



Vertical Tilt-Beam Sensors

## Applications

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

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

## Components

The wireless tilt-beam sensor consists of a wireless tiltmeter, a beam with end-brackets, and anchors. An internet gateway is also a necessary part of the system.

The wireless tiltmeter is a self-powered wireless logger or node integrated with a tiltmeter. It obtains measurements at specified intervals and transmits them to an on-site internet gateway.

The beam is a rigid metal tube supplied with two low-friction brackets that allow the beam to move, but not deform, with the structure.

Anchors are typically grouted-in, all-thread steel anchors, supplied in a length that can be embedded at least two or three inches into the structure.

The internet gateway receives measurements from the sensors and forwards them to a GeoCloud server via a cellular connection to the internet.

The GeoCloud server processes the readings, checks for alarms, and updates dedicated GeoCloud websites to show current project site status, graphs, and reports. Users can access the website with desktop and mobile browsers.

## Tiltmeter vs Tilt-Beam Sensor

Tilt-Beam sensors differ from tiltmeters in two respects: First, the tilt-beam sensor has a defined gauge length, typically 1 to 2 meters, which allows changes in tilt readings to be converted simply and accurately to millimeters or inches of displacement. Second, tilt-beam sensors can be linked end-to-end, as shown in the drawing at left, to monitor differential movements and provide displacement and settlement profiles.

## Tilt Sensor Specifications

**Sensor Type:** Three-axis MEMS accelerometer built into a logger. Reports two axes of rotation from the horizontal. For horizontal, vertical, or inclined installation.

**Range:**  $\pm 90^\circ$ .

**Resolution:** 0.00001°.

**Repeatability:** Better than 0.0003°.

**Accuracy:**  $\pm 0.005^\circ$  at 4° to  $\pm 0.06^\circ$  at 86° of tilt.

**Enclosure:** IP 68, submerged 2m, 24 hours.

**Radio:** 900 Mhz or 2.4 Ghz.

**Battery Life:** 5 to 10 years with reporting at 30 minute intervals.

**Requires:** Internet Gateway.

## Beam Specifications

**Segment:** Square-section aluminum tubing supplied in specified lengths. Includes end brackets and low-friction bushings. Segment length can be varied to suit the application. Lengths between 1 and 2 meters are most common and provide good coverage and rigidity.

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

## Gateway Specifications

**Function:** Receives transmissions from wireless loggers, forwards to internet.

**Power:** AC line power, or battery and solar panel.

**Mounting:** Pole mounted, ideally with obstruction-free line-of-sight to the sensors.