CORROSION RESISTANT PIEZOMETERS + PRESSURE TRANSDUCERS

GEOKON®

MODEL 4500CR SERIES

Model 4500INCO-170KPA with PVC cable (top) and
Model 4500INCO-350KPA with PVC cable (bottom).

Model 4500TI-2MPA with 316 stainless steel encapsulated cable (top) and
Model 4500TI-2MPA with PVC cable (bottom).

APPLICATIONS

Ideally suited for:

- Landfills
- Chemically aggressive mine tailings
- Heap Leach Pads
- Marine or highly saline conditions

For the measurement of:

- Ground water elevations
- Pore water pressures
- Contaminant plumes

OPERATING PRINCIPLE

The CR Series Vibrating Wire Piezometers and Pressure Transducers are designed for use in chemically aggressive environments, such as mine tailings, leach pads, and marine applications, where standard vibrating wire piezometers may not be particularly suitable, especially for long term monitoring. 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 by an electrical coil acting through the walls of the capsule. Piezometers incorporate a porous filter stone ahead of the diaphragm, which allows fluid to pass through while preventing soil particles from impinging directly on the diaphragm.

ADVANTAGES AND LIMITATIONS

As with the 4500S and 4500AL Series[1], the 4500CR Series Vibrating Wire Piezometers and Pressure Transducers have outstanding long-term stability and reliability, and a low thermal sensitivity. The main advantage of the 4500CR Series over the 4500S/AL Series lies in the corrosion resistant materials used in their construction, which makes them particularly well suited for use in marine, landfill, or chemically aggressive environments.

For many applications, the 316 stainless steel used in the 4500S/AL Series may suffice. But where additional corrosion resistance is required, the 4500CR Series, with versions manufactured from Inconel® (4500INCO) or Titanium (4500TI), can be considered. Both models incorporate enhanced seals at the cable entry and filter connection. (Model 4500INCO utilizes a custom, dual O-ring seal, while the 4500TI employs an all-welded construction.) The porous filters used in the CR Series match the material of the respective Models; Inconel for the 4500INCO and Titanium for the 4500TI.

Lengthy cable runs are not a problem, as the frequency output is not affected by changing cable resistances (caused by splicing or contact resistances). A thermistor (or a vibrating wire temperature sensor) located in the transducer housing permits the measurement of temperatures at the piezometer location. Internal gas discharge tubes protect against lightning damage.

A variety of cable options are available to complement the 4500CR Series. In addition to the standard PVC and Polyurethane jacketed cables, conductors encased in annealed 316 stainless steel or Duplex 2205® stainless steel are also available.

[1]Refer to the 4500 Series data sheet for more information on Models 4500S and 4500AL.

CHEMICAL RESISTANCE

The choice of piezometer and cable is largely dependent on the chemical composition of the water in the area of study and the materials through which the cables are to be routed. Often times, the appropriate selection can be made by assessing the performance of materials in equipment such as pumps, pipes and valves etc. already existing at the project site. Beyond this a number of Chemical Resistance Guides are available on the Internet to aid in selection[2]; but it is important to keep in mind that the chemical resistance of the metals and cables used in the piezometer construction can be affected not only by chemical concentration, but also by chemical combinations and temperatures.

[2]Contact Geokon for help finding references.

TECHNICAL SPECIFICATIONS

Model	Standard Ranges[1]	Over Range	Resolution	Accuracy[2]	Linearity	Nominal Temperature Range[1,3]	Thermal Zero Shift	Diaphragm Displacement	Length × Diameter, Mass
4500INCO	70, 170 kPa	1.5 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S.	–20 °C to +80 °C	< 0.01% F.S./°C (70 and 170 kPa) < 0.05% F.S./°C (All others)	< 0.001 cm^3 at F.S.	133 × 25.4 mm, 0.25 kg (70 and 170 kPa)
	350, 700 kPa								133 × 19.1 mm, 0.12 kg (350 kPa to 5 MPa)
	1, 2, 3, 5 MPa 7.5, 10, 20 MPa								194 × 25.4 mm, 0.44 kg (7.5 to 20 MPa)
4500TI	350, 700 kPa	1.5 × rated pressure	0.025% F.S.	±0.1% F.S.	< 0.5% F.S.	–20 °C to +80 °C	< 0.01% F.S./°C	< 0.001 cm^3 at F.S.	125 × 25.4 mm, 0.19 kg (350 kPa to 3 MPa)
	1, 2, 3, 5, 7.5, 10 MPa								168 x 25.4 mm, 0.28 kg (5 to 10 MPa)

Notes: PSI = kPa × 0.14503, or MPa × 145.03. Piezometers with a range of 350 kPa and higher are capable of reading negative pressures to –100 kPa. Contact GEOKON for more information.

[1]Other ranges available on request.
[2]Accuracy established under laboratory conditions.
[3]–40C to +80°C with corresponding cable as shown below in Cable Specifications.

CABLE SPECIFICATIONS

Model	Conductors	Conductor Insulation	Drain Wire	Jacket	Nominal OD	Temperature Range
02-250V6-E/M	4-conductors, 2 twisted pair, 22 AWG 7/30	8 mil HDPP	24 AWG	PVC (Blue)	6.35 mm (±0.25 mm) [0.25"]	–20 to +80 °C
02-250P4-E/M	4-conductors, 2 twisted pair, 22 AWG 7/30	8 mil HDPP	24 AWG	Polyurethane (Green)	6.35 mm (±0.25 mm) [0.25"]	–20 to +80 °C
02-250P9LT-E/M	4-conductors, 2 twisted pair, 22 AWG 7/30	8 mil HDPP	24 AWG	Polyurethane (Violet)	6.35 mm (±0.25 mm) [0.25"]	–40 to +80 °C
02-312PS4-E/M	4-conductors, 2 twisted pair, 22 AWG 7/30	10 mil HDPP	24 AWG	Polyurethane (Green) w/Braided Sheild	7.95 mm (±0.38 mm) [0.313"]	–20 to +80 °C
02-313PI-E/M	4-conductors, 2 twisted pair, 22 AWG 7/30	10 mil HDPP	24 AWG	Polyurethane (Black) w/Intregral SS Straining Wire	7.95 mm (±0.38 mm) [0.313"]	–20 to +80 °C
02-313V6-E/M	4-conductors, 2 twisted pair, 22 AWG 7/30	10 mil HDPP	24 AWG	PVC (Blue) w/Kevlar Strain Relief	7.95 mm (±0.38 mm) [0.313"]	–20 to +80 °C
02-250PEP-E/M-316	4-conductors, 24 AWG Solid	8 mil PTFE	N/A	316ss, 1mm (0.035") wall ±15% Collapse Pressure: 6,540 psi Tensile Strength: 2,010 lbs Yield Strength: 945 lbs Elongation: 300%	6.35 mm (±0.13 mm) [0.25"]	–150 to +300 °C
02-250PEP-E/M-2205	4-conductors, 24 AWG Solid	8 mil PTFE	N/A	Duplex 2205, 1mm (0.035") wall ±15% Collapse Pressure: 17,400 psi Tensile Strength: 2,245 lbs Yield Strength: 1,655 lbs Elongation: 300%	6.35 mm (±0.13 mm) [0.25"]	–150 to +300 °C

ORDERING INFORMATION

4500INCO-70KPA: Vibrating Wire Piezometer, Inconel wetted parts, 70 kPa
4500INCO-170KPA: Vibrating Wire Piezometer, Inconel wetted parts, 170 kPa
4500INCO-350KPA: Vibrating Wire Piezometer, Inconel wetted parts, 350 kPa
4500INCO-700KPA: Vibrating Wire Piezometer, Inconel wetted parts, 700 kPa
4500INCO-1MPA: Vibrating Wire Piezometer, Inconel wetted parts, 1 MPa
4500INCO-2MPA: Vibrating Wire Piezometer, Inconel wetted parts, 2 MPa
4500INCO-3MPA: Vibrating Wire Piezometer, Inconel wetted parts, 3 MPa
4500INCO-5MPA: Vibrating Wire Piezometer, Inconel wetted parts, 5 MPa
4500INCO-7.5MPA: Vibrating Wire Piezometer, Inconel wetted parts, 7.5 MPa
4500INCO-10MPA: Vibrating Wire Piezometer, Inconel wetted parts, 10 MPa
4500INCO-20MPA: Vibrating Wire Piezometer, Inconel wetted parts, 20 MPa
4500TI-350KPA: Vibrating Wire Piezometer, all titanium construction, 350 kPa
4500TI-700KPA: Vibrating Wire Piezometer, all titanium construction, 700 kPa
4500TI-1MPA: Vibrating Wire Piezometer, all titanium construction, 1 MPa
4500TI-2MPA: Vibrating Wire Piezometer, all titanium construction, 2 MPa
4500TI-3MPA: Vibrating Wire Piezometer, all titanium construction, 3 MPa
4500TI-5MPA: Vibrating Wire Piezometer, all titanium construction, 5 MPa
4500TI-7.5MPA: Vibrating Wire Piezometer, all titanium construction, 7.5 MPa
4500TI-10MPA: Vibrating Wire Piezometer, all titanium construction, 10 MPa

02-250V6: Blue PVC Cable, 6.35 mm (±0.25 mm) [0.25"] Ø, 2 twisted pairs, for the above
02-250P4: Green Polyurethane Cable, 6.35 mm (±0.25 mm) [0.25"] Ø, 2 twisted pairs, for the above
02-250P9LT: Violet Polyurethane Cable, 6 mm (±0.25 mm) [0.25"] Ø, 2 twisted pairs, for the above
02-250PEP-316: 316 Stainless Steel Encapsulated Cable, 6.35 mm (±0.13 mm) [0.25"] Ø, 4 solid conductors, for the above
02-250PEP-2205: Duplex 2205 Stainless Steel Encapsulated Cable, 6.35 mm (±0.13 mm) [0.25"] Ø, 4 solid conductors, for the above

COMPATIBLE READOUTS AND DATALOGGERS

GK-404: Handheld Readout
GK-406: Vibrating Wire Analyzer
8600 Series: Multi-Channel Dataloggers
8800 and 8900 Series: GeoNet Wireless Data Acquisition System
8920 and 8930 Series: GeoNet Cellular and Wi-Fi Network Loggers
8940 Series: GeoNet Dataloggers

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