DIRECT AND INVERTED

PENDULUMS

INCLINOMETERS
& PENDULUMS

SISGEO®

DIRECT AND INVERTED
PENDULUMS

Direct and inverted pendulums are simple, reliable, and accurate systems used for monitoring horizontal displacements.

Commonly used in concrete dams, they enable the measurement of verticality deviations in structures, ensuring effective structural safety monitoring.

The inverted pendulum anchored in foundation in combination with a direct pendulum can be read by manual optical coordinometer or automatically with T-1000 telependulum.

APPLICATIONS

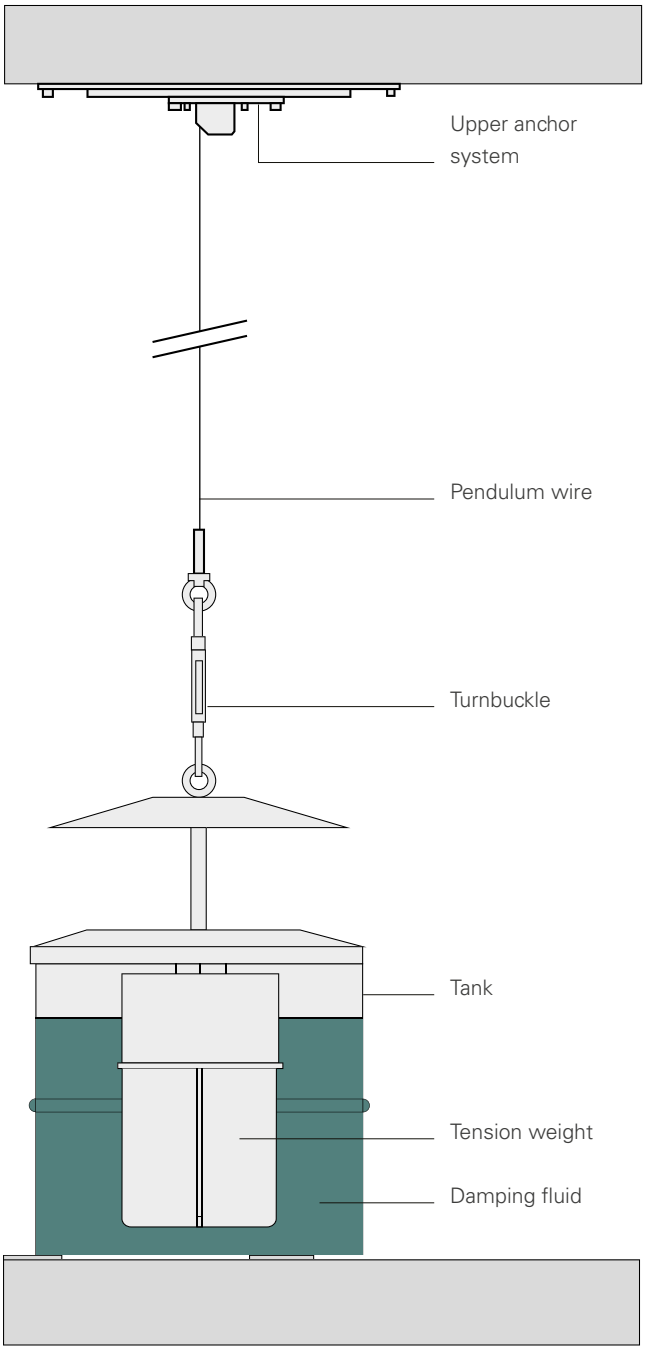
- Arch dams
- Concrete dams
- Skyscrapers
- Slender structures
- Bell towers
- Minarets

FEATURES

- Reliable and straightforward for long-term monitoring
- Measurements can be acquired at various points along the same plumb line
- Displacements can be monitored either manually or automatically

PEND_EN_01_05/2025

DIRECT HANGING PENDULUM



The direct hanging pendulum is a gravity-referenced instrument consisting of:

Tank consisting of a stainless steel cylinder filled by fluid and covered by a stainless steel conic cap fixed to the wire. Tensioning weight is suspended to the wire and immerged in the fluid tank for damping the wire oscillations. Tank is supplied without liquid.

A fully stainless steel **tensioning weight,** designed as a cylindrical tank filled with steel ballast and equipped with a damping unit composed of four cross-shaped blades.

Upper anchor system is composed by a galvanized steel plate to be fixed to the wall on which is mounted and a stainless steel rail with a sliding block bringing a tail sheave and the locking nut for the wire. The sliding block allows the perfect positioning of the wire and tensioning weight inside the tank while the locking nut allows adjustment of the wire length.

Turnbuckle mounted on the wire for trimming the position of the damping unit in the tank.

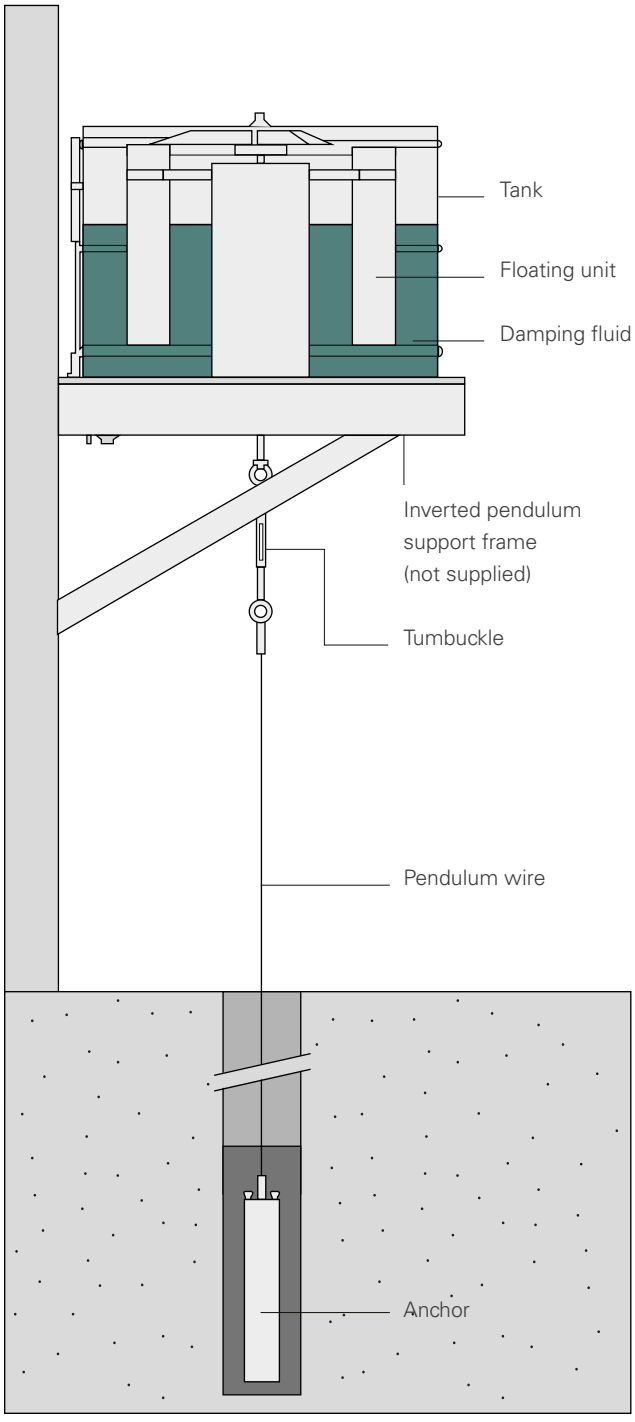
DIRECT PENDULUM	MODEL 0S911002500
Tank dimension	diameter 410 mm height 415 mm
Tank weight	15 kg
Tensioning weight dimension	diameter 200 mm height 310 mm
Tensioning weight	30 kg
Damping fluid (*)	not supplied

PENDULUM WIRE	MODEL 0WRAC200000
Material	stainless steel
Diameter	2 mm

(*) Damping fluid is usually a mineral oil and should be selected with viscosity according to the application and the local temperature condition (i.e. SAE 50-90)

PEND_EN_01_05/2025

INVERTED HANGING PENDULUM



The inverted pendulum provides a fixed datum from which structural movements can be measured. It is composed by:

Floating unit consists of a stainless steel anular chamber with an internal stainless steel float. The float is fixed to the pendulum wire by an adjustable tie bar having 80 mm of vertical stroke. The standard floating unit permits ±72 mm movement in any direction.
Tank is usually filled by oil and has a stainless steel top cover. Checking of the fluid level inside the tank is possible by an external tube. The floating unit is usually positioned on a support metal frame anchored to the structure (not supplied)

Anchor for inverted pendulums consists of a steel ballast with centralizing pins for installation in cased borehole. Installation must be carried out using the appropriate installation tool. The anchor is grouted in a cased borehole having a minimum diameter of 150 mm.

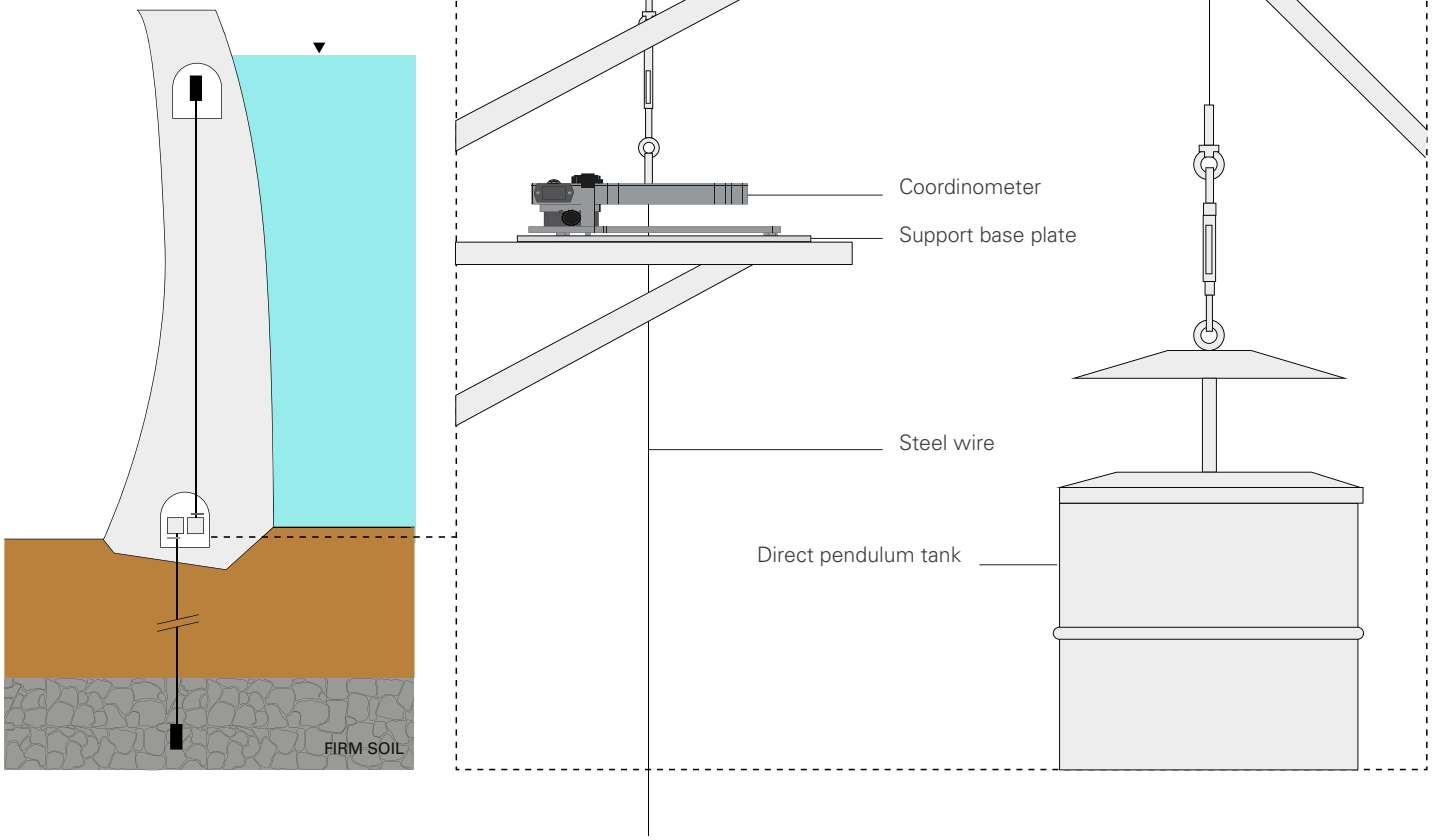
INVERTED PENDULUM	MODEL 0S912006000
Tank dimensions	diameter 615 mm height 497 mm
Tank weight	35 kg
Floating unit	diameter 465 mm height 350 mm material: stainless steel
Groutable anchor	diameter 75mm, adjustable from 80mm to 160mm by centralized pins. material: galvanized steel
Damping fluid (*)	not supplied

PENDULUM WIRE	MODEL 0WRAC200000
Material	stainless steel
Diameter	2 mm

(*) Damping fluid is usually a mineral oil and should be selected with viscosity according to the application and the local temperature condition (i.e. SAE 10)

TYPICAL DAM APPLICATION

In arch and gravity dams, one or more pendulum sections can be installed to monitor horizontal displacements (e.g., upstream-downstream and left bank–right bank directions).
A typical section includes one direct pendulum and one inverted pendulum, both read using manual or automatic devices, typically installed in a gallery chamber.



SISGEO S.R.L.
Via F. Serpero 4/F1
20060 Masate (MI) Italy
Phone +39 02 95764130
Fax +39 02 95762011
info@sisgeo.com

ADDITIONAL SUPPORT

SISGEO offers on-line assistance service to the Customers in order to maximize the performance of the system and training on the correct use of the instrument/readout.

For more information contact mail: ***assistance@sisgeo.com***