIAL ACCESSORIES



### PICO RANGE OF PRESSURE TAPS

PP972 VACUUM TAP £36 €49 \$58

PP973 FUEL HOSE PRESSURE TAP (SMALL) £36 €49 \$58

PP974 FUEL HOSE PRESSURE TAP (MEDIUM) £36 €49 \$58

- Vacuum pump efficiency
- Evaporative loss control vacuum circuits and solenoids
- Boost pressure evaluation (variable vane errors)
- Boost control vacuum circuits and solenoids
- Waste gate operation
- Variable induction system actuator/control integrity test.
- Idle control damper integrity test.
- Cruise control actuators, vacuum circuits and solenoids.
- Air suspension pump efficiency
- Air suspension residual pressure testing
- Air suspension control pneumatic circuits and solenoids
- Brake servo evaluation and integrity test

Enhance your WPS500X kit with our range of accessories that will greatly increase the use (and tests available) for your pressure transducer.

#### PP970 WPS500X ADAPTOR KIT A £85 €109 \$129

The Pico WPS500X Adaptor Kit A enables you to use your WPS500X as a replacement for the gauge in a wide range of aftermarket pressure testing kits (e.g. AST and other using a Foster 12FST connector). This kit enables you to re-use your existing adaptors and benefit from testing pressure in real time with the WPS500X for applications including:

- Diesel compression testing (cranking)
- Engine oil pressure testing
- Cooling system pressure evaluation - Head gasket failure
- Radiator cap evaluation with over-pressurized cooling
- Fuel delivery pressure, petrol
- Fuel delivery residual pressure test, petrol
- Fuel delivery/priming pump efficiency, petrol and diesel
- Fuel positive/negative priming pressure, diesel
- Fuel delivery residual pressure, diesel
- Fuel injector back leakage test, diesel
- Fuel injector contribution evaluation test, petrol

#### TA250 WPS500X ADAPTOR KIT B £85 €109 \$129

The Pico WPS500X Adaptor Kit B adaptor kit enables you to use your WPS500X as a replacement for a gauge in a wide range of aftermarket pressure testing kits (e.g. Sykes-Pickavant, Sealey, Laser and Draper kits). This kit enables you to reuse your existing adaptors and benefit from testing pressure in real time with the WPS500X for applications including:

- Diesel compression testing (cranking)
- Engine oil pressure testing
- Cooling system pressure evaluation - Head gasket failure
- Radiator cap evaluation with over pressurized cooling (314275LG)
- Fuel delivery pressure, Petrol
- Fuel delivery residual pressure test, Petrol
- Fuel delivery/priming pump efficiency, petrol and diesel
- Fuel positive/negative priming pressure, Diesel
- Fuel delivery residual pressure, Diesel (314925LG)
- Fuel injector back leakage test, Diesel
- Fuel injector contribution evaluation test, Petrol

\*Prices are correct at the time of publication. Please contact Pico Technology for the latest prices before ordering.

Pico Technology  
James House  
Colmworth Business Park  
ST. NEOTS  
PE19 8YP  
United Kingdom

☎ +44 (0) 1480 396395  
☎ +44 (0) 1480 396296  
✉ sales@picoauto.com

Pico Technology  
320 N Glenwood Blvd  
Tyler  
Texas 75702  
United States

☎ +1 800 591 2796  
☎ +1 620 272 0981  
✉ sales@picoauto.com

