Geotechnical and Structural Instrumentation

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GEOKON, INCORPORATED is located in Lebanon, New Hampshire, USA and operates on a worldwide basis through a network of agencies. The company was founded in 1979 and currently has over 100 employees. Over the years, GEOKON has emerged as the World Leader in Vibrating Wire Technology™ due to our quality, responsive customer service and industry-leading designs. Our broad range of geotechnical instrumentation is manufactured at our factory in the USA, by a staff of trained, qualified and experienced machinists and assemblers. In particular, GEOKON, through innovation and experience, has developed a line of vibrating wire sensors unsurpassed anywhere in the world. These highly reliable devices have contributed in no small way to the growing worldwide acceptance of vibrating wire as the most suitable technology for geotechnical applications.

GEOKON manufactures a complete line of geotechnical instruments including extensometers, piezometers, strain gages, crackmeters, jointmeters, load cells, settlement sensors, pressure cells, inclinometers, dataloggers and custom designs made to order. GEOKON instruments are used primarily for monitoring the safety and stability of civil and mining structures such as dams, tunnels, mine openings, foundations, piles, embankments, retaining walls, slopes, subway systems, underground powerhouses, bridges, culverts, pipelines, shafts, slurry wall excavations, braced excavations, tiebacks, nuclear waste repositories, ground water remediation schemes and the like.

The pages of this catalog provide a brief description of the standard GEOKON product lines* Individual data sheets with additional information and complete product details are also available. If these products do not meet your needs, members of our experienced staff are ready to work with you to produce custom instrumentation for special applications. Call or write for more information or visit our website at www.geokon.com and find out why GEOKON has a reputation for high quality, reliability and service unequaled in the industry.

Frequencies can be transmitted over long cables (>2000 m) without appreciable degradation of the signal caused by variations in cable resistance, which can arise from water penetration, temperature fluctuations, contact resistance or leakage to ground. This factor, coupled with the elegance and ruggedness of GEOKON designs results in sensors which exhibit excellent long-term stability and suitability for long-term measurements in adverse environments.

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GEOKON's product lines are traceable to the United States Department of Commerce, National Institutes of Standards and Technology (NIST), in particular, GEOKON, through innovation and experience, has developed a line of vibrating wire sensors unsurpassed anywhere in the world. These highly reliable devices have contributed in no small way to the growing worldwide acceptance of vibrating wire as the most suitable technology for geotechnical applications.

*GEOKON, INCORPORATED maintains an ongoing policy of design review and reserves the right to amend products and specifications without notice.
Bridge structures in many countries around the world have used GEOKON sensors for measuring key parameters such as strain, displacement, force, temperature, inclination, alignment and settlement. Sensors are installed permanently for long-term health monitoring, temporarily for load testing and/or to ensure safe working conditions during repair or strengthening. Internet-accessible data acquisition systems ensure that any significant change in the condition or behavior of the structure is logged, reported and efficiently monitored.

Dams

GEOKON instruments have been used to monitor and analyze critical elements of numerous dams throughout the world. Dams of any kind can benefit from instrumentation—including concrete, rollcrete, rock-fill and earth. GEOKON instruments are used in the dams of USA, China, Spain, South Africa, Brazil, Czech Republic, Switzerland, Colombia, New Zealand, Kenya, Pakistan, Algeria, Indonesia, Thailand and Australia.

Embankments

The construction (staged or surcharged) of highway embankments and levees often requires instrumentation to monitor the progress of consolidation and to determine whether the embankment is stable. Instrumentation can also be utilized to monitor the effectiveness of vertical drains used to accelerate consolidation in embankment construction. GEOKON piezometers, settlement systems, extensometers and inclinometers are among the most common types of instruments used for embankment monitoring.

Foundations and Deep Excavations

Excavations in urban environments require extensive monitoring to ensure their stability and to verify that nearby structures are not adversely affected. Typical excavation/foundation-related projects may require instrumentation for the walls (slurry walls and tiebacks), bracing (cross-lot struts), and/or the underlying ground or adjacent structures and utilities. Many major cities throughout the world including New York, Boston, Kuala Lumpur and Berlin have used GEOKON instruments in these situations.

Geogrids

Geogrid reinforcements can be monitored using displacement transducers attached to the grid with requisite clamps. Networks of such transducers, connected to data acquisition systems, can help identify areas of subsidence and forewarn of impending failures. Horizontal extensometers, pressure cells and settlement profilers are also commonly used in reinforced embankment constructions.

Groundwater

GEOKON offers a wide variety of options for monitoring groundwater, lake and stream levels. Products range from simple standpipe piezometers and water level meters, to downhole water level loggers and pressure transducers connected to dataloggers for pump tests and real time monitoring. Sensors for measurements in streams and weirs are also available, along with low-power data acquisition systems to wirelessly collect data from many sensors spread over a wide area.

Landfills

Environmental concerns, requiring a knowledge of groundwater conditions and the stability of landfills, have been extensively monitored using GEOKON instrumentation. In these often highly corrosive regimes, special instruments, capable of withstanding elevated temperatures and aggressive leachates, have been constructed from titanium for added reliability and longevity. The Staten Island Landfill in New Jersey is instrumented with GEOKON sensors.
### Nuclear Waste Repositories

GEOKON has been involved in the instrumentation of nuclear waste repositories in the USA, Germany, Sweden and Belgium. These applications called for special high-temperature devices capable of withstanding high radiation levels. The willingness and ability of GEOKON to innovate enabled measurements to be made where other commercially available devices were unsuccessful.

### Piles and Pile Testing

GEOKON is a leader in pile instrumentation—both steel and concrete, driven or cast-in-place. Many important projects utilizing coffer dams and sheet piling have been instrumented, plus pilings on foundations of major buildings in cities throughout the world. The Petronas Twin Towers in Malaysia, among the tallest buildings in the world, uses GEOKON gages.

### Pipelines

In situations where pipelines pass over unstable slopes, lateral forces, due to slope movements, may act on the pipe causing it to bend and possibly rupture. To monitor and determine any resulting stresses, vibrating wire strain gages can be attached at various points along the pipe. Instruments for slope monitoring and data acquisition systems, which offer near real-time monitoring, are also available.

### Slope Stability

Careful monitoring and examination of slopes for failure warning signs is critical for protecting people and/or facilities down slope. The type of instruments selected for any monitoring program will depend upon the geology of the soil or rock mass and the problems to be monitored but may include extensometers, piezometers, crackmeters, and inclinometers.

### Tunnels

Many subway systems in major cities around the world have used GEOKON instruments. GEOKON is a specialist in the supply of instruments for the NATM method of tunnel support. In addition to almost all major cities in the USA, we have instrumented subway systems in Seoul, Taipei, Guangzhou, Istanbul, Hong Kong, Singapore and London. We also have instruments in the Channel Tunnel.

### Wind Turbines

Newly constructed wind turbines often require instrumentation to verify the design and long-term performance of their foundations. For piled foundations, instrumentation is often used to measure load distribution and lateral deflections along the pile, and to monitor the effectiveness of any lock off bolts. For raft foundations, instrumentation can be installed to detect tilting and to monitor pressures and any movement between the foundation and the underlying soil or rock.

### Mines

Many mines, both underground and open pit, have used GEOKON instruments to monitor the stability of underground openings or pit slopes. Instrumented mines occur in USA, Canada, Mexico, Chile, Australia, New Guinea and Zaire among others. Of particular note is a full-scale, mine-wide monitoring system installed at J.M. Asbestos, Quebec to warn of possible collapse of the open pit slopes.
GEOKON, INCORPORATED…

Strain Gages

The Model 4200HT and 4200HT-T (pictured at left) High Temperature Embedment Strain Gages are similar to the standard Model 4200. However, the Model 4200HT is designed for short-term use at temperatures up to 200°C and the Model 4200HT-T is designed for long-term use at temperatures up to 220°C. They are particularly useful for measurements in autoclaved spun concrete piles.

**Model 4200HT / 4200HT-T High Temperature Embedment Strain Gages**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>4200HT</th>
<th>4200HT-T</th>
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</thead>
<tbody>
<tr>
<td>Range¹</td>
<td>3000 με</td>
<td>3000 με</td>
</tr>
<tr>
<td>Resolution</td>
<td>1.0 με</td>
<td>1.0 με</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.5% F.S.</td>
<td>±0.5% F.S.</td>
</tr>
<tr>
<td>Nonlinearity</td>
<td>&lt; 0.5% F.S.</td>
<td>&lt; 0.5% F.S.</td>
</tr>
<tr>
<td>Temperature Range³</td>
<td>-20°C to +80°C</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td>Active Gage Length³</td>
<td>153 mm</td>
<td>148 mm</td>
</tr>
</tbody>
</table>

¹Other ranges/lengths available on request. | ²Transducer accuracy established under laboratory conditions. | ³Other ranges available on request.

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**Model 4000 Arc Weldable Strain Gage**

The Model 4000 Strain Gage is designed primarily for arc welding to steel structures such as tunnel linings, excavation bracing, piles and bridges. The gage has a 150 mm gage length (longer or shorter versions are also available) and a 3000 με range and a 1 με sensitivity. The gage can be adapted for bonding to concrete or for bolting to steel surfaces by modification of the end blocks.

**Model 4100 / 4150 / 4151 Miniature Strain Gages**

The Model 4100/4150 Strain Gage has a 51 mm gage length (3000 με range, 1 με sensitivity) and is designed to measure strains in steel structures (4100) and on reinforcement bars (4150) where space may be limited. The gage is installed quickly and easily by means of a capacitive discharge spot welder or, for short-term use, with special epoxy adhesives. (The 4151 Strain Gage Series offers extended ranges, 5000 or 10,000 με, for use in high strain regimes).

<table>
<thead>
<tr>
<th>Specifications</th>
<th>4100</th>
<th>4150</th>
<th>4151</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range¹</td>
<td>3000 με</td>
<td>3000 με</td>
<td>3000 με</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.4 με</td>
<td>0.4 με</td>
<td>0.4 με</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.5% F.S.</td>
<td>±0.5% F.S.</td>
<td>±0.5% F.S.</td>
</tr>
<tr>
<td>Nonlinearity</td>
<td>&lt; 0.5% F.S.</td>
<td>&lt; 0.5% F.S.</td>
<td>&lt; 0.5% F.S.</td>
</tr>
<tr>
<td>Temperature Range³</td>
<td>-20°C to +80°C</td>
<td>-20°C to +80°C</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td>Active Gage Length³</td>
<td>51 mm</td>
<td>51 mm</td>
<td>51 mm</td>
</tr>
</tbody>
</table>

¹Other ranges/lengths available on request. | ²Transducer accuracy established under laboratory conditions. | ³Accuracy of ±0.1% F.S. available with optional, individual calibration.

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**Model 3900 Embedment Strain Gage**

The Model 3900 Embedment Strain Gage is designed for the measurement of dynamic strains in concrete structures, earth fills and soils. It comprises a full bridge strain gaged proving ring coupled, between two flanges, with a spring and shaft. When the flanges move relative to one another, the tension in the spring changes and hence the strain in the proving ring. A PVC tube serves as a protective housing and holds the gage at the desired initial tension.

**Model 4200 / 4202 / 4210 Concrete Embedment Strain Gages**

These Strain Gages are designed for direct embedment in concrete. The 4200 (standard model) has a 153 mm gage length and 1 με sensitivity and is commonly used for strain measurements in foundations, piles, bridges, dams, tunnel linings, etc. The 4210 has a 250 mm gage length making it particularly suitable for use in large aggregate concrete. The 4202 is designed for laboratory use and/or where there are space limitations. Low modulus versions, for measuring concrete curving strains, are also available (please contact GEOKON for details).

**Model 4200HT-T High Temperature Embedment Strain Gages**

The Model 4200HT and 4200HT-T (pictured at left) High Temperature Embedment Strain Gages are similar to the standard Model 4200. However, the Model 4200HT is designed for short-term use at temperatures up to 200°C and the Model 4200HT-T is designed for long-term use at temperatures up to 220°C. They are particularly useful for measurements in autoclaved spun concrete piles.

**Model 4911 / 4911A Rebar Strainmeters**

The Model 4911 Rebar Strainmeter is designed for measuring strains in foundations, slurry walls, precast piles, caissons, bridge abutments, tunnel linings, etc. The standard Model 4911 (#4 rebar), known as the “Sister Bar”, is installed alongside structural rebar. Larger models (4911A) are available for welding directly into structural rebar. Where short-term dynamic measurements are to be made, bonded resistance (Model 3911/3911A) strain gages can be substituted, or added.

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**Specifications**

- Model 4200HT and 4200HT-T: Range: 10,000 με, Resolution: 0.4 με. (Range is dependent on the readout).
- Model 3900: Range: 5000 με, Resolution: 0.125 mV/V nominal. (Range is dependent on the readout).
- Model 4100: Range: 3000 με, Resolution: 0.4 με. (Range is dependent on the readout).
### Model 4400 Embedment Jointmeter

The Model 4400 Embedment Jointmeter is designed for use across construction joints such as those between adjacent blocks in a concrete dam. It is normally embedded across the joint to monitor the expansion or contraction of the joint. The use of internal universal joints allows for a degree of shearing motion.

**Specifications**
- **Ranges**: 12.5, 25, 50, 100 mm
- **Resolution**: 0.025% F.S.
- **Accuracy**: ±0.1% F.S.
- **Nonlinearity**: < 0.5% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x ø)**: 441, 441, 441, 569 × 51 mm (range)

1. Other ranges available on request.  
2. Transducer accuracy established under laboratory conditions.

### Model 4410 Strandmeter

The Model 4410 Strandmeter is designed to measure strains in tendons and steel cables. Two clamps at each end of the strandmeter hold it firmly onto the cable. Various size clamps are available.

**Specifications**
- **Ranges**: 3 mm (15,000 με)
- **Resolution**: < 5 με
- **Accuracy**: ±0.1% F.S.
- **Nonlinearity**: < 0.5% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x ø)**: 203 × 45 mm (clamp radius)

1. Other ranges available on request.  
2. Transducer accuracy established under laboratory conditions.

### Model 4420 Crackmeter

The Model 4420 Crackmeter is intended to measure movement across surface cracks and joints. It is installed by grouting, bolting, or bonding two threaded anchors (with ball joints) on opposite sides of the crack and then attaching the ends of the gage to the anchors.

**Specifications**
- **Ranges**: 12.5, 25, 50, 100, 150 mm
- **Resolution**: 0.025% F.S.
- **Accuracy**: ±0.1% F.S.
- **Nonlinearity**: < 0.5% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x ø)**: 318, 343, 397, 555, 645 × 8 mm (shaft)

1. Other ranges available on request.  
2. Transducer accuracy established under laboratory conditions.

### Model 4422 Micro Crackmeter

The Model 4422 is a miniature crackmeter intended to measure displacements across surface cracks and joints. It has been specially designed for applications where access is limited and/or where monitoring instrumentation is to be as unobtrusive as possible (e.g. on historical structures or buildings).

**Specifications**
- **Range**: 4 mm (±2 mm)
- **Resolution**: 0.001 mm
- **Accuracy**: ±0.1% F.S.
- **Nonlinearity**: < 0.5% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x ø)**: 120 × 8 mm

1. Transducer accuracy established under laboratory conditions.  
2. Other ranges available on request.

### Model 4425 Convergence Meter

The Model 4425 Convergence Meter is used to monitor closures in underground excavations, tunnels, etc. It is comprised of a spring tensioned transducer, turnbuckle, connecting rod (stainless steel, fiberglass or graphite), rod clamp, and a pair of stainless steel eyebolts.

**Specifications**
- **Ranges**: 12.5, 25, 50, 100, 150 mm
- **Resolution**: 0.025% F.S.
- **Accuracy**: ±0.1% F.S.
- **Nonlinearity**: < 0.5% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x ø)**: varies with application; ≥ 25 mm (transducer)

1. Other ranges available on request.  
2. Transducer accuracy established under laboratory conditions.

### Model 4430 Deformation Meter

The Model 4430 Deformation Meter with flanged ends is designed to measure longitudinal deformation in dams and embankments. It can also be grouted or held in place by hydraulic anchors to measure deformations in boreholes (over the gage length). Gage lengths from 0.5 to 100 meters are available.

**Specifications**
- **Ranges**: 25, 50, 100, 150, 300 mm
- **Resolution**: 0.025% F.S.
- **Accuracy**: ±0.1% F.S.
- **Nonlinearity**: < 0.5% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x ø)**: 1 m, varies with application; ≥ 27 mm (pipe), 51 mm (range)

1. Other ranges available on request.  
2. Transducer accuracy established under laboratory conditions.

### Model 4435 Soil Extensometer

The Model 4435 Soil Extensometer is designed to be installed, in series, to measure horizontal strain in earthfill or rock-fill dams. The 4435 has flanges on either end, which enable a series of extensometers to be bolted together forming long strings of sensors so that complete profiles of deformation or settlement can be monitored.

**Specifications**
- **Ranges**: 25, 50, 100, 150, 300 mm
- **Resolution**: 0.025% F.S.
- **Accuracy**: ±0.1% F.S.
- **Nonlinearity**: < 0.5% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x ø)**: varies with application; ≥ 27 mm (pipe), 33 mm (slip coupling)

1. Other ranges available on request.  
2. Resolution depends on readout equipment.  
3. Transducer accuracy established under laboratory conditions.
The Model A-1 Single Position Rod Extensometer is a very simple, rugged and reliable instrument, easily installed and completely recessed within the borehole for optimum protection. The Model A-1 is a natural first choice for monitoring the safety in and around tunnels and mine openings.

The Model A-3 Multiple Point Rod Extensometer is the preferred design for installation in downward directed boreholes which are easily filled with cement grout. Up to six anchors can be installed, at various depths, in a 76 mm diameter borehole providing the capability to locate multiple failure plains and zones of movement.

The Model A-4 Multiple Point Rod Extensometer with Snap-Ring Anchors is quickly and easily installed in boreholes in hard or competent rock. Anchors are pushed to the required depth on the end of setting rods and then a cord is pulled to remove the locking pin which allows two retaining rings on each anchor to snap outward and grip the borehole. Up to six anchors can be installed, at various depths, in a 76 mm diameter borehole. Particularly useful in upward directed boreholes.

The Model A-5 Multiple Point Rod Extensometer with Hydraulic Anchors is recommended for use in soft ground and soils or in rock where the borehole may deteriorate. This anchor is very versatile and can be used in boreholes of varying diameter and roughness oriented in any direction.

The Model A-6 Flexible Rod Extensometer uses continuous lengths of fiberglass rods (inside protective tubing), cut to customer-specified lengths, coiled at the factory and shipped ready for installation. The extensometer is lightweight, making it easier to handle for installation and less costly to ship. On-site assembly time is minimal and the installation procedure is simplified.

The Model A-9 Retrievable Extensometer (Patent No. 5,585,555) is designed to measure deformations in boreholes in rock and concrete. The device can be used in pile load test studies, plate jacking tests and virtually any application where a hole can be drilled or a pipe can be cast into the structure being studied. The system features adjustable gage lengths, rapid and simple installation/removal and high accuracy.

The purpose of the heave/settlement points is to measure vertical movements in foundation soils during, and subsequent to, construction. The heave/settlement point consists of a three-prong anchor, a ¼” standard inner pipe, and a 1” standard outer pipe. The pipes are assembled in sections and fastened together with standard couplings to the required anchor depths.
Extensometer Anchor Types

1. Borros Type Hydraulic Anchor
   - For use in soft soils and clays, especially in augered boreholes. Can also be driven directly through soft ground without a borehole being required.

2. Groutable Anchor
   - The preferred anchor for use in downward-directed boreholes. The pre-assembled extensometer is installed in the borehole, which is then filled with cement grout. These anchors can also be used in upward-directed boreholes with a more complicated grouting procedure.

3. Hydraulic Anchor
   - For use in rough boreholes in rock and soft ground, especially if dilations and contractions of the borehole are anticipated. Also useful in upward directed boreholes with or without grouting.

4. Snap-Ring Anchor
   - For use in hard or competent rock where smooth uniform boreholes can be drilled. The simplicity of its design allows for quick and easy installation.

Readout Instruments - Sensors

1. Model 1400-4 Digital Depth Micrometer
   - Readout of borehole extensometers is made on a digital counter after manual adjustment of the thimble. Accuracy is ±0.01 mm, Range is 25 mm extensible to 150 mm using the extension rods supplied.

2. Model 1400-1 Dial Indicator
   - Used for quick and easy readout of borehole extensometers. Accuracy is ±0.01 mm, Range is 50 mm.

3. Model 1450 DC-DC LVDT
   - DC-DC LVDT’s are for dynamic and/or high-temperature applications. Ranges are 50 mm, 100 mm and 150 mm. Other ranges available on request.

4. Model 1500 Linear Potentiometer
   - Utilizes a sturdy 6.5 mm diameter rod which protrudes from both ends as the actuating shaft. This facilitates connection of the linear potentiometer to extensometer rods and also permits a mechanical check on the readings.

5. Model 4450 VW Displacement Transducer
   - Vibrating Wire Displacement Transducers provides remote readout for GEOKON Extensometers. They are particularly useful where other types of VW sensors are used and where long cable runs are required. Ranges are 12.5, 25, 50, 100, 150, 200, 230 and 300 mm. Other ranges available on request.

Model 1610 Tape Extensometer

The Model 1610 Tape Extensometer is designed to measure small changes in the distance between opposite walls or between the roof and floor of excavations, tunnels, or mine openings. It can also be used to monitor deformation in structures and supports and to measure movements of unstable slopes. Readout is provided electronically via a front panel LCD.

Specifications

- **Tape Lengths**: 20, 30, 50 m and 66, 100, 165 ft
- **Tape Tension**: 10 kg
- **Accuracy**: ±0.1 mm
- **Dimensions (L )**: 520 mm

Model 1900 Magnetic Extensometer

The Model 1900 Magnetic Extensometer is designed to measure settlement or heave of soft ground under the influence of loading or unloading due to the construction of embankments, fills, buildings, foundations, and structures. A probe is lowered inside a guide tube to detect and measure the position of magnetic anchors located around the guide tube at various depths along the borehole or within the fill. Plate anchors are used in fill and “spider” anchors in boreholes.

Specifications

- **Cable Lengths**: 30, 50, 100, 150, 200 m; 100, 125, 200, 300 ft
- **Resolution**
- **Repeatability**: ±3 mm
- **Temperature Range¹**: -30°C to +80°C
- **Borehole Size**: 102 to 152 mm
- **Dimensions (L × ø)**: 178 × 19 mm (probe)

¹Other ranges available on request.

Model 4427 Long Range Displacement Meter

The Model 4427 Long Range Displacement Meter is ideally suited for the measurement of large displacements associated with landslides. The Model 4427 can also be used for monitoring the movement of boulders, snow, etc., on unstable slopes.

Specifications

- **Ranges**: 1, 2 m (without resetting)
- **Resolution**: 0.025% F.S. (0.25 mm for 1 m range)
- **Accuracy²**: ±1.0% F.S.
- **Temperature Range³**: -30°C to +60°C
- **Dimensions (L+W+H)**: 610 × 152 × 152 mm (enclosure)

²Transducer accuracy established under laboratory conditions. ³Other ranges available on request.
The Model 4500 Standard Piezometer is designed to measure fluid pressures such as ground water elevations and pore pressures when buried directly in embankments, fills, etc. Also for installation inside boreholes, observation wells and standard (>19 mm diameter) piezometer riser pipe. The Model 4500AL is designed for low-pressure ranges. The vented version (ALV) provides automatic compensation for barometric pressure changes. Thermistors are included to measure temperatures.*

The Model 4500DP Drive Point Piezometer has the transducer located inside a housing with an EW drill rod thread and removable pointed nose cone. This model is ideally suited for use in peat and soft clays. Also available which use metric threads allowing for installation using conventional core penetrometer or other drill rods with adapters.*

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.*

The 4500HT Series High Temperature Piezometers and 4500HHT Series High Temperature Pressure Transducers are designed for monitoring downhole pressures and temperatures in oil recovery systems and geothermal applications, where the temperature may be as high as 250°C. These sensors are supplied with either mineral insulated cables or Teflon® cables inside stainless steel tubing.*

The Model 4500MLP system overcomes the problems associated with the installation of multiple piezometers in a single drill hole. The 4500MLP is lowered into position and a spring loaded apparatus is fitted inside 19 mm pipe and the 4500C will fit inside 12 mm pipe.*

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

<table>
<thead>
<tr>
<th>Specifications</th>
<th>4500S/SV</th>
<th>4500SH</th>
<th>4500AL/ALV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ranges</strong></td>
<td>-100 to 350, 700 kPa; 1, 2, 3, 5 MPa</td>
<td>-100 kPa to 5, 7.5, 10, 20 MPa</td>
<td>70, 170 kPa</td>
</tr>
<tr>
<td><strong>Over Range</strong></td>
<td>2 x rated pressure</td>
<td>2 x rated pressure</td>
<td>2 x rated pressure</td>
</tr>
<tr>
<td><strong>Resolution (minimum)</strong></td>
<td>0.025% F.S.</td>
<td>0.025% F.S.</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td><strong>Accuracy¹</strong></td>
<td>±0.1% F.S.</td>
<td>±0.1% F.S.</td>
<td>±0.1% F.S.</td>
</tr>
<tr>
<td><strong>Linearity²</strong></td>
<td>&lt; 0.5% F.S.</td>
<td>&lt; 0.5% F.S.</td>
<td>&lt; 0.5% F.S.</td>
</tr>
<tr>
<td><strong>Temperature Range²</strong></td>
<td>-20°C to +80°C</td>
<td>-20°C to +80°C</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td><strong>Dimensions (L x ø)</strong></td>
<td>133 × 19.1 mm</td>
<td>194 × 25.4 mm</td>
<td>133 × 25.4 mm</td>
</tr>
</tbody>
</table>

¹Transducer accuracy established under laboratory conditions. ²Other ranges available on request.

### Model 4500B/BV / 4500C Small Diameter Piezometers

These piezometers are uniquely designed to enable the automation of small diameter non-standard piezometer standpipes. The 4500B will fit inside 19 mm pipe and the 4500C will fit inside 12 mm pipe.*

### Model 4500HT/HHT High Temp Piezometers / Pressure Transducers

### Model 4500MLP Multilevel Piezometer

The Model 4500MLP system overcomes the problems associated with the installation of multiple piezometers in a single drill hole. The 4500MLP is lowered into position and a spring loaded apparatus is actuated forcing specially configured piezometer filter elements into firm contact with the borehole walls. The borehole is then grouted from the bottom in one quick and simple operation.*
The Model 4500Ti Titanium Piezometer 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 exposed surfaces are made from titanium.*

The Model 4500H, 4500HH and 4580 Pressure Transducers are supplied with a female pipe thread fitting to permit the transducer to be coupled directly into hydraulic or pneumatic pressure lines. The 4580 is designed for very low fluid pressure measurements, such as ground-water elevations in wells, water levels in streams, weirs, flumes, etc. where changes in water levels of as little as 0.2 mm can be measured. Sealed types can be used as a barometer to measure atmospheric pressure changes.†

The Model 4573 Series Downhole Water Level Dataloggers are available in 3 pressure ranges, with measurement accuracy ±0.1% F.S. ±0.075% F.S. ±0.05% F.S. ±0.05% F.S. per year. For saltwater deployments, such as brackish wetlands and tidal lands, the Model 4573-1 should be used. The 4573-2 (Titanium) are available in 4 pressure ranges with measurement accuracies between ±0.075% F.S. and ±0.05% F.S. For less demanding applications and/or where cost is a consideration, the Model 4573-3 with a polypropylene housing is available in 3 pressure ranges, with measurement accuracy ±0.1% F.S.

The Model 4573 Series Downhole Water Level Dataloggers specification includes:

- **Ranges**: ±100 to 500, 700 kPa; 1, 2, 3, 5, 7.5 MPa
- **Accuracy**: ±0.1% F.S.
- **Linearity**: ±0.1% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions**: L x ø = 125 x 25.4 mm

The Model 4573 Series Autoresonant Vibrating Wire Sensors, page 17.)

The World Leader in Vibrating Wire Technology™

The Model 4675LV Weir Monitor is a water level monitoring system that uses a vibrating wire force transducer to provide a highly stable and sensitive means of monitoring water levels. The main component is a cylindrical weight suspended from the force transducer. The cylinder hangs partially submerged in the water whose level is to be monitored. As the water level changes the changing buoyancy force on the cylinder acts directly on the vibrating wire transducer and alters its tension and hence its resonant frequency.

Model 4500H | 4500HH | 4580 Pressure Transducers

- **Ranges**: ±100 to 70, 170, 350, 700 kPa; 1, 2, 3, 5, 7.5 MPa
- **Accuracy**: ±0.025% F.S. (minimum)
- **Linearity**: ±0.05% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions**: L x ø = 140 × 25.4 mm, 140 × 32 mm (Barometer), 165 × 38 mm, 165 × 63.5 mm; 200 Mbar (Barometer)

Model 4675LV Weir Monitor

- **Ranges**: ±100 to 350, 700 kPa; 1, 2, 3, 5, 7.5 MPa
- **Accuracy**: ±0.1% F.S.
- **Linearity**: ±0.1% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions**: L x ø = 165 × 25 mm (transducer)

*All经营范围: Incorporated vibrating wire piezometers and pressure transducers include tripolar plasma surge arrestors to protect the sensor coils from possible lightning damage. Semiconducting piezometers and pressure transducers are also available (3400 Series). Please see page 22 for further details.

† 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.
The Model 4651 Settlement Profiler consists of a pressure transducer inside a torpedo which is connected by a long liquid filled tube to a liquid reservoir. The torpedo is pulled through a pipe buried in a fill, surcharge, embankment, etc. The transducer gives a measure of the elevation profile of the pipe relative to the reservoir located on stable ground. The liquid tube is stored on a reel.

Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Model 4651 Settlement Profiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range¹</td>
<td>7 m</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.1% F.S.</td>
</tr>
<tr>
<td>Cable Reel Capacity</td>
<td>100 m</td>
</tr>
<tr>
<td>Temperature Range³</td>
<td>−20°C to +80°C (using antifreeze solutions)</td>
</tr>
<tr>
<td>Dimensions (L × ø)</td>
<td>203 × 35 mm (probe); 178 × 610 mm (reel)</td>
</tr>
</tbody>
</table>

¹Other ranges available on request. | ²Transducer accuracy established under laboratory conditions. | ³Temperature range depends on readout; accuracy ±0.1% F.S.

Model 4670 Settlement System

The Model 4670 Settlement System is designed for the remote measurement of surface or subsurface settlement in fills, surcharges, dams, embankments, etc. A fluid filled tube extends upward connecting the transducer to a reservoir located in the moving strata or fill. The measurement of fluid pressure indicates the settlement between the sensor and the reservoir. Multiple level systems are also available (please contact GEOKON for details).

Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Model 4670 Settlement System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range¹</td>
<td>70, 150, 300, 600 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.1% F.S.</td>
</tr>
<tr>
<td>Temperature Range³</td>
<td>−20°C to +80°C (using antifreeze solutions)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>depends on range</td>
</tr>
</tbody>
</table>

¹Other ranges available on request. | ²Transducer accuracy established under laboratory conditions. | ³Temperature range depends on readout; accuracy ±0.1% F.S.
**Pressure Cells**

**Load Cells**

*Models are also available with semiconductor pressure transducers (please contact GEOKON, INCORPORATED for details).

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**Model 4800 Earth / 4810 “Fat Back” Pressure Cells**

The Model 4800 is designed to measure total pressure in earth fills and embankments and consists of two circular stainless steel plates, welded around their periphery, with a narrow cavity filled with de-aired oil. Changing earth pressure squeezes the plates together causing a corresponding increase of oil pressure, which is measured by a vibrating wire pressure transducer connected via a short length of steel tubing. The Model 4810 is similar, but has an extra-thick backplate to minimize point loading effects when installed on concrete or rock surfaces.*

**Specifications**

<table>
<thead>
<tr>
<th></th>
<th>4800</th>
<th>4810</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranges¹</td>
<td>70, 170, 350, 700 kPa</td>
<td>350, 700 kPa</td>
</tr>
<tr>
<td>Over Range</td>
<td>150% F.S. (maximum)</td>
<td>150% F.S. (maximum)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025% F.S.</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.1% F.S.</td>
<td>±0.1% F.S.</td>
</tr>
<tr>
<td>Temperature Range¹</td>
<td>-20°C to +80°C</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td>Cell Dimensions (H x ø)¹</td>
<td>6 x 230 mm</td>
<td>12 x 230 mm</td>
</tr>
</tbody>
</table>

¹ Other ranges/sizes available on request. / ²Transducer accuracy established under laboratory conditions.

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**Model 4820 Jackout Pressure Cell**

The Model 4820 Jackout Pressure Cells are used to measure earth pressures on slurry walls. They are designed to fit inside a plate which is pressed against the side of a slurry wall excavation using a hydraulic jack arrangement. This method of installation ensures that the jackout cell is located with its sensitive face in contact with the adjacent soil.*

**Specifications**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranges¹</td>
<td>350, 700 kPa; 1, 2, 3, 5 kPa</td>
</tr>
<tr>
<td>Over Range</td>
<td>150% F.S. (maximum)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.1% F.S.</td>
</tr>
<tr>
<td>Temperature Range¹</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td>Cell Dimensions (L x W)¹</td>
<td>600 x 50 mm</td>
</tr>
</tbody>
</table>

¹Other ranges/sizes available on request. / ²Transducer accuracy established under laboratory conditions.

---

**Model 4830 Push-In Pressure Cell**

The Model 4830 Push-In Pressure Cell is designed to be pushed in place for the measurement of total pressures in soils and earth fills. Where effective stress is required, the cell is fitted with an integral piezometer. A thread is provided on the end of the cell to allow for installation using lengths of pipe or drill rods.*

**Specifications**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranges¹</td>
<td>70, 170, 350, 700 kPa; 1, 2, 3, 5 kPa</td>
</tr>
<tr>
<td>Over Range</td>
<td>150% F.S. (maximum)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.1% F.S.</td>
</tr>
<tr>
<td>Temperature Range¹</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td>Dimensions (L x W x H)¹</td>
<td>200 x 100 x 6 mm</td>
</tr>
</tbody>
</table>

¹Other ranges/sizes available on request. / ²Transducer accuracy established under laboratory conditions.

---

**Model 4850 NATM Style Shotcrete Stress Cells**

The Model 4850 NATM Style Shotcrete Stress Cells are designed for the measurement of tangential (4850-1) and radial (4850-2) stresses in shotcrete tunnel linings. The cells consist of two rectangular steel plates welded together around the periphery with a de-aired fluid occupying the space between the plates. A short tube connects the cell to a vibrating wire pressure transducer. A prestressing tube is provided for expanding the cell after the concrete has cured. Cells of this type are also used for measurements of stress in mass concrete.

**Specifications**

<table>
<thead>
<tr>
<th></th>
<th>4850-1</th>
<th>4850-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range¹</td>
<td>7.5, 20, 35 MPa</td>
<td>2, 3, 5 MPa</td>
</tr>
<tr>
<td>Over Range</td>
<td>150% F.S.</td>
<td>150% F.S.</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025% F.S.</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.1% F.S.</td>
<td>±0.1% F.S.</td>
</tr>
<tr>
<td>Temperature Range¹</td>
<td>-20°C to +80°C</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td>Dimensions (L x W x H)¹</td>
<td>200 x 100 x 6 mm</td>
<td>250 x 150 x 6 mm</td>
</tr>
</tbody>
</table>

¹Other ranges/sizes available on request. / ²Transducer accuracy established under laboratory conditions.

---

**Model 4855 Pile Tip Pressure Cell**

The Model 4855 is used to measure the pressure in cast-in-place concrete piles (caissons). The cell is roughly the diameter of the pile and has a thick upper plate, which provides hooks or sections of rebar to allow connection to the bottom of the reinforcement cage. Two vibrating wire pressure transducers are included, for redundancy in case damage occurs during installation, and a remote repressurization mechanism ensures good contact between the cell and the surrounding concrete.*

**Specifications**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranges¹</td>
<td>2, 3, 5, 7.5, 10, 20 MPa</td>
</tr>
<tr>
<td>Over Range</td>
<td>150% F.S. (maximum)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.1% F.S.</td>
</tr>
<tr>
<td>Temperature Range¹</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td>Dimensions (H x ø)¹</td>
<td>50 x 600 mm</td>
</tr>
</tbody>
</table>

¹Other ranges/sizes available on request. / ²Transducer accuracy established under laboratory conditions.

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**Model 3000 / 4900 Load Cells**

The Model 4900 Vibrating Wire Load Cell (inset, right) consists of a cylinder of high-strength steel with 3 or 6 vibrating wire strain gages located around the circumference of the cell. Loads applied to the cell are measured by the vibrating wire strain gages. The effects of uneven and eccentric loading are minimized by averaging the output of all 3 or 6 individual readings. The Model 3000 Load Cell (inset, left) has the same annular design, using high-strength steel or aluminum, but uses electrical resistance strain gages in a Wheatstone Bridge configuration.

**Specifications**

<table>
<thead>
<tr>
<th></th>
<th>3000</th>
<th>4900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Capacities¹</td>
<td>100 to 10,000 kN</td>
<td>100 to 10,000 kN</td>
</tr>
<tr>
<td>Over Range</td>
<td>150% F.S.</td>
<td>150% F.S.</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025% F.S.</td>
<td>0.025% F.S.</td>
</tr>
<tr>
<td>Accuracy²</td>
<td>±0.5% F.S.</td>
<td>±0.5% F.S.</td>
</tr>
<tr>
<td>Temperature Range¹</td>
<td>-20°C to +80°C</td>
<td>-20°C to +80°C</td>
</tr>
<tr>
<td>Dimensions (ID)¹</td>
<td>solid, 25, 50, 75, 100, 125, 150, 200, 250 mm</td>
<td>solid, 25, 50, 75, 100, 125, 150, 200, 250 mm</td>
</tr>
</tbody>
</table>

¹Other capacities and diameters available on request. The limit of the 0.001% M.O.T. strain gauge calibration capability is ±0.001% F.S. (1500 lbs) / ²Transducer accuracy established under laboratory conditions.

*Other ranges available on request.

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**The World Leader in Vibrating Wire Technology™**
Inclinometers

The Model 6015 Horizontal Inclinometer Probe is a modification of the standard Model 6000 probe which allows it to be used in horizontal inclinometer casing. The probe, in effect, measures differential settlement along the length of the casing.

The Model 6005 Spiral Indicator uses a flux-gate magnetometer to measure any spiraling of inclinometer casing. It’s lowered into the casing on the end of a standard inclinometer cable connected to the Model GK-604 Analog Inclinometer Readout and provides a direct reading of the azimuth at any point along the casing. Not suitable for use in steel casing.

Model GK-604D Digital Inclinometer System

The Model GK-604D Digital Inclinometer System is delivered in its entirety and includes a Model 6100D Digital Inclinometer Probe, a reel-mounted cable and a Field PC. The Model 6100D contains electronics to convert the analog voltage into a digital signal, which is transmitted by the control cable to the cable reel containing the Interface, which communicates via Bluetooth® to the Model FPC-2 Field PC. A Digital Compass is built into the Inclinometer Probe to correct the inclinometer data sets for any twist (or spiraling) in the inclinometer casings. The spiral survey data is presented on (and stored in) the same FPC-2 Field PC used for taking inclinometer readings.

Model 6005 Spiral Indicator

The Model 6005 Spiral Indicator uses a flux-gate magnetometer to measure any spiraling of inclinometer casing. It’s lowered into the casing on the end of a standard inclinometer cable connected to the Model GK-604 Analog Inclinometer Readout and provides a direct reading of the azimuth at any point along the casing. Not suitable for use in steel casing.

The Model 6015 Horizontal Inclinometer Probe is a modification of the standard Model 6000 probe which allows it to be used in horizontal inclinometer casing. The probe, in effect, measures differential settlement along the length of the casing.

SiteMaster Inclinometer Data Reduction Software

SiteMaster is a powerful inclinometer processing and presentation program that’s used to process and present all inclinometers within a project. It can also include plan view displacement graphs related to any excavation history. SiteMaster works with any inclinometer system which produces a text data file. Data are stored systematically in an easy to modify folder, with corresponding displacement graphs organized in a simple and efficient manner. A reporting tool allows reports to be quickly generated and exported in PDF or Microsoft® Word format.

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Range</th>
<th>Resolution (Probe)</th>
<th>Resolution (System)</th>
<th>Total System Accuracy</th>
<th>Temperature Range</th>
<th>Casing Size ID</th>
<th>Dimensions (L × ø) (probe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6005</td>
<td>±360°</td>
<td>0.1°</td>
<td>±0.025 mm/500 mm</td>
<td>±0.0001 ft/2 ft</td>
<td>−20°C to +65°C</td>
<td>59 to 89 mm</td>
<td>700 × 25 mm</td>
</tr>
<tr>
<td>6015</td>
<td>±53°</td>
<td>±0.025 mm/500 mm</td>
<td>±0.0001 ft/2 ft</td>
<td>±0.0001 ft/2 ft</td>
<td>0°C to +50°C</td>
<td>59 to 79 mm</td>
<td>51 to 89 mm</td>
</tr>
<tr>
<td>6100D</td>
<td>±30°</td>
<td>0.0013°</td>
<td>±0.025 mm/500 mm</td>
<td>±0.0001 ft/2 ft</td>
<td>0°C to +50°C</td>
<td>59 to 89 mm</td>
<td>680 × 51 mm</td>
</tr>
<tr>
<td>6100D</td>
<td>±0.1°</td>
<td>±0.025 mm/500 mm</td>
<td>±0.0001 ft/2 ft</td>
<td>±0.0001 ft/2 ft</td>
<td>0°C to +50°C</td>
<td>59 to 79 mm</td>
<td>671 × 45 mm</td>
</tr>
</tbody>
</table>

System Requirements

- **Operating Systems**: Windows® 8, 7, Vista, XP Professional
- **Memory Requirements**: 512 MB or more (minimum). More RAM will improve application performance.
- **Hard Disk Requirements**: 60 MB (minimum)

¹ ±10 arc seconds. The resolution shown is only true in the range of ±5° from vertical.
² Within 2° of vertical.
The Model 6300 Vibrating Wire In-Place Inclinometer is used in conjunction with near vertical inclinometer casing for the measurement of lateral displacement similar to the Model 6000 Inclinometer Probe. However, the Model 6300 In-Place system is designed to be left in place inside the casing to permit automatic or continuous monitoring. Strings of sensors are joined together to obtain deflection profiles.

**Model 6300 VW In-Place Inclinometer**

- **Specifications**
  - **Range** ±10°
  - **Resolution** ±0.02 mm/m (±4 arc seconds)
  - **Accuracy** ±0.05° (±10 arc seconds)
  - **Shock Survival** 2000 g
  - **Temperature Range** −20°C to +80°C
  - **Dimensions (L × ø)** 219 × 32 mm (sensor); 362 × 32 mm (sensor³)

Model 6155 MEMS In-Place Inclinometer

The Model 6155 MEMS In-Place Inclinometers consist of a string of MEMS (Micro-Electro-Mechanical Systems) tilt sensors (uniaxial or biaxial) mounted on lengths of stainless steel tubing which are linked together by universal joints. The string of sensors is inserted inside a pipe, or a casing installed in a borehole in the ground, with the sensor cable(s) passing to the surface where they are connected to Terminal Boxes or Dataloggers. Several models are available, including analog, digital, addressable and wheelless versions, allowing for optimal configuration based on application and site specifics.

**Model 6155 MEMS Horizontal In-Place Inclinometer**

- **Specifications**
  - **Range** ±15°
  - **Resolution** ±0.02 mm/m (±4 arc seconds)
  - **Accuracy** ±0.05 mm/m (±10 arc seconds)
  - **Sensor Output** Analog (±4 V @ ±15°); Digital
  - **Shock Survival** 2000 g
  - **Temperature Range** −20°C to +80°C
  - **Dimensions (L × ø)** 219 × 32 mm (sensor); 362 × 32 mm (sensor³)

Model 6400 Inclinometer Casing

Model 6400 Glue-Snap ABS Inclinometer Casing is used in conjunction with an inclinometer probe or in-place inclinometer system to monitor the stability of embankments, slopes, foundation and excavation walls, piles, etc. The Model 6400 is flush-coupled allowing for quick and easy assembly.

**Model 6400 Inclinometer Casing**

- **Specifications**
  - **Maximum OD** 70 mm, 85 mm
  - **Wall Thickness** 5.5 mm
  - **Dimensions (L)** 1.5 or 3 m
  - **Telescoping Coupling** available up to 3 m (specify)

Model 6500 Inclinometer Casing

The Model 6500 Inclinometer Casing is manufactured from pultruded fiberglass ensuring a lightweight, strong, environmentally resistant casing with grooves free from spiraling. The casings and couplings are pop-riveted together and the joints are waterproofed using caulk and tape.

**Model 6500 Inclinometer Casing**

- **Specifications**
  - **Maximum OD** 70 mm (casing); 76.5 mm (coupling)
  - **Wall Thickness** 3 mm (casing); 2 mm (coupling)
  - **Dimensions (L)** 3 m (casing); 300 mm (coupling)
  - **Telescoping Coupling** available up to 3 m (specify)
The sensing element is a highly accurate MEMS (Micro-Electro-Mechanical Systems) tilt sensor, which communicates with the Model FPC-2 Field PC Readout via Bluetooth.

Model 6101D MEMS Digital Tiltmeter

The Model 6101D MEMS Digital Tiltmeter is a low-cost, portable device designed to measure tilt in structures such as buildings, dams and embankments and also for measurements related to the stability of slopes, open pits and the walls of excavations (e.g. slurry walls). The sensing element is a highly accurate MEMS (Micro-Electro-Mechanical Systems) tilt sensor, with associated signal conditioning, packaged inside a water-proof, stainless steel housing. Four versions are available: analog, analog addressable, digital addressable and RS-485.

Model 6160 MEMS Tilt Sensors

The Model 6160 MEMS Tilt Sensor is designed for attachment to structures, on either a vertical or horizontal surface, and for the subsequent measurement of any tilting that may occur. The sensor comprises one (uniaxial) or two (biaxial) MEMS (Micro-Electro-Mechanical Systems) sensors, with associated signal conditioning, packaged inside a water-proof, stainless steel housing. Four versions are available: analog, analog addressable, digital addressable and RS-485. (Also see the Model 8003 (LC-3) Series MEMS Dataloggers, page 17.)

Model 6161 MEMS Tilt Sensors

The Model 6161 MEMS Tilt Sensor, like the 6160, is designed for attachment to structures, on either a vertical or horizontal surface to measure any tilting that may occur, but is packaged in a rugged epoxy-coated steel enclosure with a mounting plate. As with the 6160, four versions are available (uniaxial or biaxial): analog, analog addressable, digital addressable and RS-485. (Also see the Model 8003 (LC-3) Series MEMS Dataloggers, page 17.)

Model 6350 VW Tiltmeter

The Model 6350 VW Tiltmeter is designed to measure tilt in structures such as buildings, dams and embankments and also for measurements related to the stability of slopes, open pits and the walls of excavations (e.g. slurry walls). The tiltmeter is permanently attached to the structure to be monitored and can make measurements on horizontal or vertical surfaces. Readings are taken with the Model GK-404/GK-405 Vibrating Wire Readout or continuously and remotely with the 8600 Series or 8002 dataloggers.

Model 6155 MEMS Tilt Beam

The Model 6155 MEMS Tilt Beam is designed for attachment to structures, on either a vertical or horizontal surface, for the measurement of any tilting or differential settlements that may occur. The Tilt Beams can be coupled together in long horizontal strings to measure differential settlement along embankments, railroad tracks, pipelines, tunnels, etc., or they can be used in vertical strings to measure the horizontal deformation of retaining walls, sheet piling, etc.

Model 6850 Pendulum Readout

The Model 6850 is designed to make accurate measurements of the relative movements of normal and inverted pendulums, such as those found in dams, and can be installed as a new system or as an electronic upgrade for an existing system. The electronics package provides both 4-20 mA and EIA RS-485 data outputs. The data can be stored locally, or remotely, with the 8600 Series Dataloggers, or other dataloggers, and thence by hard-wire or modem to a computer. Manual sighting/reading tables with optical (LED) readout are available where automated systems are not necessary, or where a manual reading back-up is required.
The Model GK-405 is designed for use with all of the GEOKON vibrating wire sensors, and their thermistors (when included) displaying the temperature directly in °C. It comprises a battery-powered readout unit, which communicates, via Bluetooth®, to the FPC-2 Field PC running the GK-405 application. All the readings can be stored and exported to a number of different file formats and syncing to a host computer is easily done. The GK-405 Readout is available with or without the FPC-2 Field PC because the Field PC, provided with the GEOKON GK-604 Inclinometer Readout, is compatible with both systems.

Model GK-405 Vibrating Wire Readout

Specifications

- **Excitation Range**: 450 Hz to 6000 Hz, 5 Volt Square Wave
- **Resolution**: 0.001 Hz
- **Timebase Accuracy**: ±50 ppm
- **Temperature Range**: -20°C to +50°C
- **Dimensions (LxWxH)**: 120 x 65 x 22 mm

The Model GK-405 is designed for use with all of the GEOKON vibrating wire sensors, and their thermistors (when included) displaying the temperature directly in °C. It comprises a battery-powered readout unit, which communicates, via Bluetooth®, to the FPC-2 Field PC running the GK-405 application. All the readings can be stored and exported to a number of different file formats and syncing to a host computer is easily done. The GK-405 Readout is available with or without the FPC-2 Field PC because the Field PC, provided with the GEOKON GK-604 Inclinometer Readout, is compatible with both systems.

Model GK-404 In Intrinsically Safe Vibrating Wire Readout

Specifications

- **Excitation Range**: 400 Hz to 6000 Hz, 5 volt Square Wave
- **Resolution**: 0.1 digit, 0.1 Hz, 0.1 μs, 1 με, 0.1°C
- **Timebase Accuracy**: ±50 ppm
- **Temperature Range**: -20°C to +50°C
- **Dimensions (LxWxH)**: 165 x 110 x 45 mm

The Model 404, based on the GK-404 (above) and designed in cooperation with GEL Instrumentation, is a portable, low-power, hand-held unit, capable of running for more than 6 hours continuously on a single charge. The Model 404 is designed to read specific GEOKON vibrating wire sensors in hazardous environments (IECEx ia, approval SIM 13.0014X) and is approved only for designated GEOKON sensors, identified as Type 1, 2, 3 and 4. Six excitation positions (A-F) are provided, with a display resolution of 0.1 digit. The Model 404 is capable of displaying the reading in either digits, frequency (Hz), period (μs) or microstrain (με), and the transducer temperature (embedded thermistor) with a resolution of 0.1°C.

Model FPC-2 Field PC

Specifications

- **Processor**: Texas Instruments 4470 dual-core @ 1.5 GHz
- **Operating System**: Microsoft® Windows® Embedded Handheld 6.5.3
- **Memory/Disk**: 1 GB RAM/4 GB iNAND Flash
- **Battery**: Li-ion, 3.7 V 5200 mAh (19.2 Wh) (Warm-swappable) with smart gauge
- **Operating Temperature**: -30°C to 60°C, MIL-STD-810G, 501.5/502.5 Procedure II and III
- **Dimensions (LxWxH)**: 191 x 80 x 35 mm

The Model FPC-2 Field PC is a rugged, handheld, easy-to-use instrument for reading Digital Inclinometer Probes and Tiltmeters (in the GK-604D) and VW Sensors (in the GK-405). It’s a standalone device for reading the Model 3810A Addressable Thermistor Strings and the Model 6101D MEMS Digital Tiltmeter. It can also be used to take compass bearings (with Inclinometer Probes) and to program and retrieve data from the Model 8002 (LC-2) Series Data loggers using LogView Mobile software, a particularly useful option in harsh environments that are too extreme for a typical laptop PC.

Model VWA Vibrating Wire Analyzer

Specifications

- **Resolution**: 0.001 Hz RMS
- **Excitation**: 2 V, 5 V, 12 V (user selectable)
- **Accuracy**: ±0.005% of reading
- **Battery**: Five AA (1.5 V)
- **Temperature Range**: -20°C to +70°C
- **Dimensions (LxWxH)**: 200 x 100 x 35 mm

The Campbell Scientific VWA is field ready and used to quickly measure a sensor, save the data, and communicate the results with custom PDF reports and spreadsheet output. The VWA uses spectral-analysis technology (VSPECT™), which can be helpful for reading sensors in electrically noisy environments. The large color display offers an easy-to-view graphical presentation of the sensor output and operation, and a Project File maintains Site/Sensor information for 40 unique sites with up to 22 sensors per site. Site/Sensor locations are geolocated, allowing the internal GPS to guide a user directly to a sensor location.
**Model GK-502 Load Cell Readout**

The Model GK-502 Load Cell Readout is designed to read the GEOKON Model 3000 4-wire and 6-wire full bridge electrical resistance strain gage type load cells. The readout incorporates a 12 Volt, 1.4 Ahr Sealed Lead Acid battery, 16 x 2 graphic LCD with backlight, membrane keypad, and battery charger circuit. Two side-mounted Bendix® connectors are provided for load cell and communications/battery charger connection. The GK-502 displays the output in Digits, mV, mV/V, or in engineering units (lbs, Kg, Kips, etc.) by entering a gain factor and zero reading.

<table>
<thead>
<tr>
<th>Specifications</th>
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<tbody>
<tr>
<td><strong>Range</strong></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
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<tr>
<td><strong>Accuracy</strong></td>
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<tr>
<td><strong>Power Requirements</strong></td>
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<tr>
<td><strong>Operating Temperature</strong></td>
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<tr>
<td><strong>Dimensions (L x W x H)</strong></td>
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</table>

**Model RB-100 Linear Potentiometer Readout**

The Model RB-100 Linear Potentiometer Readout is designed to read the range of GEOKON Model 1500 Linear Potentiometers. The unit utilizes a high resolution, 4½ digital LCD digital voltmeter with circuitry to power and read out the potentiometers. A three wire ratio-metric system is used to minimize errors caused by long lead lengths and varying temperatures. In use, a regulated voltage is applied to the ends of the potentiometer resistance element and the position of a wiper that rides along the element can be determined by the voltage measured at this point.

<table>
<thead>
<tr>
<th>Specifications</th>
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<tbody>
<tr>
<td><strong>Input Range</strong></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
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<tr>
<td><strong>Temperature Range</strong></td>
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<tr>
<td><strong>Dimensions (L x W x H)</strong></td>
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**Model RB-500 MEMS Readout**

The Model RB-500 MEMS (Micro-Electro-Mechanical Systems) Readout is designed to read the voltage output from the Model 6100 Series MEMS sensors. The RB-500 incorporates a 12 volt, 1.2 Ahr lead acid battery, a 4½ digit liquid crystal display (LCD), a power on/off switch and an A/B selector switch. The RB-500 supplies +12 V power to the MEMS sensor and displays the output in volts which is proportional to the angle of inclination.

<table>
<thead>
<tr>
<th>Specifications</th>
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<tbody>
<tr>
<td><strong>Range</strong></td>
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<tr>
<td><strong>Display Range</strong></td>
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<tr>
<td><strong>Resolution</strong></td>
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<tr>
<td><strong>Accuracy</strong></td>
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<tr>
<td><strong>Power Requirements</strong></td>
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<tr>
<td><strong>Operating Temperature</strong></td>
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<tr>
<td><strong>Dimensions (L x W x H)</strong></td>
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**Model 4999 Terminal Box**

The Model 4999 Terminal Box allows instrument leads to be grouped in one convenient location thereby saving time when readings have to be made on a number of instruments. Housed in a fiberglass enclosure, the Terminal Box provides a quick and easy means of taking sensor readings. The Terminal Box can handle up to sixteen 4-conductor sensors (e.g. 16 vibrating wire gages with their thermistors) or thirty-two 2-conductor sensors (e.g. 32 vibrating wire gages). It's protected from lightning damage by plasma surge arrestors and a suitable earth-ground connection. (4 and 8 channel Terminal Boxes also available.)

<table>
<thead>
<tr>
<th>Specifications</th>
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</thead>
<tbody>
<tr>
<td><strong>Switching Current</strong></td>
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<tr>
<td><strong>Contact Resistance</strong></td>
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<tr>
<td><strong>Insulation Resistance</strong></td>
</tr>
<tr>
<td><strong>Switch Life</strong></td>
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<tr>
<td><strong>Enclosure</strong></td>
</tr>
<tr>
<td><strong>Temperature Range</strong></td>
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<tr>
<td><strong>Dimensions (L x W x H)</strong></td>
</tr>
</tbody>
</table>

*For Breakdown Voltage: 6V, 16 V or 30 V nominal, Peak Current: 10 kA [20 μs maximum, Temperature Range: −20°C to +80°C, Dimensions (L x W x H): 160 x 74 x 76 mm*.
**Model 8020-59 Vibrating Wire Frequency to Analog Converter**

The Model 8020-59 Vibrating Wire (VW) Frequency to Analog Converter provides a simple way to connect the GEOKON vibrating wire transducers to data acquisition systems, which are not capable of reading frequency signals nor able to generate the proper signals required to excite VW transducers. The converter can operate with single transducers, as a stand-alone device, or with multiple transducers in conjunction with the Model 8032 Multiplexer. The converter is powered using either a 12 V or 24 V supply.

### Specifications
- **Power Requirements**
  - 12 V or 24 V
  - 50 mA (max) @ 12 V (operation), 10 μA (standby)
  - 75 mA @ 24 V (operation), 16.5 mA (standby)
- **Operation Modes**
  - Single Channel, 16 VW sensors with thermostats, or 32 VW sensors
- **Output (Analogue)**
  - 0 V-5 V, 4-20 mA (non-isolated loop generator)
- **Resolution**
  - 16 bit
- **Accuracy**
  - ±0.1% F.S. (−20 Hz to 200 Hz), ±0.5% F.S. (4-20 mA)
- **Temperature Range**
  - −20°C to +80°C
- **Dimensions (L×W×H)**
  - 111 × 108 × 36 mm (with cover)

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**Model 4500CPR | 8020 Series Autoresonant Vibrating Wire Sensors**

Autoresonant Vibrating Wire Sensors expand the possibilities of dynamic monitoring while retaining the inherent long-term stability of the GEOKON line of vibrating wire instruments. GEOKON offers three types of autoresonant sensor: one uses a custom sensor and an electronic adaptor (Model 4500CPR), another uses the standard vibrating wire sensor and one of two electronic adaptors (Model 8020-42/8020-42CPR) and the third type is a custom sensor with internal electronics (see the Model 4500AR Autoresonant Piezometer, page 9).

### Specifications
- **Input**
  - ±12 VDC at 50 mA (max)
- **Output**
  - 4-20 mA, Frequency¹
  - Frequency (-20 Hz to 200 Hz)
  - Frequency (−20 Hz to 200 Hz)
- **Temperature Range**
  - 0°C to +80°C
- **Dimensions (L×W×H)**
  - 342 × 301 × 160 mm (with cover)

¹Open collector output requires external pull-up termination resistor.

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**Model 8002 (LC-2) Series Dataloggers**

The Model 8002-1 LC-2(A) is a single-channel datalogger designed to read both the vibrating wire element and the integral thermostor of any GEOKON vibrating wire sensor. The LC-2×4 is a self-contained version of the LC-2, but provides 4 channels of vibrating wire (with thermostor). The LC-2×16 is similar to the LC-2×4, but provides 16 channels of vibrating wire (with thermostat). The dataloggers are housed inside Fiberglass NEMA 4X enclosures, suitable for operation in harsh environments. Power is provided via alkaline D cells or an optional external 12 V source.

### Specifications
- **Measurement Accuracy**
  - ±0.05% F.S. (−20 Hz to 200 Hz)
- **Measurement Resolution**
  - 1 part in 20,000
- **Program Memory**
  - 24K FLASH
- **Data Memory**
  - 32K EEPROM
- **Temperature Range**
  - −30°C to +50°C
- **Dimensions (L×W×H)**
  - 122 × 120 × 81 mm (LC-2×4)
  - 260 × 160 × 91 mm (LC-2×16)

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**Model 8003 (LC-3) Series MEMS Dataloggers**

The Model 8003 Series LC-3 MEMS DATALOGGERS read both the MEMS sensors and their integral thermostats. The 8003A and 8003B are standalone dataloggers to which external MEMS sensors are connected via cables, while the 8003C and 8003D are dataloggers containing integral MEMS sensors. The Model 8003 Series LC-3 MEMS DATALOGGERS are powered by three, easily accessible, alkaline D cells, or by an optional 12 V source. A solar panel and rechargeable batteries can also be used.

### Specifications
- **Accuracy**
  - ±0.05% F.S.
- **Resolution**
  - 18 bit
- **Storage Capacity (Arrays)**
  - 21,000
- **Temperature Range**
  - −30°C to +50°C
- **Temperature Measurement**
  - ±1.0% F.S. (accuracy), 0.1°C (resolution)
- **Scan Interval**
  - 5-86,400 seconds (24 hours)
- **Dimensions (L×W×H)**
  - 122 × 120 × 81 mm (8003A/B)
  - 260 × 160 × 91 mm (8003C/D)

¹Mounting Panel: 276 × 133 × 6 mm

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**Model 8001-3 LogView | 8001-10 LogView Mobile Software**

LogView Software simplifies the task of configuration, communication, monitoring, data collection and data reduction using the Model 8002-1/4/16 (LC-2) Series and Model 8003 (LC-3) Series Dataloggers. The software is an easy-to-use, menu-based application, and includes screens for configuration, connection, measurement and data collection, plus a real-time text-based monitor, graphical monitor and terminal emulator. LogView Mobile performs most of the same functions as LogView but was designed to operate on a ruggedized, handheld PC.

### Specifications
- **System Requirements**
  - Operating Systems: Windows® 95, Vista, XP Pro, XP (LogView/LogView Mobile)
  - Windows® Mobile 6.1 or greater (LogView Mobile)
  - .NET Framework: Microsoft® Compact Framework 3.5 (LogView Mobile)
  - System Requirements (Minimum): Pentium® IV (or equivalent) running at 500 MHz, 64 MB RAM, 20 MB Hard Disk¹ (LogView/LogView Mobile)
  - Storage Memory: 10 MB free (minimum), 20 MB free (recommended) (LogView Mobile)
  - Program Memory: 5 MB free (minimum), 10 MB free (recommended) (LogView Mobile)

¹Space required for LogView software installation and log files only. Additional space is required to accommodate data files.
**Model 8600 Series Dataloggers**

The Model 8600 Series Dataloggers are designed around the Campbell Scientific, Inc. (CSI) Model CR800 Measurement and Control System. Manufactured primarily for use with vibrating wire sensors and thermistors, the Model 8600 Series can also be configured, at the GEOKON factory, to read MEMS sensors, Carlson type sensors, voltage type sensors, 4-20 ma sensors, and numerous other specialty sensor types. The Model 8600-1 and 8600-2 Dataloggers are housed in a NEMA 4X fiberglass reinforced polyester enclosure and the Model 8600-3 Datalogger is housed in a rugged, water-resistant PVC enclosure (other enclosures are available), together with a battery pack (for unattended operation) and an integral Spread Spectrum Radio (for wireless data transmission).

**Specifications**

- **Resolution**: ±2.5 millivolts to ±5 volts (analog); DC to 200 kHz (frequency)
- **Contact Resistance**: 0.1 Ω (maximum)
- **Switch Life**: > 200,000 cycles
- **Battery**: 4 × D cell lithium 8.5 Ah
- **Temperature Range**: -25°C to +60°C
- **Dimensions (L × W × H)**: 342 × 301 × 160 mm

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**Model 8026 Wireless Datalogger**

The Model 8026 is designed around the Campbell Scientific, Inc. Model CR800 datalogger, specifically to read the line of GEOKON Vibrating Wire Sensors. The 8026 Datalogger is housed in a rugged, water-resistant enclosure (standard enclosure is PVC; optional stainless steel and moisture resistant. It’s configured to read 6 sensors: either 6 VW or 3 VW plus 3 thermistors, or any combination thereof. A Spread Spectrum Radio Modem and Antenna are typically installed with the 8026.

**Specifications**

- **Switching Current**: 1 A (maximum)
- **Contact Resistance**: 0.1 Ω (maximum)
- **Insulation Resistance**: > 1 GΩ
- **Switch Life**: > 200,000 cycles
- **Enclosure**: NEMA 4X fiberglass
- **Temperature Range**: -40°C to +80°C
- **Dimensions (L × W × H)**: 502 × 461 × 263 mm

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**Model 8040 Series Wireless Vibrating Wire Interface**

The Model 8040 Series is designed to expand the data collection possibilities of the Model 8600 Series Dataloggers via wireless connectivity, which eliminates the need for running lengthy cables. Available for 2, 4 or 16 sensors (VW plus thermistor), the 8040 Series comprises Campbell Scientific’s AVW206 (as AVW216) spectrum analyzer (with built-in 900 Hz or 2.4 GHz radio transmitter), power supply and antenna. It’s housed in a rugged NEMA 4X FRP enclosure designed for use in harsh environments with wide temperature tolerance, and resistance to moisture and humidity.

**Specifications**

- **Input Range**: 100 to 6500 Hz (vibrating wire); ±2500 mV (thermistors)
- **Resolution**: 0.001 Hz RMS (vibrating wire); ±5 Hz (thermistors)
- **Accuracy**: ±0.13% of reading (vibrating wire)
- **Wireless Transmission Range**: up to 10 miles (when using a higher gain directional antenna, under ideal conditions)
- **Battery**: 12 V, 7 Ah Gel Cell
- **Temperature Range**: -25°C to +60°C
- **Dimensions (L × W × H)**: varies by model (please contact GEOKON)

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**Model 8020-30 Addressable Vibrating Wire Interface**

The Model 8020-30 Addressable Interface is designed to “daisy-chain” vibrating wire sensors on a single 4-conductor cable. It is particularly useful for reducing cable runs in multipoint systems, incremental extensometers, and for applications where many sensor cables might compromise a grout or cement bond. The system features state of the art signal conditioning and digital addressing to provide a measuring system comprising of up to 100 sensors. (Please contact GEOKON for more information). Readout is achieved with the FPC-2 Field PC, 8600 Series Dataloggers or via a PC application.
GeoNet is a low-power, wireless data acquisition network developed to more efficiently collect data from many points. The system consists of a Network Supervisor (8800-2), which controls the network, and up to 100 Single-Channel Sensor Nodes (8800-1). The system is compatible with all GEOKON Vibrating Wire instruments. GeoNet is built on top of the IEEE 802.15.4 standard. The network is self-healing and will reconfigure itself, if possible, to tolerate disturbances to the physical environment. Up to 12 networks can coexist by setting each to a different operating frequency (channel). A Cellular Modem option (8800-2-4A/B), mounted in a rugged, RFI shielded fiberglass enclosure, is available for the GeoNet Network Supervisor.

GeoNet Multiplexers expand the capacity of each Model 8800-1 Sensor Node to 8 channels, thereby allowing clusters of closely spaced sensors to be added to the system, or to add vibrating wire load cells (which contain between 3-6 sensors), multipoint borehole extensometers (which contain between 3-8 sensors) or multilevel piezometers. Sensor cables are connected to the multiplexer through cable glands (Model 8800-8-1, 8800-8-3) or via 10-pin plugs (Model 8800-8-2). Multiplexers are connected to the nodes via a 3 m interconnect cable (with 10-pin plugs at each end) and are supplied with mounting brackets for attaching to poles or backboards as required.

**LoggerNet® Datalogger Software**

LoggerNet® Datalogger Software supports programming, communication, and data retrieval between the CSI based GEOKON dataloggers and a PC. It includes tools for network setup, configuration, monitoring, and backup; datalogger programming, maintenance, and data collection; and real-time or historical data display. It can support connections to a single datalogger, or applications that require telecommunications or scheduled data retrieval in large datalogger networks.

**Model 8800 Series GeoNet Multiplexers**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Measurement Accuracy</th>
<th>±0.025% F.S. (400-5000 Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Frequency, ISM Band</td>
<td>2.4 GHz</td>
<td></td>
</tr>
<tr>
<td>Range (Outdoor, line-of-sight)</td>
<td>1600 m (North American), 750 m (International)</td>
<td></td>
</tr>
<tr>
<td>Data Memory</td>
<td>32 MB</td>
<td></td>
</tr>
<tr>
<td>Storage Capacity</td>
<td>&gt;1.04 M Arrays</td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td>D Cell Alkaline or Lithium (2×)</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +85°C</td>
<td></td>
</tr>
<tr>
<td>Dimensions (L+W+H)</td>
<td>122 × 120 × 91 mm</td>
<td></td>
</tr>
</tbody>
</table>

**VDV Vista Data Visualization Software**

Vista Data Vision (VDV) is a hosted software package which organizes and displays data collected from almost any datalogger system including the GEOKON Model 8600 Series, Micro-1000, Micro-800 and LC-2 Series Dataloggers for viewing over the Internet via all major web browsers. The software platform provides the user of a system comprising one or more dataloggers with a customized sign-in page (with corporate logos and text) which leads to an overview of all the data on a single web page configured with a map or a photograph (space permitting) showing data boxes with latest values (including alarms). Users can view and display data from multiple sensors in graphical format which makes it possible to identify max, min and average for any period of time. Data can also be viewed as a table and downloaded into a .txt file. Please contact GEOKON for further details and hosting packages.

**System Requirements**

- **Operating Systems:** Windows® 7 (32 and 64 bit), Vista, XP
- **Minimum Requirements:** Windows® XP running on an Intel®-based PC

**Hosting Service Configuration¹**

- Graph per sensor or per group of sensors
- Alarm for low battery voltage and for missing data collection
- Scaling of sensor readings
- Missing data alarms (issued if there has been no data collection for a certain number of user specified intervals)
- Cumulative displacement graphs for In Place Inclinometers
- Real-Time Displays (RTD) showing latest data, per location with background image
- Information Page for each datalogger, attached sensors and other pertinent info
- Setup of (1 to 3) contacts who will receive sensor alarms (emails or SMS)²
- Add documents to the Clients project (5 docs max)
- Alarm thresholds
- 3 usernames and passwords for access to the web based data hosting service

¹Please contact GEOKON for further details and hosting packages.
²Please contact GEOKON for details regarding SMS.
The Model 5000 Borehole Deformation Gage is the proven USBM-style gage used to measure in situ rock stresses using the overcoring technique in rock that is competent and elastic. The measurement of in situ stresses is important in the design of underground openings such as power houses, crushing stations, mines, tunnels and the like. It is also useful for determining the inherent stability of pit slopes, foundation excavations, mine pillars and dam abutments.

### Specifications

- **Borehole Diameter**: 38 mm (1.5 in)
- **Resolution**: 1.0 με
- **Minimum Overcore Depth**: 203 mm (2.5 in)
- **Maximum Overcore Depth**: 15 m standard; 20 m with 50 ft extension
- **Temperature Range**: -19°C to +80°C
- **Dimensions (L x ø)**: 267 x 35 mm

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The Model 3200 Hydraulic Borehole Pressure Cells are used to measure rock stress changes and is designed to be grouted inside boreholes. The BPC is manufactured from two steel plates welded together around their periphery. The plates are deformed into a “dog bone” configuration so that they can be expanded easily without damage to the welds. Hydraulic oil fills the space between the two plates and a high-pressure stainless steel tube connects the plates to a stainless steel pressure gage and/or a pressure transducer.

### Specifications

- **Ranges**: 20, 35, 75 MPa
- **Resolution**: 0.25% of range (approximately)
- **Accuracy**: ±0.25% F.S. (gage); ±0.1% F.S. (transducer)
- **Borehole Size**: 57 mm
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x W x H)**: 210 x 51 x 6 mm

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The Model 4300 VW Borehole Stressmeters are designed to measure stress changes in rock and can be installed in boreholes up to 100 feet deep. The Stressmeter consists of a high strength steel proving ring wedged tightly across one diameter inside a borehole and a vibrating wire tensioned across the other diameter inside the stressmeter. Changes in rock stress cause a related change in the resonant frequency of vibration of the tensioned wire providing output which is read by the Model GK-404 or GK-405 Readouts.

### Specifications

- **Range in Compression**: 70 MPa
- **Range in Tension**: 3 kPa
- **Resolution**: 14 to 70 kPa
- **Accuracy**: ±0.1% F.S.
- **Temperature Range**: -20°C to +80°C
- **Borehole Diameter**: 77 to 79 mm (4300EX)
  - 79 to 81 mm (4300BX)
  - 74 to 77 mm (4300EX) (transducer)

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The Model 4360 VW Soft Inclusion Stress Cells (SISC) is a larger version of the Model 4300 Borehole Stressmeters. The SISC is pre-loaded by wedging it into a large size diamond drill hole using an integral screw mechanism or hydraulic piston and can be set to measure both tensile and/or compression stress changes. It has been used successfully in over 152 mm diameter overcoring holes (drilled to measure in situ stresses) to measure Aggregate/Alkali Reactions (AAR) in concrete dams.

### Specifications

- **Range**: ±35 MPa
- **Resolution**: 35 kPa
- **Accuracy**: ±0.5% F.S.
- **Temperature Range**: -20°C to +80°C
- **Borehole Diameter**: 74 to 77 mm (4300EX)
  - 79 to 81 mm (4300BX)

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The Model 4350 VW Biaxial Stressmeter is designed to measure compressive stress changes in rock, salt, concrete or ice. Three or six VW sensors oriented at 60° intervals allow the principal stress changes to be measured in the plane perpendicular to the stressmeter axis. The stressmeter consists of a high strength steel cylinder which is grouted (or frozen, in the case of ice) into a BX (60 mm) size borehole.

### Specifications

- **Range**: ±70 MPa
- **Resolution**: 14 to 70 kPa
- **Accuracy**: ±0.1% F.S.
- **Temperature Range**: -20°C to +80°C
- **Borehole Diameter**: 60 mm (BX)

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The Model 4370 Concrete Stressmeter comprises a short vibrating wire load cell in series with a longer cylinder of concrete, which has the same properties as the surrounding concrete but is de-bonded from it by means of a plastic tube. It's coupled at its ends to the surrounding concrete by means of two flanges. The vibrating wire load cell measures the load imposed on the inner concrete cylinder by stresses in the surrounding concrete.

### Specifications

- **Range**: ±3 MPa to ±25 MPa
- **Resolution**: 10 kPa
- **Accuracy**: ±0.25% F.S.
- **Temperature Range**: -20°C to +80°C
- **Dimensions (L x ø)**: 600 x 76 mm, 86 mm (ID)

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The Model 4350 VW Biaxial Stressmeter is designed to measure stress changes in rock proving ring wedged tightly across one diameter inside a borehole and a vibrating wire tensioned across the other diameter inside the stressmeter. Changes in rock stress cause a related change in the resonant frequency of vibration of the tensioned wire providing output which is read by the Model GK-404 or GK-405 Readouts.
The Model FP4000 Fiber Optic Strain Gages are designed for use in environments where it may be difficult to use conventional types of strain gages because of space considerations, high levels of electrical interference or where intrinsic safety is an issue. Measurements of dynamic events are also possible with these gages and the requisite dataloggers. The strain gages have a very low coefficient of thermal expansion and can be used to measure both mechanical and thermo-mechanical strains in a variety of different materials.

**Model FP4000 Fiber Optic Strain Gage**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>FP4000-1.0</th>
<th>FP4000-2.5</th>
<th>FP4000-5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranges</td>
<td>-1000 to +1000 με</td>
<td>-2500 to +2500</td>
<td>-5000 to +5000 με</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.15 με</td>
<td>0.30 με</td>
<td>0.50 με</td>
</tr>
<tr>
<td>Gage Factor Accuracy¹</td>
<td>±3% F.S</td>
<td>±3% F.S</td>
<td>±10% F.S.</td>
</tr>
<tr>
<td>Temperature Sensitivity</td>
<td>0.85 to 1.22 με/°C</td>
<td>0.85 to 1.22 με/°C</td>
<td>0.85 to 1.22 με/°C</td>
</tr>
<tr>
<td>Transverse Strain Sensitivity</td>
<td>transverse strain insensitive</td>
<td>transverse strain insensitive</td>
<td>transverse strain insensitive</td>
</tr>
<tr>
<td>Temperature Operating Range</td>
<td>-40°C to +80°C</td>
<td>-40°C to +80°C</td>
<td>-40°C to +80°C</td>
</tr>
<tr>
<td>Dimensions (L × W × H)</td>
<td>100 × 25 × 1 mm</td>
<td>100 × 25 × 1 mm</td>
<td>100 × 25 × 1 mm</td>
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</tbody>
</table>

¹The accuracy of the OSP sensors is determined by sample testing of controlled batches at the factory. The manufacturing technique results in the spans shown above and is confirmed by actual strain tests performed on samples from batch lots.

The Model FP4700 Fiber Optic Temperature Sensor is designed for use in environments where high levels of electrical interference exist or where intrinsic safety is an issue. The FP4700 uses the temperature-dependent birefringence of a specially selected crystal as the temperature transduction mechanism. This crystal does not show thermal creep or aging as with some other fiber optic sensors.

**Model FP4700 Fiber Optic Temperature Sensor**

<table>
<thead>
<tr>
<th>Specifications</th>
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<tbody>
<tr>
<td>Temperature Ranges¹</td>
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<tr>
<td>Resolution</td>
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<tr>
<td>Accuracy²</td>
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<tr>
<td>Response Time</td>
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<tr>
<td>Operating Humidity Range</td>
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<tr>
<td>Dimensions (L × ø)</td>
</tr>
</tbody>
</table>

¹The available operating range is dependent on cable type (contact GEOKON with temperature parameters).

²Total accuracy over the full range including both signal conditioner and sensor errors. Higher accuracy available on request.

The Model FP4911 Fiber Optic Rebar Strainmeter is designed for measuring strains in foundations, slurry walls, precast piles, caissons, bridge abutments, tunnel liners, etc. The standard Model FP4911 (#4 rebar), known as the “Sister Bar,” is installed alongside structural rebar. The Fibre Optic element employed in this sensor makes it particularly suitable where dynamic measurements are to be made and/or on projects where other fiber optic sensors are deployed.

**FP4911 Fiber Optic Rebar Strainmeter**

<table>
<thead>
<tr>
<th>Specifications</th>
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<tbody>
<tr>
<td>Range</td>
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<tr>
<td>Resolution</td>
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<tr>
<td>Accuracy</td>
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<tr>
<td>Nonlinearity</td>
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<tr>
<td>Temperature Sensitivity</td>
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<tr>
<td>Temperature Operating Range¹</td>
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<tr>
<td>Rebar Size</td>
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<tr>
<td>Active Gage Length</td>
</tr>
</tbody>
</table>

¹Other ranges available on request.
The Model 4700 VW Temperature Gage consists of a stainless steel transducer body to which a vibrating wire element is attached. As the thermal coefficients of expansion of the body and wire are different, a simple yet sensitive, temperature measuring device can be constructed. These gages are ideally suited for use in projects that require datalogging and where other types of VW transducers are in use.

### Specifications
- **Range**: +100°C to +80°C
- **Resolution**: ±0.1°C
- **Accuracy**: ±0.5°F S. or better
- **Dimensions (L×ø)**: 127 × 19 mm (sensor)

**Note:** Transducer accuracy established under laboratory conditions.

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### Cables

**GEOKON** cables are waterproof, have good electrical properties and can be buried in soil or embedded in concrete. Cable construction consists of one or more shielded pairs with individual drain wires for electrical noise protection. Cable jackets include PVC for standard applications, **Teflon®** for use at high temperatures and Polyurethane, for use where extra abrasion resistance is required. Armored cables, for use in earth dams, and cables with straining wires and integral vent tubes are available.

**Conductors**: 4, 6, 8, 10, 12 and 24

**Conductor Insulation**: High Density Polypropylene, 8 and 10 mil; Fluorinated Ethylene Polypropylene, 10 mil

**Shielding**: Aluminum polyester with drain wire, 12 AWG tinned copper

**Jackets**: Extruded PVC standard, **Teflon®**, Polyurethane, Polyethylene and Armored Polyethylene

**Temperature Range**: -20°C to +80°C (-80°C to +200°C for **Teflon®**)

**Other cable jackets are available for special applications.**
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