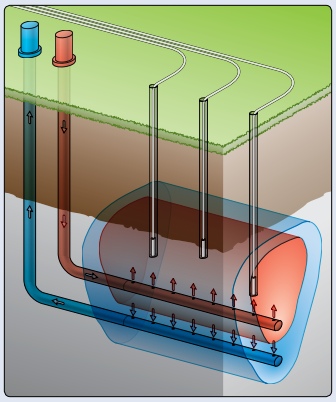
High Temperature Piezometers and Pressure Transducers

Applications

For the measurement of downhole pressures and temperatures in oil recovery systems and geothermal applications.



• *Model 4500HT used for monitoring pressures and temperatures in oil recovery applications.*

• *Model 4500HT High Temperature Piezometer (front) and Model 4500HHT High Temperature Pressure Transducers (center, back).*

The ***GEOKON®*** 4500HT Series High Temperature Piezometers and 4500HHT Pressure Transducers are designed for monitoring downhole pressures and temperatures in oil recovery systems and geothermal applications.

These sensors are capable of operation under extreme conditions and at temperatures up to 250°C. In thermal recovery applications (steam assisted gravity drainage (SAGD) or cyclic steam stimulation (CSS)), they can provide accurate, real-time, continuous monitoring of pressures in production and injection wells thereby optimizing the recovery rate and reducing the costs of the steam injection process. In geothermal applications, they offer a means for in situ and continuous monitoring of pressures and temperatures over extended periods of time.

Operating Principle

The sensors use 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.

Advantages and Limitations

Vibrating wire sensors can be modified for use in environments subject to temperature extremes more easily than many other commercially available sensor types because the electromagnetic coil (used to excite the wire) is the only electronic component inside the sensor. In addition, the construction of vibrating wire sensors that are highly corrosion-resistant and capable of long-term use, in very aggressive environments, is possible due to the careful selection of materials and use of proprietary assembly techniques. All exposed components are made of corrosion-resistant stainless steels and internal components (plucking coils, electrical hook-up wire, thermistors, and internal seals) are high-temperature versions.

The 4500HT Series High Temperature Piezometers and 4500HHT Series Pressure Transducers offer outstanding long-term stability and reliability, and low thermal zero shift. Cable lengths of several kilometers

Model 4500HT shown with TEC cable (coiled, pre-installed configuration).

are possible 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 secondary vibrating wire temperature sensor (or thermistor), located in the same housing, permits the measurement of temperatures at the piezometer location.

Calibrations are performed at six different temperatures throughout the range to determine zero shift and the change in gage factor with temperature.

The 4500HT/HHT Series piezometers and pressure transducers are delivered either with mineral insulated cables, comprising 4 x 22AWG solid copper conductors in magnesium oxide inside a stainless steel tube, or with tubular encapsulated cables (TEC) comprising 4 x 24AWG stranded, tinned copper, conductors with PFA insulation, encapsulated inside a 316L stainless steel tube.

These sensors are designed for static measurements only and at least one second is required to excite and read the sensor.

Technical Specifications

Standard Ranges[1]	–100 to 700 kPa; 1, 2, 3, 5, 7.5, 10, 20, 50, 75, 100, 150 MPa
Over Range	1.5 × rated pressure
Resolution	0.025% F.S. (minimum)
Accuracy[2]	±0.1% F.S.
Linearity	< 0.5% F.S. (±0.1% F.S. optional)
Temperature Range[1]	0°C to +250°C
Thermal Zero Shift	< 0.05% F.S./°C
Diaphragm Displacement	< 0.001 cm^3 at F.S.

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

[1] *Other ranges available on request.*

[2] *Accuracy established under laboratory conditions.*

▾ 4500HT Piezometer

Dimensions (L × ø)[1]	191 × 19 mm *(–100 to 700 kPa; 1, 2, 3, 5, 7.5, 10 MPa)*

▾ 4500HHT Pressure Transducer

Dimensions (L × ø)[2]	191 × 19 mm *(–100 to 700 kPa; 1, 2, 3, 5, 7.5, 10 MPa)* 191 × 32 mm *(20, 50, 75 MPa)* 216 × 32 mm *(100, 150 MPa)*

[1] *Please contact **GEOKON, INCORPORATED** for dimensions of ranges higher than 10 MPa.*

[2] *Pressure Connections are Female 7/16-20 UNF Medium Pressure 60° Cone.*

Cable Specifications

▾ Mineral Insulated

Conductors	4-conductors, 22 AWG, solid copper
Sheath	Stainless Steel
Sheath Wall	0.76 mm (0.03")
Nominal O.D.	4.76 mm (0.1875")
Coil ID	1m / 3 ft

▾ Tubular Encapsulated (TEC)

Conductors	4-conductors 24AWG stranded, tinned, copper
Insulation	PFA
Sheath	316L Stainless Steel
Nominal OD	4mm / 0.160"
Sheath wall	0.76mm / 0.030"
Coil Diameter	1m / 3ft

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GEOKON, INCORPORATED
48 Spencer Street
Lebanon, NH 03766 · USA

phone: 1 · 603 · 448 · 1562
email: info@geokon.com
web: www.geokon.com

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