VW Piezometers & Pressure Transducers

Applications

For the measurement of...

- **Ground water elevations**
- **Pore water pressures**
- **Pump tests**
- **Uplift pressures in dam foundations**
- **Hydraulic pressures in tanks and pipelines**
- **Wick drain efficiency**
- **Water pressures behind tunnel linings**

Model 4500C, 4500S, 4500H, 4500DP and 4500HD Vibrating Wire Piezometers (front to back).

Operating Principle

The transducer uses a pressure sensitive diaphragm with a vibrating wire element attached to it. The diaphragm is welded to a capsule which is evacuated and hermetically sealed. Fluid pressures acting upon the outer face of the diaphragm cause deflections of the diaphragm and changes in tension and frequency of the vibrating wire. The changing frequency is sensed and transmitted to the readout device by an electrical coil acting through the walls of the capsule.

Piezometers incorporate a porous filter stone ahead of the diaphragm, which allows the fluid to pass through but prevents soil particles from impinging directly on the diaphragm.

Advantages and Limitations

The 4500 Series Vibrating Wire Piezometers and Pressure Transducers have outstanding long-term stability and reliability, and low thermal zero shift. Cable lengths of several kilometers are no problem and the frequency output signal is not affected by changing cable resistances (caused by splicing, changes of length, terminal contact resistances, etc.), nor by penetration of moisture into the electronic circuitry.

A thermistor located in the housing permits the measurement of temperatures at the piezometer location.

All-stainless steel or titanium construction and evacuation of the capsule guarantees a high level of corrosion resistance. Integral gas discharge tubes inside the main housing protect against lightning damage.

Standard porous filters are made from sintered 316 stainless steel. High air-entry ceramic filters are available for use in applications requiring that air be prevented from passing through the filter.

Vented versions of all models are available to provide automatic compensation for barometric pressure fluctuations. Negative pressures up to 1 Bar can be measured.

Vibrating wire pressure transducers are not suitable for the measurement of rapidly changing pressures: for these purposes Model 3400 transducers should be used.

Model 4500S/SV/SH/AL/ALV Standard Piezometers

● *Model 4500S (front) and Model 4500AL (rear) Standard Piezometers.*

The Model 4500S/SV Standard Piezometer is designed to measure fluid pressures such as ground water elevations and pore pressures when buried directly in embankments, fills, etc. It is also suitable for installation inside boreholes, observation wells and standard (>19 mm diameter) piezometer riser pipe.

The Model 4500SH is designed with a heavy duty housing for pressures that exceed 3 MPa.

The Model 4500AL is designed for low-pressure ranges. The vented version (Model 4500ALV) provides automatic compensation for barometric pressure changes. Thermistors are included to measure temperatures.

Model 4500B/BV/C Small Diameter Piezometers

● *Model 4500C (front) and Model 4500B (rear) Small Diameter Piezometers.*

These piezometers are designed to enable the automation of small diameter piezometer standpipes. The 4500B/BV fits inside 19 mm pipe and the 4500C inside 12 mm pipe.

Model 4500DP Drive Point Piezometers

● *Model 4500DP Drive Point Piezometers.*

The Model 4500DP Drive Point Piezometer has the transducer located inside a housing with an EW drill rod thread and removable pointed nose cone. When threaded onto the end of EW drill rods, the unit can be pushed directly into soft ground with the signal cable located inside the drill rod. This model is ideally suited for use in soft clays and landfills. The piezometer may be recovered at the end of the job.

Models are also available that are similar in construction to the 4500DP but which use standard metric threads allowing for installation using cone penetrometer and other drill rods with adapters.

Model 4500HD Heavy Duty Piezometer

● *Model 4500HD Heavy Duty Piezometer.*

The Model 4500HD Heavy Duty Piezometer is designed for direct burial in fills and dam embankments. The 4500HD is used in conjunction with heavily armored cable to withstand earth movements during construction. Recommended for use in earth dams.

Model 4500H/HH Pressure Transducers

● *Model 4500H Pressure Transducer.*

The Model 4500H and 4500HH Pressure Transducers are supplied with a $\frac{7}{16}$-20 SAE J514 pipe thread fitting to permit the transducer to be coupled directly into hydraulic or pneumatic pressure lines. Other pipe thread sizes are also available.

Model 4500HT High Temperature Piezometer

● *Model 4500HT High Temperature Piezometer.*

The Model 4500HT High Temperature Piezometer is designed for applications for temperatures up to 230°C. These sensors are supplied with either mineral insulated cables or Teflon cables inside stainless steel tubing. *For further details, please see the Model 4500HT data sheet.*

Model 4500Ti Titanium Piezometer

● *Model 4500Ti Titanium Piezometer.*

The Model 4500Ti is designed specifically for use in highly corrosive environments such as landfills and leach fields. Also used in critical areas where long term survivability is essential, for example, as in nuclear waste repositories and aggressive mine tailings. All exterior surfaces are made from titanium.

Model 4580 Barometer & Pressure Transducers

● *Model 4580-1 Barometer (inset), Model 4580-2 and 4589-2V Pressure Transducers.*

The Model 4580 Pressure Transducers are designed for very low fluid pressure measurements, such as groundwater elevations in wells, water levels in streams, weirs, flumes, etc. Changes in water levels of as little as 0.2 mm can be measured. The Model 4580-1 is a barometer used to measure atmospheric pressure changes.

Model 4500AR Autoresonant Piezometer

● *Model 4500AR "Autoresonant" Piezometer.*

The Model 4500AR "Autoresonant" Piezometer is designed for use with existing data acquisition systems incapable of reading standard (pluck and read) vibrating wire sensors. It can also be used where low frequency (<20 Hz) dynamic measurements are required.

The Model 4500AR is powered using a 6-24 VDC supply, which yields a 5 V square wave output at the sensor frequency. This high-output offers excellent noise immunity and enhanced signal transmission over long (300 m+) cables. The Model 4500AR is available in standard pressure ranges, with corresponding resolution, linearity and accuracy.

Technical Specifications

Model	Standard Ranges	Over Range	Resolution	Accuracy[1]	Linearity	Temperature Range[2]	Thermal Zero Shift	Diaphragm Displacement	Length × Diameter	Mass
4500S/SV	–100 to 350, 700 kPa; 1, 2, 3 MPa	2 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	133 × 19.1 mm	0.12 kg
4500SH	–100 kPa to 5, 7.5, 10, 20 MPa	2 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	194 × 25.4 mm	0.44 kg
4500AL/ ALV	70, 170 kPa	2 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	133 × 25.4 mm	0.25 kg
4500B/BV	–100 to 350, 700 kPa; 1, 2, 3 MPa	2 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	133 × 17.5 mm	0.10 kg
4500C	–100 to 350, 700 kPa	2 × rated pressure	0.05% F.S.	±0.1% F.S.	< 0.5% F.S.	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	165 × 11 mm	0.09 kg
4500DP	–100 to 70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5 MPa	2 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	187 × 33.3 mm	0.90 kg
4500HD	–100 to 70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5 MPa	2 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	203 × 38.1 mm	1.50 kg
4500H[3]	–100 to 70, 170, 350, 700 kPa; 1, 2, 3 MPa	1.5 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	140 × 32 mm[4] 140 × 25.4 mm	0.30 kg
4500HH[3]	–100 to 5, 7.5, 10, 20, 35, 75, 100 MPa	1.5 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	143 × 25.4 mm	0.30 kg
4500HT	–100 to 700 kPa; 1, 2, 3, 5, 7.5, 10, 25, 50, 75, 100, 150 MPa	2 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	0°C to +230°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	133 × 19.1 mm	0.12 kg
4500Ti	–100 to 350, 700 kPa; 1, 2, 3, 5, 7.5 MPa[2]	2 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	125 × 25.4 mm	0.19 kg
4580-1 (Barometer)	200 Mbar[2]	2 × rated pressure	0.025% F.S.[5]	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	n/a	110 × 63.5 mm	1.18 kg
4580-2/2V	17, 35 kPa	2 × rated pressure	0.025% F.S.[5]	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	n/a	165 × 38 mm	0.86 kg
4580-3V	7 kPa	2 × rated pressure	0.025% F.S.[5]	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	n/a	165 × 63.5 mm	1.72 kg
4500AR[6]	7, 17, 35, 70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5, 10, 20, 25, 35, 50, 75, 100, 150 MPa	2 × rated pressure	0.025% F.S.[5]	±0.1% F.S.	< 0.5% F.S. (±0.1% F.S. optional)	–20°C to +80°C	< 0.05% F.S./°C	< 0.001 cm^3 at F.S.	varies according to pressure range	varies according to pressure range

Note: PSI = kPa × 0.14503, or MPa × 145.03

[1]Accuracy established under laboratory conditions.

[2]Other ranges available on request.

[3]All high pressure sensors are potentially dangerous and care must be taken not to over-range them beyond their calibrated range. Sensors are tested to 150% of the range to provide a factor of safety.

[4]For 70 and 170 kPa range only.

[5]Depends on readout system.

[6]Power Supply Voltage Range: 6 V (min), 12 V (nom), 24 V (max).
Power Supply Current: 15.5 mA @ 12 V @ 20°C.
Operating Temperature Range: 0° to +70°C.
VW Output Signal Voltage: 5 V square wave @ fundamental vibrating wire frequency.
VW Output Signal Impedance: 50 ohms.
Cable: 3 twisted pairs.

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