



Vertical Tilt-Beam Sensors

## Applications

Tilt-Beam sensors, also known as fixed inclinometers, are deployed to monitor structural rotation, differential settlements, and deformation. Typical applications include:

- Monitoring the stability of structures adjacent to excavations.
- Monitoring deformation and rotation of shoring walls.
- Monitoring differential settlements (horizontal deployments only).

## Operation

Similar in principle to shape arrays or in-place inclinometers, the tilt-beam system is an array of tilt sensors mounted on rigid segments of tubing that are anchored to the structure.

Movement or deformation of the structure changes the spatial position of the anchors and the inclination of the rigid segments attached to the anchors.

The length and inclination of each segment is used to calculate lateral deviation. Summing the deviations over the length of the array provides a profile. Changes in the profile indicate displacement, deformation, or rotation.

## Configurations

Each segment of the tilt-beam system is instrumented with a high resolution, narrow angle, electrolytic tilt sensor. Sensors are typically uniaxial, but biaxial sensors can be supplied as needed.

Segment length can be varied to suit the application. Lengths between 3 and 6 feet are most common and provide good coverage and rigidity. Longer lengths are possible but less rigid.

Tilt-beam sensors can also be deployed horizontally to monitor differential settlements.

## Advantages

**High Resolution:** Tilt-Beam sensors can reliably detect changes in tilt as small as one second of arc.

**Proven Technology:** Tilt-Beam sensors have no moving parts and simple components that are immune to electronic noise, moisture, and dust.

**Compatible:** Tilt-Beam data is fully compatible with GeoCloud, GEO's automated monitoring platform, which processes the measurements, checks for alarms, and posts plots and planviews on the project website.

## Tilt Sensor Specifications

**Sensor Type:** Electrolytic. Uniaxial tiltmeter contains one sensor, Biaxial tiltmeter contains two sensors.

**Range:**  $\pm 3^\circ$ .

**Calibrated Range:**  $\pm 0.68^\circ$  or 12 mm/m.

**Resolution:** 1 arc second or  $6 \times 10^{-5}$  inch per foot (0.005 mm/m)

**Accuracy:** <1% FS (calibrated range).

**Temperature Rating:** -20 to +50 °C.

**Enclosure:** IP 66, powder-coated metal.

**Dimensions:** Uniaxial enclosure measures 4.9 x 3.2 x 2.3" (125 x 80 x 59 mm).

**Logger:** Campbell Scientific Loggers.

## Segments & Anchors Specifications

**Segment:** Square-section aluminum tubing supplied in specified lengths. Includes end brackets and low-friction bushings.

**Anchors:** Stainless steel all-thread. Length as required.