Retrievable Extensometer

Applications

The Model A-9 Retrievable Extensometer is designed for the measurement of deformations in boreholes and is particularly suited for use in load testing of concrete piles. Borehole deformation can be measured in…

- **Piles**
- **Concrete**
- **Rock**
- **Other materials**

Model A-9 Retrievable Extensometer bottom anchor (front), transducer with anchor (middle two), and connecting rod (rear).

Operating Principle

The Model A-9 Retrievable Extensometer is designed for the measurement of extensions and contractions along boreholes in the ground or in concrete. It is particularly useful in concrete pile testing where it can be installed inside a PVC or steel pipe cast in the pile: in this application it is a substitute for either tell-tales or strain gages. A primary feature of the Model A-9 is its ability to be retrieved and used repeatedly.

In use, the extensometer incorporates a string of electronic displacement sensors linked together by extension rods and designed to measure the relative displacement between a series of pneumatically expandable anchors. The string of sensors is assembled (with variable lengths of connecting rods to enable positioning of the anchors at the required depths), inserted into the pipe or borehole, and then locked in position by pneumatically actuating the various anchors, which remain fully expanded throughout the monitoring period. When monitoring has been completed, the pneumatic pressure is released which retracts the anchor pistons and allows removal of the string for further use.

Advantages and Limitations

The displacements are measured over specific increments, eliminating the inaccuracies associated with Tell-Tales or Multiple Position Borehole Extensometers, where measurements of inter-anchor strains are calculated from the difference between two long base measurements from the surface to each of the anchor points in question. When used as a substitute for strain gages, the measured distance is longer; hence, the Model A-9 Retrievable Extensometer integrates the strains over a larger and possibly more representative sample than would be obtained using strain gages.

The ability to retrieve and re-use the Model A-9 can result in significant cost savings where repeated tests are required that would otherwise use either non-retrievable extensometers or strain gages.

High accuracies can be achieved using a variety of sensor types with various available ranges.

The design of the anchors requires the use of borehole or pipe sizes, which are closely controlled.

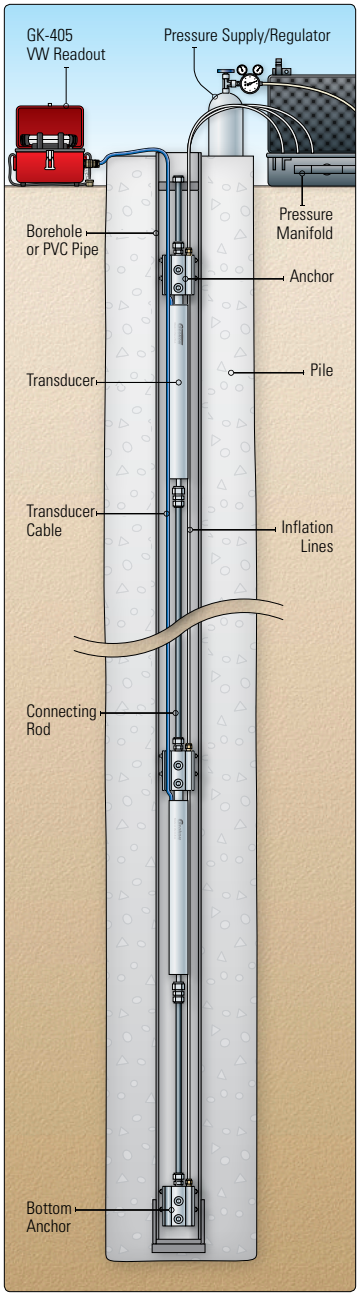

Illustration shows a typical Model A-9 installation in a concrete pile.

Model 1300-3 Pressure Manifold.

Model GK-405 Vibrating Wire Readout.

System Components

The standard system is designed for a maximum of eight anchor/sensor segments. Each anchor contains eight pistons, which can be pneumatically actuated to force them out against the sides of the borehole. The pistons are spring-loaded and automatically retract when the pressure is removed. A pressure manifold, containing on/off valves and check-valves, connects to each of the inflation lines leading to the anchors, enables each of the anchors to be actuated in turn, and maintains the anchor pressure during the monitoring period. Gas pressure is obtained from a pressurized nitrogen bottle.

Each anchor is attached to a vibrating wire sensor (or, optionally, to a DCDT or linear potentiometer sensor) and can be linked to adjacent anchors by means of Swagelok fittings that grip the interconnecting rods. These rods can be adjusted to various lengths using a hacksaw. Rods may be made from fiberglass, stainless steel or carbon graphite.

Readout is accomplished by connecting cables from each sensor to Model GK-404 or GK-405 Readouts. Switch panels or Multiplexers (Model 8032) are available to rapidly switch through all the active sensors.

Technical Specifications (VW Sensors)

Standard Range[1]	12.5, 25 mm
Resolution	0.02% F.S.
Accuracy[2]	±0.1% F.S.
Temperature Range[1]	–20°C to +80°C
Number of Anchors	2 - 8 (minimum - maximum)
Materials	stainless steel anchors and transducers
Connecting Rods	graphite, fiberglass, stainless steel
Cable	4-conductor shielded
Borehole Diameter	46 - 53 mm
Diameter	*(anchor)* 45 mm *(transducer)* 25 mm
Overall Length	495 mm

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

***Please note:** the Model A-9 Retrievable Extensometer was awarded Patent No. 5,585,555 in 1996 by the USPTO.*

Geokon, Incorporated
48 Spencer Street
Lebanon, NH 03766
USA

1 • 603 • 448 • 1562
1 • 603 • 448 • 3216
geokon@geokon.com
www.geokon.com

The World Leader in Vibrating Wire Technology™