

IPI-X

In-Place Inclinator - Extensometer

The Geosense IPI-X is designed to be installed in inclinometer casing to automatically measure settlement or heave, together with tilt for full 3D borehole profiling



IPI-X

Overview



The IPI-X is an Automatic Magnetic Extensometer combined with an In-Place Inclinator which can be used typically to measure vertical and horizontal displacement in embankments, dam foundations, deep foundations and around tunnels and diaphragm walls.

It comprises an In-place Inclinator with the addition of a low power digital Magnetic Positional Sensor inside the adjoining extension rod. The system is placed vertically within inclinometer casing in a borehole.

Magnetic targets are positioned at various locations along the length of the inclinometer casing corresponding to the location of the Magnetic Positional Sensors. Vertical displacement is measured by the relative position of the magnetic targets from their original position.

Horizontal displacement is measured through tilt by the In-Place Inclinator to provide a 3D profile of the borehole. All the digital sensors are BUSSED together allowing fast and reliable communication.

Any combination of extension rod lengths (1, 1.5, 2 & 2.5m) and IPIs (0.5m) can be used so that sensors can be located at the required depths.

To provide an absolute reference for vertical displacement, the bottom magnetic target should be installed into stable ground together with a geodetic survey of the top of the installation.

Data acquisition is either by WI-SOS 480 wireless digital Nodes or other GeoLogger systems.

APPLICATIONS

Automatic measurement of inclination and settlement in:

Excavations

Embankments

Dams

Tunnels

Foundations

FEATURES

Single borehole for settlement and inclination

Automatic monitoring of settlement or heave

Automatic monitoring of inclination

3D borehole profile

Used with standard inclinometer casing

Low power digital BUS sensors

Up to 30 sensors per WI-SOS 480 digital Node

High accuracy

High resolution

Vertical settlement range up to 400 mm

Robust rod quick connectors

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Specifications

SETTLEMENT SENSOR (IPX)

Sensor type	Positional
Measuring range	400mm (+/- 170 mm)
Minimum target spacing	1.5m
Resolution	0.1mm
Accuracy	± 1mm
Output signal	RS-485 digital BUS
Output unit	mm, m
Extension rods	1.0, 1.5, 2.0, 2.5m x 25mm Ø

TILT SENSOR (IPI)

Sensor type	Biaxial MEMS
Accuracy ¹	±0.004° (±13.5 arc sec, ±0.07 mm/m) ±0.0125% FS
Resolution	0.0005° (2 arc sec, 0.01 mm/m) 0.0017% FS
Repeatability	±0.002° (±7.2 arc sec, ± 0.037 mm/m) ±0.007% FS
Output signal	RS-485 digital BUS
Output unit	Sine of angle, degrees
Temperature sensor range	-40 to +85°C
Temperature sensor accuracy	±1°C
Operating temperature	-40 to +85°C
Thermal stability	±0.005% FS/°C
IPI Probe diameter	32mm
IPI Probe gauge length	500mm
IPI Probe weight	1.3kg
Compatible casing sizes	70-85mm
Enclosure rating	IP68 (20 bar)

MATERIALS

IPI Probe	316 stainless steel
Extension rods	316 stainless steel

EXTENSION CABLE (If required, to extend from IPI top fly lead assembly to data logger)

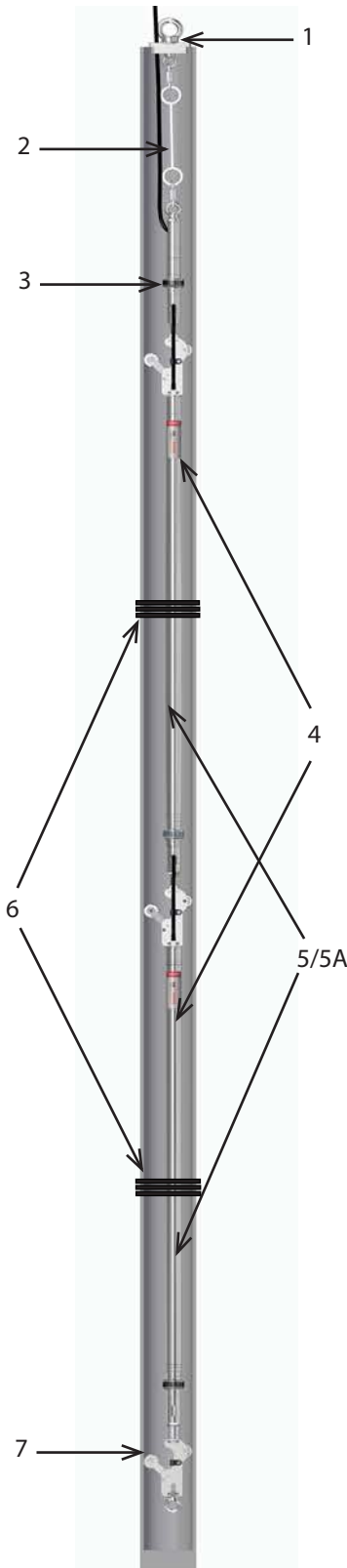
Construction	2 x twisted pair, braided, PUR sheath
Type	Type 800 - multi-core with braid
Diameter	8mm
Cable	Type 800 - Multi-core with Braid

¹ Using 3rd order polynomial

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System Components



SECURITY COVERS

A range of special covers placed over the top of the installation for protection.

1 - TOP HANGER

Used to suspend the complete string. Placed on the top of the 70mm inclinometer casing. Weight 0.3kg

INSTALLATION FORK

Used to support the string during installation. It fits into two slots on top of the IPI sensor and is placed on top of the inclinometer casing.

2 - WIRE HANGER EXTENSION

A 3mm wire suspension rope used to position the first sensor at the required depth and is connected to the top collar hanger and the IPI top fly lead assembly. Available either as pre-assembled lengths (1, 2, 3, 4m) or supplied as site adjustable. Weight 0.05kg/m

3 - IPI TOP FLY LEAD ASSEMBLY

A universal component which acts as top suspension adaptor and cable connector. Fitted as standard with 4.5m of digital BUS cable for connection to a readout or data logger. Other cable lengths available on request. Weight 0.5kg

4 - IN-PLACE INCLINOMETER PROBE

Instrument fitted with two (Biaxial) MEMS sensors. It is mounted within a watertight stainless steel tube fitted with two wheel sets that run in the internal grooves of inclinometer casing. One set has a fixed wheel and the other is sprung loaded. The output from the sensors is digital RS-485 BUS so that several IPIs can be connected together on one single cable. Weight 1.3kg

5 - EXTENSION ROD

Used to connect each IPI sensor together to create a full tilt profile. Specially designed quick connecting fittings on each end, together with an integral internal signal cable. Available in 0.5, 1, 1.5, 2, 2.5m lengths. (Special lengths are available on request).

Weights: 0.5m - 0.75kg; 1m - 1kg; 1.5m - 1.45kg; 2m - 1.9kg; 2.5m - 2.35kg

5A - EXTENSION ROD WITH SETTLEMENT SENSOR

Extension Rod with internal Positional Sensor to create a full settlement profile.

6 - MAGNETIC TARGETS

Attached to the outside of the casing to measure vertical displacement.

7 - BOTTOM WHEEL/TERMINATION ASSEMBLY

Fitted with a rigid joint, the bottom wheel assembly acts as the base reference from which all other readings are taken. It is fitted with an integral end termination resistor which is required at the end of the RS-485 string. Fitted with an eye bolt for support rope. Weight 0.5kg.

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Accessories & Ordering Information

DATA ACQUISITION

GeoLogger CR Series (Pic 1) – Specification will vary.

WI-SOS 480 Digital Node (Pic 2) - Wireless digital node that can be connected to a maximum of 30 sensors.

RS-485 to RS-232 Interface (Pic 3) - Enables digital RS-485 sensors to be used with Campbell Scientific loggers.

Nexus Geo Readout

SOFTWARE

GeoAxiom (Pic 4) – Software which provides data handling, storage, visualisation, alarms, reporting and web-based access. specification will vary according to project requirement.

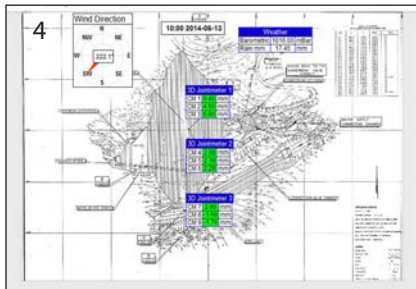
G-TILT - Data display software for use with Windows Tablet

ELECTRICAL

Extension Cable Type - 800/TP/04/050/PUR/GY/8.0

End of line resistor

EMC Splice Kit



ORDERING INFORMATION

Number of installations

Depth to first & last sensor

Sensor spacing per installation

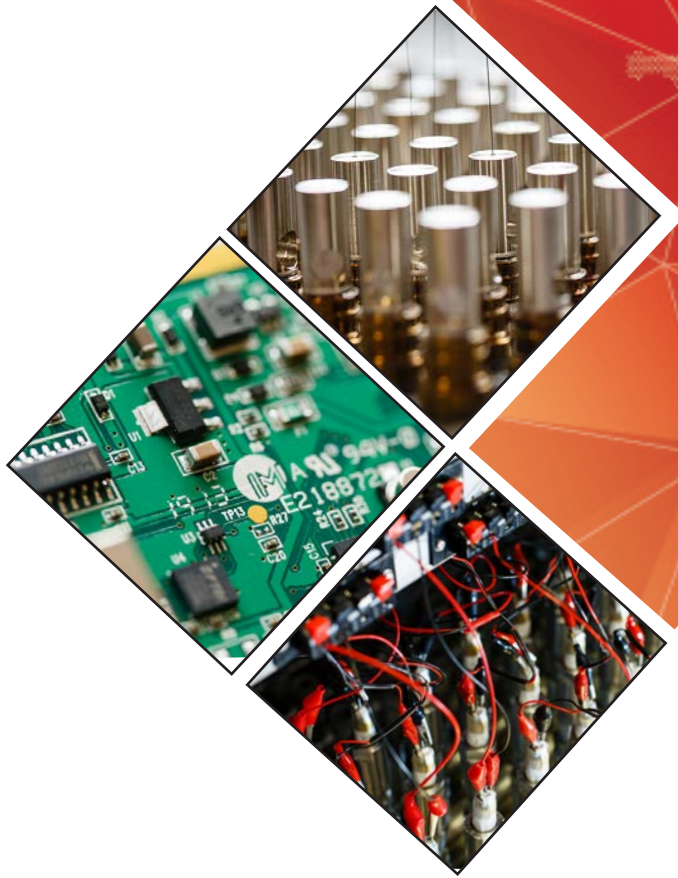
Casing diameter

Safety support rope

Data acquisition type

Data visualisation

Extension Cable



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