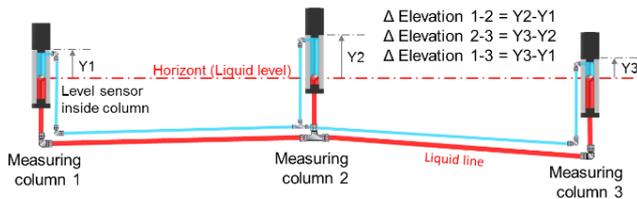


Multi-point level monitoring

Automatic Hose level system

For precision levelling and settlement monitoring in demanding environmental conditions

The automatic Hose level system is based on the "communicating vessels principle", where each measuring column represents a monitoring point. Any vertical movement of a measuring column causes fluid redistribution in the hydraulic circuit and consequently a level variation inside each column. The change in fluid level is recorded electrically by a level sensor and the elevation changes are derived by the difference in level readings between columns.



NGI's automatic Hose level system - Operating principles

The system is hermetically sealed and was originally developed for levelling of underwater piling templates. By means of a closed system the readings are not affected by outside pressure variations. Minor temperature (thermal) effects may occur and for locations exposed to significant temperature gradients it is recommended to include a temperature sensor in each measuring column. The system has proven to withstand large vibrations and the readings are not sensitive to noisy environment. The measuring columns are interconnected with hydraulic hoses and the monitoring system be configured as a measuring line, circuit or star as long as the columns are hydraulically communicating with each other.

For practical reasons the level range in each column is limited to ~ 500 mm. For applications where larger elevation difference is present a continuous monitoring line can be built up by segments with overlapping steps. The precision is in general not affected by the distance between the measuring columns and the hose level system can have long distributed lines.

The automatic Hose level system can be used for levelling of subsea templates and structures or monitoring of differential settlements in tunnels, along bridges, dams or piers. The system can be submerged to ~ 50 m depth (larger depth rating can be obtained if the system is internally pressurized).



Subsea self-levelling piling template with hose level system

The full range accuracy in level measurements is better than 1mm and the resolution is < 0.1 mm. The level sensors can be provided with analogue (4-20 mA) or digital output. Normally NGI provides a complete monitoring solution including data acquisition system and web based interface for remote monitoring.



NGI's automatic Hose level system mounted in Bjørvika (E18 Oslo) submerged tunnel for settlement monitoring (above left)

Example of Hose level instrumentation along a bridge (above right)