

## Applications

The GeoCloud MPBX (Multi-point borehole extensometer) is a rod-type extensometer that monitors changes in distance between downhole anchors and a reference head.

Typical applications include:

- Monitoring settlement in soil above tunneling and other mining activity.
- Monitoring settlement due to loading of foundation soils.
- Monitoring deformation of retaining walls, cut slopes, and tunnel walls

## GeoCloud MPBX Components

MPBX components include anchors, rods, reference head with displacement sensors, and a wireless logger.

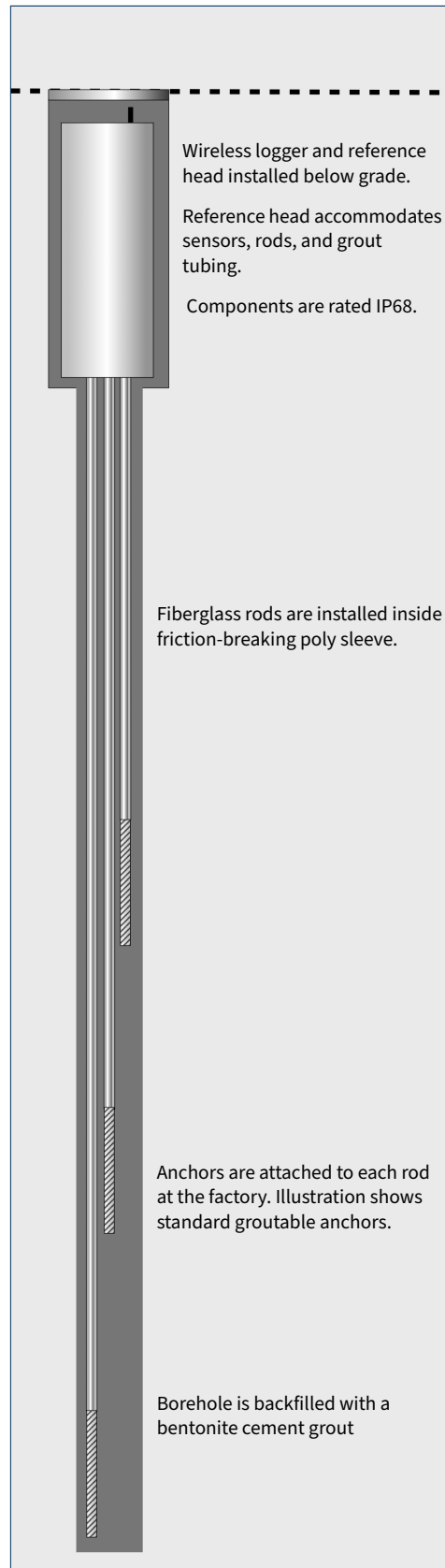
Anchors and rods are installed at specified depths in the borehole. Rods run upwards from the anchors to the reference head at the borehole collar.

Displacement sensors inside the reference head monitor the rods, which follow the upward or downward movement of the anchors.

Displacement sensors are powered by a wireless logger. The logger obtains sensor readings at scheduled intervals, then transmits the measurements to an internet gateway.

The gateway receives the transmissions and forwards them to a GeoCloud server on the internet. The GeoCloud server processes the measurements, checks them against alarm thresholds, and then stores them in a database.

Users access the measurements via a secure GeoCloud project website, using their desktop or mobile web browsers. The website presents data in trend plots, site-wide status views, and PDF reports.



## Specifications

**Reference Head:** Holds displacement sensors connected to rods. Provides for 2 grout lines.

**Displacement Sensors:** Linear potentiometer with 4-20mA output.

**Sensor Range:** 6 inch.

**Sensor Resolution:** 0.01 % FS.

**Sensor Accuracy:**  $\pm 0.20$  % FS.

**Rods:** 0.1875-inch OD fiberglass installed inside friction-breaking sleeve.

**Sleeve:** Continuous poly tubing.

**Anchors:** Groutable type, 16-inch length, attached to rod and sleeve at factory.

## Wireless Logger Specifications

**Sensor Compatibility:** 4-20MA current loop sensors, 2 or 3 wire.

**Measurement range:** 0-20mA.

**Accuracy (0 to +50°C):**  $\pm 0.05$  % FS.

**Reading Intervals:** 30 second to 24 hours.

**Memory:** 200,000 readings for single sensor, 72,000 readings each for multiple sensors.

**Built-in Barometer:** Range 300-1100 hPa, Resolution 0.18 Pa, Accuracy  $\pm 0.12$  hPa.

**Built-in Temperature Sensor:** -40°C to +80°C range, 0.01°C resolution,  $\pm 1.8^\circ\text{C}$  accuracy.

**Battery:** 3.6V C-type Saft LSH 14. User changeable. Battery life 11 to 35 months.

**Operating Temp:** -40°C to +80°C.

**Dust & Water:** IP67 or IP68, depending on logger.

**Wireless Protocol:** LoRaWan. Requires availability of LoRaWan internet gateway.

## Typical Transmission Range

**Line of sight:** 9 miles (15 km).

**City street:** 2.5 miles (4 km).

**Manhole in city street:** 1.2 miles (2 km).

**Tunnel:** 2.5 miles (4 km).