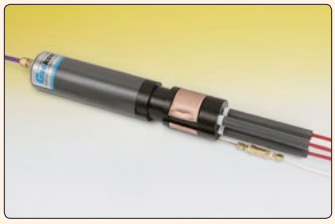
Flexible Rod Type Borehole Extensometer

Applications

Flexible Rod Type Borehole Extensometers measure displacement or deformation in soil, rock and concrete structures. Typical applications include the measurement of…

- **Ground movements around tunnels**
- **Deformation of dam abutments and foundations**
- **Ground movement behind retaining walls, sheet piling, slurry walls, etc.**
- **Ground movements in the walls of open pit mines**
- **Deformation of concrete piles (tell-tales)**
- **Fracturing in the walls of underground caverns**
- **Subsidence above tunnels and mine openings**
- **Settlement and heave of foundations in soft soil**



Model A-6 Flexible Rod Extensometer, with flangeless type head assembly.

Model A-6 assembled with groutable anchors and coiled for shipment. All anchor options shown right (left to right): Snap-Ring, Hydraulic, Groutable and Borros Type.

Operating Principle

Flexible Rod Type Borehole are usually installed in boreholes with from one to eight borehole anchors. Movement of rods attached to the anchors is measured relative to the head of the extensometer anchored at the mouth of the borehole and can be analyzed to reveal the magnitude of the deformation between the anchors.

Installation is accomplished by assembling the anchors, rods and pipes outside the borehole, placing the assembly in the borehole then fixing the anchors in place. The head of the extensometer can be configured for manual readout using a dial indicator and/or for electronic readout using vibrating wire sensors, linear potentiometers or DCDT's.

Two main types of extensometer heads can be identified. The Flange type is designed to sit on the surface of the rock, soil or concrete structure at the mouth of the borehole. The Flangeless type is designed to be recessed into the borehole or into an enlarged section of the borehole; usually to provide protection of the head from traffic, vandalism or from blasting, construction activity, etc.

The Model A-6 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-6 can be supplied with either groutable rebar-type anchors or hydraulic anchors. Where grouting is required, the extensometer can be supplied with a pre-assembled grout tube. When hydraulic anchors are used, the extensometer is supplied with oil-filled tubes attached.

To install the extensometer, the assembly is uncoiled on the surface and fed into the borehole. The assembly is usually lightweight enough so that this operation can be carried out easily by one person (even for overhead installations). With the extensometer in position, the borehole is either grouted, or the hydraulic anchors actuated (and then grouted, if necessary).

Readout can be either manual, electronic or both.

Readout Instruments

Manual/Electronic

Manual readout is performed using the Model 1400-1 Dial Indicator (50 mm range) or 1400-4 Digital Depth Micrometer (50-150 mm range).

Electronic readout is achieved using Model GK-404 or GK-405 Vibrating Wire Readouts (Model 4450) or the Model RB-100 Linear Potentiometer Readout (Model 1500). *(See below).*

Model 1400-1 Dial Indicator (top) and Model 1400-4 Digital Depth Micrometer.

Automatic Monitoring

Automatic monitoring is best accomplished using the Model 8021 or Model 8025 Dataloggers which can be configured to read at predetermined intervals, and to initiate alarms in the event threshold levels are exceeded. Alternatively, for extensometers installed in active roadways the Model 8026 Wireless Datalogger provides a convenient option.

Model 8026 Datalogger and Model 1280 (A-6) Extensometer in manhole.

Sensors

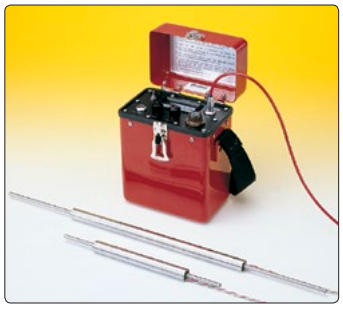
Model 1450 DC-DC LVDT

DC-DC LVDT's for dynamic and/or high temperature applications are also available. Standard ranges are 50 mm, 100 mm and 150 mm. Other ranges available on request.

Model 1450 DC-DC LVDT

Model 1500 Linear Potentiometer

The Model 1500 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 using either a dial indicator or a depth micrometer.



Model 1500 Linear Potentiometer pictured with Model RB-100 Readout.

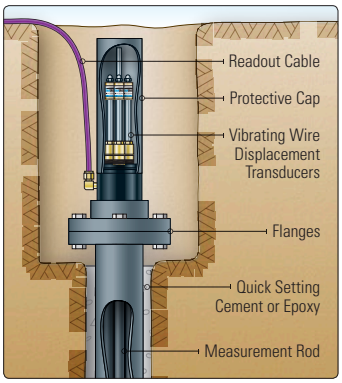
Technical Specifications

Standard Ranges	50, 100, 150, 250, 610 mm
Least Reading	0.025 mm
Accuracy[1]	±0.25% F.S.
Nonlinearity	< 0.5% F.S.

[1]*Accuracy established under laboratory conditions. Accuracy of ±0.1% available on request.*

Model 4450 Vibrating Wire Displacement Transducer

The Model 4450 Vibrating Wire Displacement Transducer provides remote readout for Geokon extensometers. They are particularly useful where other types of Vibrating Wire sensors are used and for installations where long cable runs are required.



Model 4450 Extensometer Head Assembly.

Technical Specifications

Standard Ranges[1]	12.5, 25, 50, 100, 150, 200 mm
Resolution	0.02% F.S.
Accuracy[2]	±0.1% F.S.
Nonlinearity	< 0.5% F.S.
Temperature Range[1]	–20°C to +80°C

[1]*Other ranges available on request.*
[2]*Accuracy established under laboratory conditions.*

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