WPS500X

500 psi /34.5 bar
Automotive Pressure Transducer

User's Guide

1. Safety terms and symbols

Please review the following safety precautions to avoid injury and prevent damage to this transducer or any equipment that is connected to it.

Appearing on the product:

Danger of personal injury or property damage. Refer to manual for details.

Appearing in manual:

Your help and efforts are required to protect and keep our environment clean. Therefore either return this product to the manufacturer or ensure WEEE compliant collection and treatment yourself at the end of life. Do not dispose of as unsorted municipal waste.

A **CAUTION** identifies conditions or practices that could result in damage to the product or equipment to which it is connected.

A **WARNING** identifies conditions or practices that could result in injury or death.

WARNING:

- To avoid damage or injury, you must safely connect the transducer using only the supplied pressure hoses and connectors. Pico Technology cannot accept responsibility for damage or injury caused by the use of unsuitable pressure hoses or connectors.
- To avoid damage or injury, follow the vehicle manufacturer's safety instructions. This is particularly important when connecting the transducer to pressurized fuel lines.
- To avoid damage or injury, connect the transducer to an electrical ground when working on or near fuel systems. If you use the transducer with a PicoScope oscilloscope, connect a suitable lead from any unused BNC connector on the front panel of the scope to the ground of the vehicle.
- To avoid injury, you should wear appropriate personal protective equipment (PPE) when working with pressurized fluids.
- To avoid injury, do not use the transducer with pressures that exceed the maximum rating of 500 psi / 34.5 bar.
- To avoid equipment damage and personal injury, do not operate this transducer with the covers removed.
- To avoid personal injury and fire hazard, do not operate this transducer in an explosive atmosphere.

- To avoid damage or injury, have the transducer inspected by qualified service personnel if you suspect it is damaged. Do not attempt to operate it, or to dismantle or repair it yourself.
- To avoid damage or injury, do not use the pressure-tested hoses supplied by Pico Technology if they have been disassembled or damaged.
- To avoid damage or injury, do not use for running compression tests on diesel engines. The combination of high cylinder pressure and high combustion temperature may cause permanent damage to the WPS500X, and may also cause personal injury.

CAUTION:

- To avoid damage, do not use the WPS500X for long-term or permanent application, such as a monitoring system on a race car. It is intended for immediate diagnostic purposes only.
- To avoid damage, do not store or operate the unit at temperatures above 60 °C (140 °F). The lithium polymer (LiPo) battery inside the transducer can be damaged by excessive heating.
- To avoid incorrect readings and possible equipment damage, do not operate this transducer in wet or damp conditions or submerge it in liquid. The transducer is splash-resistant but not immersion-proof.

2. Description

The WPS500X automotive diagnostic pressure transducer allows quick and accurate pressure analysis of many automotive systems. It can be used for many different pressure diagnostic applications, saving the need to own several transducers for different applications.

It offers these features:

- high resolution and accuracy
- auto-zeroing
- built-in zoom tool
- integrated bleed-off / pressure relief valve
- three pressure ranges

Note: While you cannot use the WPS500X to measure the pressure from the mechanical fuel pump (usually found in the engine bay), you can safely and accurately measure the pressure from the electronic fuel pump (usually found between the fuel tank and the fuel filter).

Please contact your distributor or support@picotech.com if you have any queries.

3. Re-ordering codes

If you need to re-order spare parts, please use the part numbers listed here:

WPS500X pressure transducer (PP652)

Part No	Qty	Description
TA098	1	5 m (16 foot) BNC to BNC cable
DO157	1	WPS500X manual
PA094	1	WPS500X carry case

WPS500X pressure transducer kit (PP939)

Part No	Qty	Description
TA071	1	WPS500X pressure transducer
TA081	1	USB to mini-USB charging cable
TA083	1	Gasoline fuel pressure hose with large Schrader valve
TA085	1	Vacuum hose
TA086	1	Bleed hose
TA087	1	Exhaust adaptor
TA130	1	BNC to BNC cable 5 m (16 foot)
TA117	1	Gasoline fuel pressure hose with small Schrader valve
TA129	1	Universal vacuum adaptor
DO157	1	WPS500X manual
TA212	1	Standard compression hose for WPS500X
TA217	1	Adaptor M14 short reach
TA218	1	Adaptor M14 deep reach
TA213	1	Adaptor M10 short reach
TA216	1	Adaptor M12 deep reach
PA094	1	WPS500X carry case

Optional accessories

The following accessories are also available for purchase:

Part No	Description
TA142	Spare Foster 2 Series quick coupler female to 1/8" MPT male for making custom hoses
TA214	Adaptor M10 deep reach
TA219	Adaptor M16 Ford Triton
TA220	Adaptor M18
TA250	WPS500X Adaptor Kit B
PP970	WPS500X Adaptor Kit A

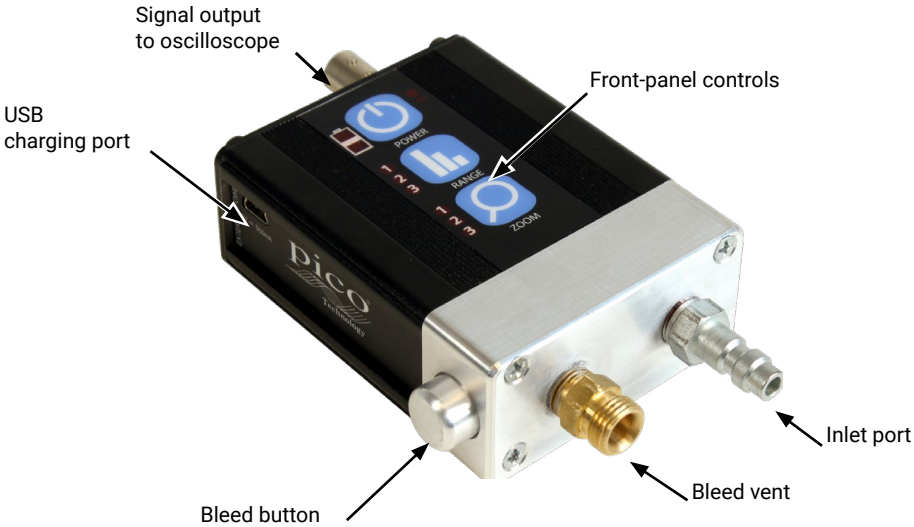
O-rings

The following O-rings can be used as replacements on our compression hoses:

Nominal code*	Description	Size	Cross-section	Material
AS568-011	Used on Compression Adaptor M10 (TA213 & TA214)	OD 7/16" ID 5/16"	1/16"	Viton
AS568-012	Used on Compression Adaptor M12 (TA216)	OD ½" ID 3/8"	1/16"	Viton
AS568-013	Used on Compression Adaptor M14 (TA217 & TA218)	OD 9/16" ID 7/16"	1/16"	Viton
AS568-015	Used on Compression Adaptor M18 (TA220)	OD 11/16" ID 9/16"	1/16"	Viton

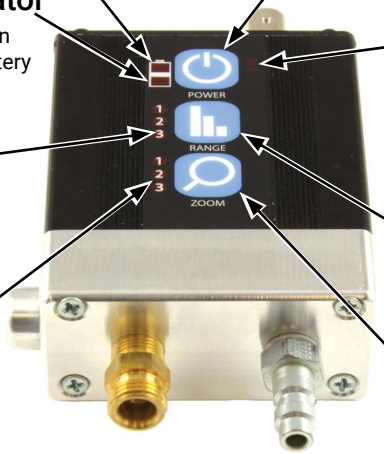
*Pico Technology does not stock these parts.

4. The parts of your WPS500X pressure transducer



Signal output	Use the BNC-to-BNC cable supplied to connect the oscilloscope to this.
Front-panel controls	See Section 5.
USB charging port	For battery recharging only (no data connection). Connect to any USB port on a computer or a 5 volt USB wall charger.
Inlet port	Connect the pressure hose here.
Bleed vent	When the bleed screw is opened, this vent allows fluid to drain out of the measurement chamber.
Bleed button	Push to open the bleed vent. Some models have a screw instead of a push-button.

5. Front-panel controls



Power button

Press once to switch on. Press once again to switch off. Conserve battery power by keeping the unit switched off when not in use.

Charging indicator

The indicator lights up when the battery is charging.

Low battery indicator

The indicator lights up when the power is on but the battery is low.

Battery fault indicator

The indicator lights up if there is a problem with the battery.

Range indicators

The indicators show which of the three ranges is selected.

Range button

Press this button to cycle through the three ranges.

Zoom indicators

The indicators show which of the three zoom modes, if any, is in use.

Zoom button

Press to cycle through the three zoom modes. Zoom mode subtracts the static pressure and magnifies the remaining dynamic pressure.

See Section 6: "Operating modes"

6. Operating modes

Ranges 1 to 3

Select the range using the Range button shown in Section 5: “Front-panel controls”.

Range 1: The first range measures from –15 psi (–1 bar) to +500 psi (34.5 bar). It offers high resolution and accuracy for high-pressure tests, such as cranking and running cylinder compression or fuel pressure testing. It is also helpful for identifying cam timing issues, such as jumped timing belts and stretched timing chains, especially on multi-cam engines that may not have a cam sensor on each camshaft. The WPS500X kit includes a specially designed compression hose for performing this test, with significantly reduced error and higher operating temperature ranges than conventional compression hoses and adapters.

Range 2: The second range measures from –15 psi (–1 bar) to +50 psi (+3.45 bar). This range is ideal for vacuum test and fuel system tests. When testing these systems the zoom function is especially useful to analyze valve operation with the vacuum waveform, or the injectors through the fuel waveform.

Range 3: The third range measures –5 to +5 psi (–0.345 to +0.345 bar). This setting is sensitive enough to analyze small pressures or pulses, such as exhaust pulses from the tail pipe.

Zoom modes 1 to 3

The zoom feature is used to show small signal details within a larger signal, such as pulses from intake vacuum, or to amplify pressure pulses from the exhaust. It operates by removing all of the voltage from the signal within the selected range below 100 Hz and then magnifying the remaining signal.

Select the zoom using the zoom button shown in Section 5: “Front-panel controls”. Continued pressing of the zoom button will step the level of amplification through the three zoom modes. Press one of the range buttons to turn off the zoom.

7. Preparation for use

Compatible fluid types

The WPS500X is suitable for use with the following types of fluid:

- Gasoline and diesel (low pressures only – see warning on p. 2)
- Engine oil
- Air

Before first use

- Remove all packaging.
- Charge the internal battery. For instructions, see Section 9: “Maintenance”.

8. Making a measurement

Making a pressure measurement involves the following steps. Each step is explained in more detail in the sections below.

- Prepare the transducer
- Measure pressure
- Release the pressure in the measurement chamber
- Clean the measurement chamber

Preparing the transducer

- Ensure that the transducer's internal battery is charged.
- Unplug the charging cable from the transducer.
- Before switching on, disconnect any pressure source from the transducer. A pressure source left connected will interfere with the self-calibration procedure described below.
- Switch on the transducer and wait until the three Range LEDs light up in sequence. At the end of the sequence, Range 1 LED remains lit, showing that the transducer has finished its auto-zeroing procedure. The entire procedure should take less than 10 seconds.

Measuring pressure

- If your WPS500X has a bleed screw, ensure that the screw is firmly closed.
- Connect the pressure hose to the pressure sensing port. If measuring compression, ensure that you have selected the correct-sized adaptor for the spark plug that you have removed.

WARNING:

- To avoid damage or injury, only use pressure hoses and connectors supplied with the WPS500X or otherwise manufactured to an adequate standard. Pico Technology cannot accept responsibility for damage or injury caused by the use of unsuitable pressure hoses or connectors.
- To avoid damage or injury, always check that the pressure hose is securely fastened to the transducer before pressurizing the system. Always check for leaks when connecting the unit and never leave it connected to a vehicle unattended (especially when connected to fuel).

- If measuring liquid pressure, bleed any air out of the measurement chamber first.
- Use the BNC cable supplied to connect the output of the transducer to the input channel of the oscilloscope.
- Switch on the computer and run the PicoScope software.
- In the PicoScope software, select the "Automotive" menu and then the appropriate pressure test.
- Press the Range button on the transducer to select the measuring range.
- Start the vehicle's engine.
- A waveform showing the pressure of the system will appear on the PicoScope display.

Releasing the pressure in the measurement chamber

After each measurement, some fluid will remain under pressure in the measurement chamber. Follow the instructions below to release the pressure.

- Hold the transducer over a suitable container to catch the fluid expelled from the bleed vent.

WARNING:

- To avoid damage or injury, position the transducer so that the fluid released from the bleed vent, which may be under high pressure, points away from equipment and people

Push-button units

Press the button to release the pressure from the chamber.

Bleed-screw units

- SLOWLY loosen the bleed screw by turning it counter-clockwise. Do not remove the screw from the transducer.
- Allow the fluid to emerge from the bleed vent.
- When no more fluid emerges, tighten the bleed screw.

Cleaning the measurement chamber

If you are measuring the pressure of a liquid, some of the liquid will remain in the measurement chamber after use. To prevent cross-contamination between liquids, or between liquids and air, you must clean the measurement chamber after use.

WARNING:

- To avoid damage or injury, DISCONNECT all pressure hoses from the transducer. DO NOT attempt to clean the measurement chamber when the unit is under pressure.

CAUTION:

- To avoid damage when disassembling the bleed valve for the first time, hold the transducer over an empty container in case any loose parts drop out.
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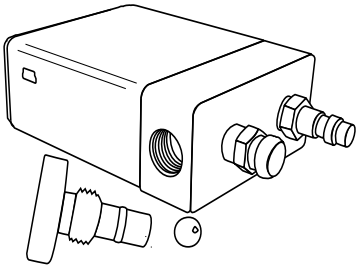
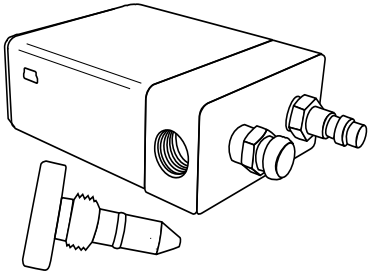
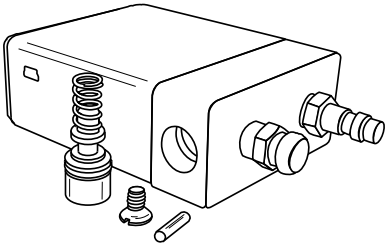
1. Dismantle the bleed valve and allow any liquid to drain out.
2. The bleed valve in the WPS500X pressure transducer may be a ball valve, needle valve or Schrader valve, as shown in the following drawings:



WPS500X with ball valve



WPS500X with needle valve



WPS500X with push button valve

Ball valve

1. If the ball is still inside the ball valve, allow it to drop out. Clean and oil the ball with non-hygroscopic oil compatible with steel and aluminum. Ordinary motor oil is suitable.
2. If the ball needs replacing, see Section 9: "Maintenance".
3. Clean the bleed screw. Flush out the measurement chamber with brake cleaner if necessary, and replace the ball and the bleed screw.

Needle valve

1. Clean the bleed screw. Flush out the measurement chamber with brake cleaner if necessary, and replace the bleed screw.

Push button valve

1. Remove the countersunk screw from the back of the transducer near the push-button.
2. Hold the transducer with the screw hole facing down.
3. Prepare to catch the retaining pin that will drop out of the hole in the next step
4. Depress the push-button until the retaining pin drops out.
5. Withdraw the push-button assembly, including the spring.
6. Clean the valve parts, spring, retaining pin, and screw with brake cleaner.
7. Flush out the measurement chamber with brake cleaner. Push in the centre of the Schrader valve, at the bottom of the push-button hole, to let the cleaner flow through.
8. Replace the push-button, retaining pin and screw. When you replace the screw, take care to not get grit in the mechanism. The screw should be hand-tight.

9. Maintenance

Cleaning the housing

Clean the transducer's housing by wiping it with a rag moistened with clean water or a water-based detergent. Allow the housing to dry before use.

- Do not use fuel or any other solvent
- Do not use abrasive cleaning agents
- Do not submerge the unit in any liquid
- Do not dismantle the unit
- Do not use the unit until it is perfectly dry.

Cleaning the measurement chamber

See Section 8 above.

Recharging the internal battery

- To charge using a computer, switch on the computer and allow it to boot. Disable any power-saving modes to ensure that the computer does not switch off before recharging is complete. Connect the transducer to the USB port of the computer using the USB charging cable provided.
- To charge using a USB wall charger, connect the transducer to the charger using the USB charging cable provided.
- Leave the transducer to charge for 5 hours.
- Unplug the USB cable from the transducer before use. Leaving the cable plugged in may affect measurement accuracy.
- The battery inside the WPS500X is designed to give a long service life and is not user-replaceable.

Repairs

If the unit is damaged or it stops working, or the battery does not charge or hold charge, return the unit to Pico Technology or an authorized Pico distributor for repair. Do not attempt to dismantle or repair the unit.

Replacing the bleed valve ball (if fitted)

If the ball in the bleed valve is lost, it can be replaced with a standard 0.25 inch (6.35 mm) steel bearing ball. To re-seat the ball, clean the port and then seat the ball using a brass drift.

Disposal

The WPS500X contains a lithium polymer (LiPo) battery. If the battery has reached the end of its life, you may return the unit for repair. When the transducer reaches the end of its life, take the entire unit to a battery recycling facility for safe disposal.

WARNING:

- To avoid damage or injury, YOU MUST observe the instructions below. Incorrect disposal of the battery could cause a fire or an explosion.

1. Do not open the unit to remove the battery
2. Do not crush or shred the unit
3. Do not dispose of in fire

10. Specifications

Inlet			
Pressure ranges	Range 1	Range 2	Range 3
	–15 to +500 psi –1 to +34.5 bar	–15 to +50 psi –1 to +3.45 bar	–5 to +5 psi –0.345 to +0.345 bar
Connector	Male push-fit		
Output			
Scaling	1 V/100 psi (6.89 bar)	1 V/10 psi (0.689 bar)	1 V/1 psi (0.0689 bar)
Offset (typical)	Auto-zeroing		
Connector	BNC female, fits Pico Technology cable TA098		
Performance			
Accuracy	1% of scale	1% of scale	5% of scale
Response time (10% to 90%)	100 µs	100 µs	
Power supply			
Type	Built-in LiPo battery, not user-serviceable		
Charging current	500 mA (max.) at 4.75 V to 5.25 V from USB charger cable		
Charging connector	USB mini, fits Pico Technology cable TA081		
Ambient operating temperature	0 to 60 °C (32 to 140 °F) max.		
Ambient storage temperature	0 to 60 °C (32 to 140 °F) max.		
Environmental protection	Splash-resistant against water, gasoline and diesel. Not immersion-proof.		
Weight	332 g (11.7 oz)		
Dimensions	133 x 74 x 30 mm (5.2 x 2.9 x 1.2 in.)		
Compliance	Electromagnetic Compatibility (EMC) Directive 2014/30/EU FCC part 15 class A		

11. Conversion factors

The SI unit of pressure and vacuum is the pascal, symbol Pa. These are some other units in common use:

1 bar	100 000 Pa
1 psi (pound per square inch)	≈ 6 895 Pa
1 inHg (inch of mercury)	≈ 3 386 Pa
1 inH2O (inch of water)	≈ 250 Pa
1 mmH2O (millimeter of water)	≈ 10 Pa

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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