

PRECISION SETTLEMENT MONITORING SYSTEM

GEOKON®

MODEL 46750C



Model 46750C Precision Settlement Monitoring System.

APPLICATIONS

The Model 46750C Precision Settlement Monitoring System is designed to measure differential settlement in dams, tunnels and foundations. It provides:

- High resolution (≈ 0.025 mm)
- Long term stability
- High accuracy
- Locking mechanism for easy installation and portability

OPERATING PRINCIPLE

The Model 46750C Precision Settlement Monitoring System was designed in conjunction with Shannon & Wilson, Inc. to measure differential settlements with a very high degree of accuracy and resolution. Therefore, the system is suitable for applications of a highly critical nature where the expected settlements are small.

The system uses a horizontal open channel pipe, half-filled with water or antifreeze solution, fixed to the structure or tunnel under observation. Short lengths of tubing hydraulically connect the water inside the pipe to sensors situated at intervals along the exterior. The open channel pipe prevents the complications associated with air bubbles forming in a pipe completely filled with water. A vent tube connects the air spaces in the upper part of the sensor and the 76 mm pipe, preventing any build-up of back pressure inside the sensor. One end of the 76 mm pipe is commonly located on solid ground, with a sensor at this location to serve as a benchmark.

The sensor consists of a cylindrical weight partially submerged in liquid and suspended by a vibrating wire force transducer. As the water level inside the sensor rises or falls, the buoyancy force changes the cylinder's apparent weight and alters the tension and resonant frequency of the vibrating wire. This frequency is measured by either a portable readout or, more frequently, a datalogger. The frequency can be equated to settlement through the calibration algorithm provided with the sensor.

The diameter of the cylindrical weight determines the sensor's range and resolution. For example, a range of 75 mm with a resolution of 0.025 mm can be achieved. Various ranges are available on request.

The 467500C differs from the Model 4675LV Weir Monitor by the inclusion of a locking mechanism. This mechanism facilitates installation by locking the suspended cylinder in place, thus permitting the sensor to be moved from location to location without fear of damage.

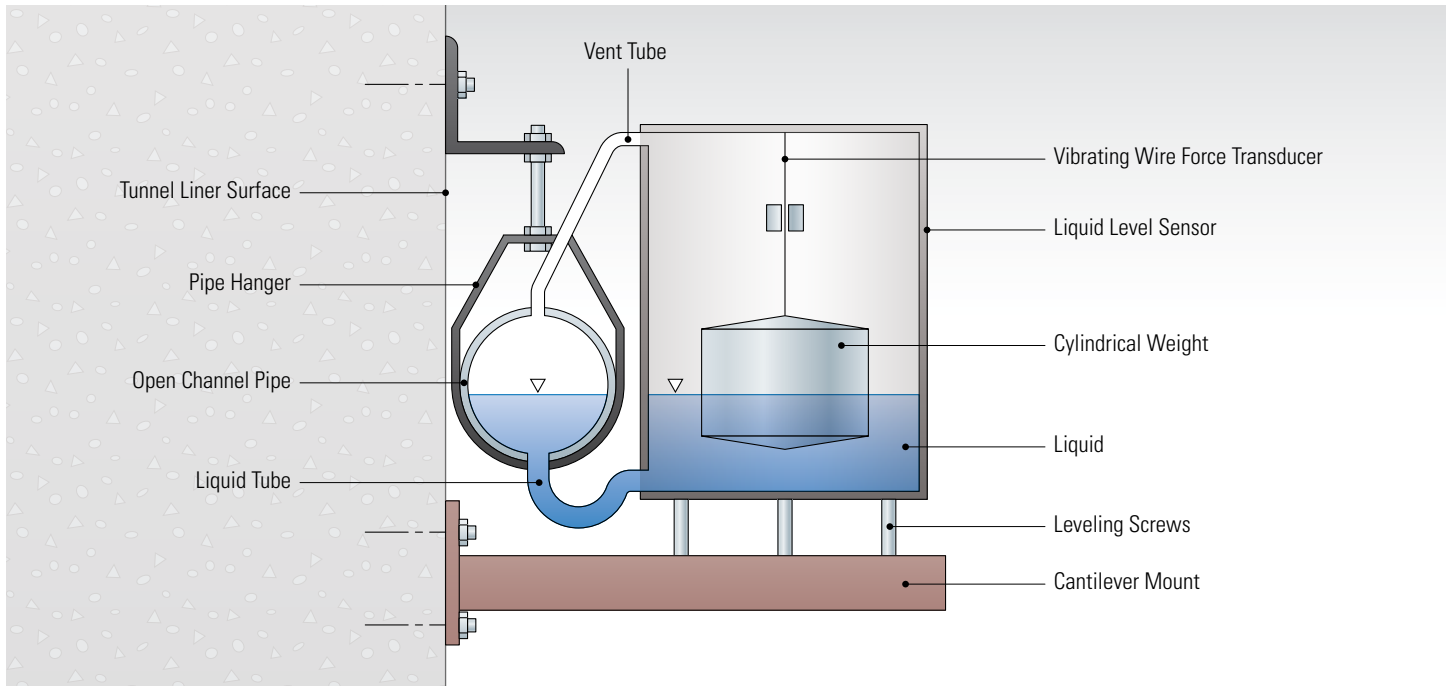
ADVANTAGES AND LIMITATIONS

The advantage of the system lies in its ability to carry a stable datum over long distances, as achieved by the water level in the half-filled pipe. Each sensor measures the settlement by direct reference to this datum level rather than referencing a neighboring sensor, as is the case where chains of tilt-measuring sensors are used. Thus, the accuracy of each measurement is not diminished by the accumulation of errors in a series of dependent measurements.

Further accuracy can be obtained by fully submerging the cylindrical weight in the liquid to measure changes in the liquid density caused

by changing temperatures or chemical composition. Liquid density sensors can be connected at intervals to the open channel pipe in the same manner as the active sensors, but at a slightly lower elevation to only partially submerge the hanging weight. Using this method, the liquid's density can be measured with an accuracy of $\pm 0.5\%$.

As with all vibrating wire systems, the output signal is a frequency and is not affected by long cables. Additionally, since the sensor is a force transducer, it is immune to zero drift and temperature effects.



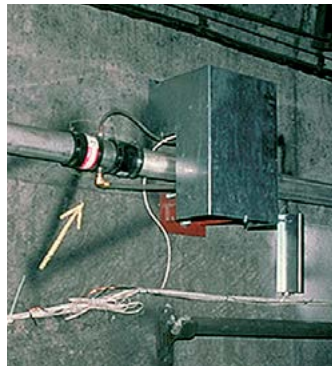
Model 46750C schematic.



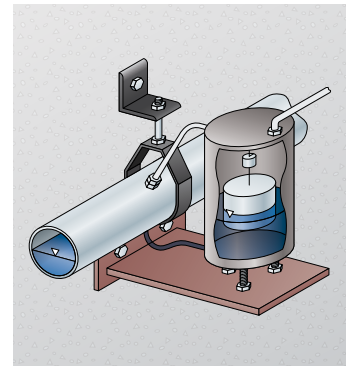
Model 46750C "through-pipe" version.



The Model 46750C Liquid Level Vessel with cantilevered mounting bracket.



Model 46750C shown with protective cover.



The Model 46750C Precision Settlement Monitoring System.

SPECIFICATIONS

| | |
|--------------------------------|----------------------|
| Standard Range ¹ | 75 mm |
| Resolution | 0.025 mm |
| Accuracy ² | ±0.1% F.S. |
| Linearity | ±0.5% F.S. |
| Stability | ±0.05% F.S. per year |
| Repeatability | ±0.2% F.S. |
| Temperature Range ³ | -20 °C to +80 °C |

¹Other ranges and resolutions are available.

²Accuracy established under laboratory conditions.

Accuracy can be achieved using polynomial calibration constants.

³Below 0 °C an antifreeze solution is required.

COMPATIBLE READOUTS AND DATALOGGERS

GK-404: Handheld Readout
GK-406: Vibrating Wire Analyzer
8600 Series:
 Multi-Channel Dataloggers

8800 and 8900 Series: GeoNet Wireless Data Acquisition System
8920 and 8930 Series: GeoNet Cellular and Wi-Fi Network Loggers
8940: GeoNet Dataloggers