

MEMS Tiltmeter



Applications

The MEMS tiltmeter is a compact, waterproof tiltmeter with a range of $\pm 10^\circ$ from vertical. It is used to monitor changes in the inclination of a structure. Applications for the tiltmeter include:

- Monitoring rotation of retaining walls, piers, and piles.
- Providing early warning of potential structural damage.
- Documenting any effects of nearby deep excavations.

Operation

The MEMS tiltmeter measures tilt over a range of $\pm 10^\circ$ from vertical and is available in uniaxial and biaxial versions. Signal conditioning makes the tiltmeter compatible with most data loggers.

The tiltmeter is fixed to the structure via an angle bracket that can be welded to steel or bolted to an anchor set into concrete or rock. Because the tiltmeter has a relatively wide range, careful zeroing of the sensor is not required.

Readings are obtained with a data logger or a portable readout. The initial reading is used as a baseline. Changes in the inclination of the structure are found by comparing current readings to the initial.

Advantages

Mounts Anywhere: The tiltmeter is supplied with a bracket that can be welded to steel or bolted to anchors.

Wide Range: The tiltmeter has a range of $\pm 10^\circ$, so it can be installed without careful zeroing.

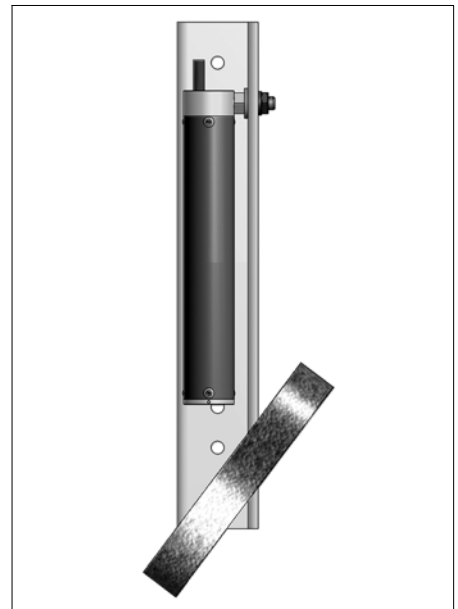
Uniaxial or Biaxial: The tiltmeter is available in uniaxial and biaxial versions.

Waterproof: The tiltmeter can tolerate submersion.

Suitable for Automatic Readings: The tiltmeter outputs a voltage signal that can be read by most data loggers. It can also be read manually with the EL/MEMS Data Recorder.



The tiltmeter can be fixed to most structures via the included angle bracket. The bracket can be anchored to rock or concrete and welded to steel.



An optional embedment mounting bracket provides a way to stand tiltmeters on sloping surfaces, such as the concrete face of a rock-fill dam.

MEMS TILTMETER SPECIFICATIONS

MEMS Tiltmeter, Uniaxial57803101
 MEMS Tiltmeter, Biaxial57803102

Tiltmeter includes angle bracket, 5 m of signal cable, calibration record, and user manual. Anchor is not included.

Sensor Type: MEMS (Micro Electro-Mechanical Systems) sensor for tilt readings and a 3K ohm thermistor for temperature readings.

Range: ±10 degrees.

Resolution: 9 arc seconds, using a 13 bit readout device such as the CR1000 datalogger.

Repeatability: ±22 arc seconds.

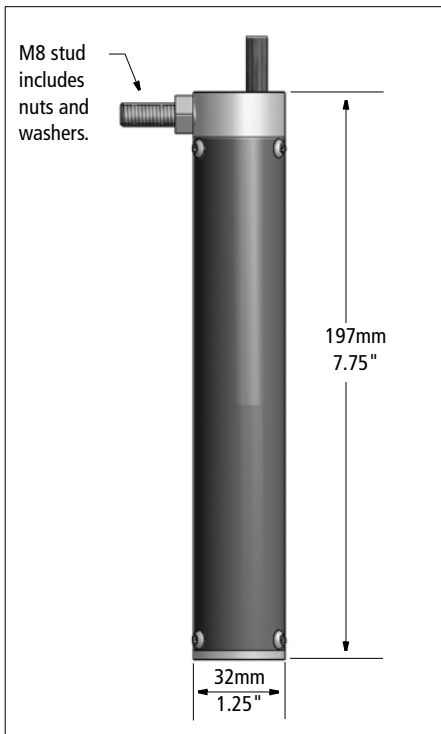
Calibration: 11-point calibration taken at three temperatures from -8 to 40 °C.

Input Power: 8 to 15 Vdc.

Output Signal: ±2.5 Vdc.

Body: Stainless steel. Waterproof to 20m.

Dimensions: 32 x 190 mm (1.25 x 7.5"). Mounting stud is M8.



SIGNAL CABLE, CUSTOM LENGTHS

Signal Cable 50613527
 Cable has seven 22-gauge tinned-copper conductors, shield, and polyurethane jacket. The standard product includes 5 m of cable. Custom lengths of cable can be special ordered.

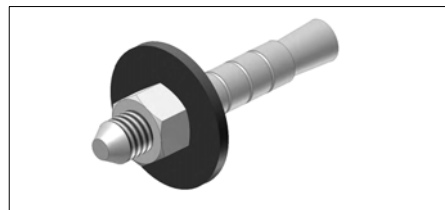
MOUNTING BRACKETS

Angle Bracket. included
 The angle bracket included with the tiltmeter is suitable for most applications. It can be welded to steel or bolted to an anchor. The bracket does not include an anchor.

Embedment Mounting Bracket . . 97803115
 This special-order bracket provides a way to stand the tiltmeter on sloping surfaces, such as the concrete face of a rock-fill dam. The bracket is grouted into a drill hole.

ANCHORS

Anchors are used in concrete or rock. Order one anchor per tiltmeter.



Expansion Anchor 57803128
 Includes anchor, bolt, and washer. Install in 9.5 x 64 mm (3/8 x 2.5") drill hole.



Groutable Anchor. 57803130K
 Includes anchor, bolt, and washer. Install in 13 x 90 mm (0.5 x 3.5") drill hole. Requires epoxy grout (see below).

Epoxy Grout Kit 57803133
 Includes plastic dispenser and cartridge of quick-set epoxy grout. Sufficient for 15 anchors.

PORTABLE READOUT

EL/MEMS Data Recorder56813500
 Terminal Box for 12 Sensors57711600
 Jumper Cable56813557

The EL/MEMS Data Recorder is a portable readout that displays and stores tilt readings in volts and temperature readings in degrees C. Includes software for transferring stored readings to a Windows PC.

Terminal box allows connection of up to 12 tiltmeters. Sensors are selected by a rotary switch. Fiberglass box measures 290 x 345 x 135 mm (11.5 x 13.5 x 5.25").

Jumper cable is required to connect the Data Recorder to the terminal box.



DATA LOGGERS

M-Logger58810100

The M-Logger, shown above, is a simple data logger dedicated to MEMS sensors. It reads one tiltmeter connected directly or up to 16 sensors connected via a multiplexer. See separate data-sheet.

Campbell Scientific Loggers

The Campbell Scientific CR1000 data logger allows direct connection of two biaxial sensors or three uniaxial sensors. Adding a multiplexer increases the capacity to 16 uniaxial or biaxial sensors. Up to six multiplexers can be added to the CR1000 data logger. See separate datasheet.