DATASHEET

In-Place Inclinometer

Proven MEMS technology
Uniaxial & biaxial options
Excellent temperature stability
Single cable digital BUS system
No external connectors
Stainless steel construction
Waterproof rated to 20 bar

In-Place Inclinometer

Overview

The Geosense® In-Place Inclinometer System (IPI) measures tilt and is used to calculate rotation and/or displacement in a vertical, inclined, or horizontal orientation. It is available in either a Uniaxial or Biaxial version.

The system consists of a series of wheeled sensors placed at various depths within the casing which are connected together either with extension rods or wire rope.

A digital bus system consisting of one single cable runs the length of the chain of connected sensors eliminating the need for a separate cable for each sensor and thus reducing the amount of cable required.

The extension rod system (IPI-ER) uses specially-designed connection rods to link sensors which allows them to move independently to each other without influencing the sensors above or below. This provides a profile of displacement over the complete length of the installation and the extension rod lengths can be varied to suit individual gauge length requirements. Sensors can also be concentrated in areas where movement is expected.

The wire rope system (IPI-WR) is used where only specific zones are of interest rather than the profile of the entire borehole.

A specially-designed signal cable connection not only eliminates the need for external cables and connectors but ensures highly watertight joints and full EMC screening.

In-place inclinometers are typically used for safety critical applications where 'real time' monitoring and early warning is required in order to protect life and valuable assets. They are easy to automate using data acquisition systems and GeoAxiom Vista software.

APPLICATIONS

- Dams & embankments
- Retaining walls & deep excavations
- Slopes & embankments
- Tunnels & shafts
- Bridges
- Ground improvement

USED TO MONITOR

- Lateral displacement of soil or rock
- Lateral displacement of diaphragm walls
- Lateral displacement of retaining walls
- Lateral displacement of dam cores
- Downstream face of rock filled dams
- Settlement & heave under tanks

FEATURES

- EMC compliant to EN 61326-1:2013
- Uniaxial & biaxial options
- High accuracy and resolution
- Universal sensor for all extension rod lengths
- Quick & easy to install
- Proven high quality MEMS sensors
- Single cable RS-485 digital BUS system
- Stainless steel construction
- Variable gauge lengths
- IP68 (20 bar) rated

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Specifications

MODELS			
Orientation	**Range[1]**	**Uniaxial**	**Biaxial**
Vertical	±15° from vertical	IPI-V-1	IPI-V-2
Inclined	±15° from 45°	IPI-I-1	IPI-I-2
Horizontal	±15° from horizontal	IPI-H-1	IPI-H-2
PERFORMANCE			
Accuracy[2]	±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		
Temperature sensor range	-40 to +85°C		
Temperature sensor accuracy	±1°C		
Operating temperature	-40 to +85°C		
Thermal stability	±0.005% FS/°C		
ELECTRICAL			
Supply input	8-15VDC		
Output signal	RS-485 Digital BUS		
Output unit	Sine of angle		
Sensor Type	MEMS		
PHYSICAL			
Probe diameter	32mm		
Probe gauge length	500mm		
Probe weight	1.3kg		
Compatible casing sizes	70-85mm		
Extension rods	0.5, 1.0, 1.5, 2.0, 2.5m x 25mm Ø		
Enclosure rating	IP68 (20 bar)		
MATERIALS			
Probe	316 stainless steel		
Extension rods	316 stainless steel or carbon fibre		
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		

[1] Other ranges available on request; [2] Using 3rd order polynomial

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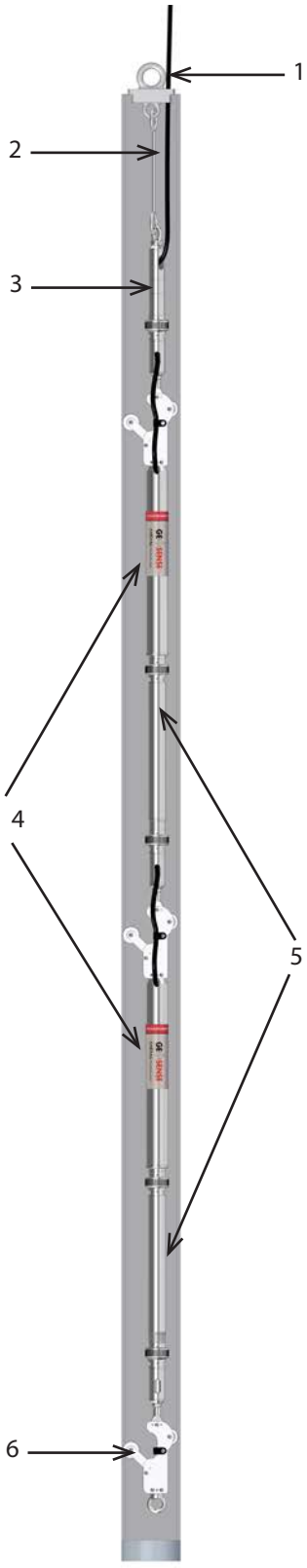
System Components - Extension Rod



SECURITY COVERS

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

1 - TOP HANGER - G38-511

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

INSTALLATION FORK - G38-507

Used to support the IPI 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 - G38-551/557

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 (G86-502). 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 - G38-502

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 (IPI - ER) - G38-201/202

Instrument fitted with one (Uniaxial) or 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 RODS - G38-351/355

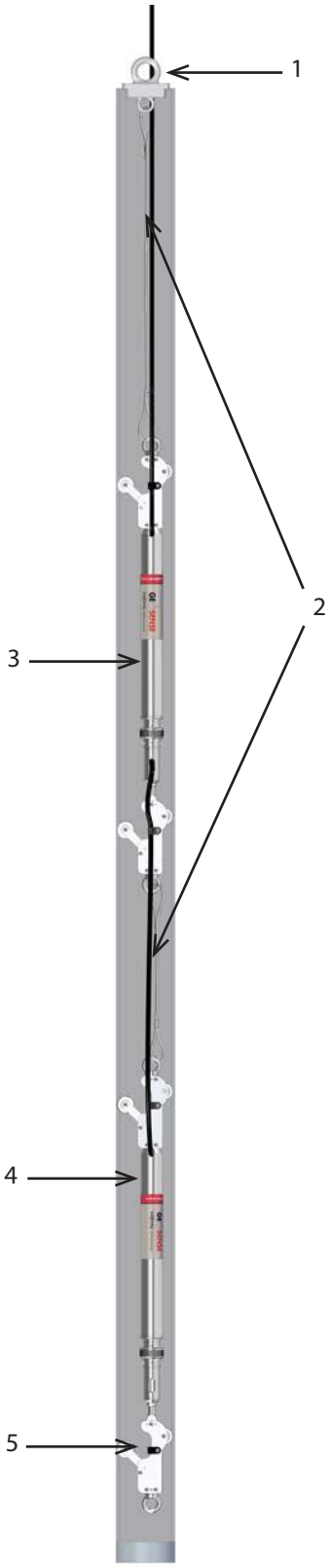
Used to connect each IPI sensor together to create a tilt profile. Specially designed quick connecting fittings on each end, together with an integral internal signal cable. Available in 0.5, 1, 1.5, 2, 2.5m lengths. (Special lengths are available on request).
Weights: 0.5m - 0.75kg; 1m - 1kg; 1.5m - 1.45kg; 2m - 1.9kg; 2.5m - 2.35kg

6 - BOTTOM WHEEL/TERMINATION ASSEMBLY - G38-506

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.

In-Place Inclinometer

System Components - Wire Rope



SECURITY COVERS

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

1 - TOP HANGER - G38-511

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

INSTALLATION FORK - G38-507

Used to support the IPI 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 EXTENSIONS - G38-551/557

A 3mm wire suspension rope used to suspend and connect each IPI-WR sensor. Available either as pre-assembled lengths (1, 2, 3, 4m) or supplied as site adjustable. Weight 0.05kg/m

3 - IN-PLACE INCLINOMETER (IPI -WR) TOP PROBE - G38-213/214

Instrument fitted with one (Uniaxial) or two (Biaxial) MEMS sensors which is placed at the top of the system from which all other probes are suspended. 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

4 - IN-PLACE INCLINOMETER (IPI -WR) PROBE - G38-211/212

Instrument fitted with one (Uniaxial) or 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 - BOTTOM WHEEL/TERMINATION ASSEMBLY - G38-506

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

Accessories & Ordering Information

DATA ACQUISITION

GeoLogger G8 Plus (Pic 1) – Specification will vary (G211-001)

WI-SOS 480 Digital Node (Pic 2) - Wireless digital node that can be connected to a maximum of 30 IPI sensors (G216-046)

RS-485 to RS-232 Interface (Pic 3) - Enables digital RS-485 sensors to be used with Campbell Scientific loggers (Q38-010)

10" Windows Tablet - Manual data display (G200-040)

SOFTWARE

GeoAxiom (Pic 4) – Software which provides data handling, storage, visualisation, alarms, reporting and web-based access. specification will vary according to project requirement (T10-020).

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

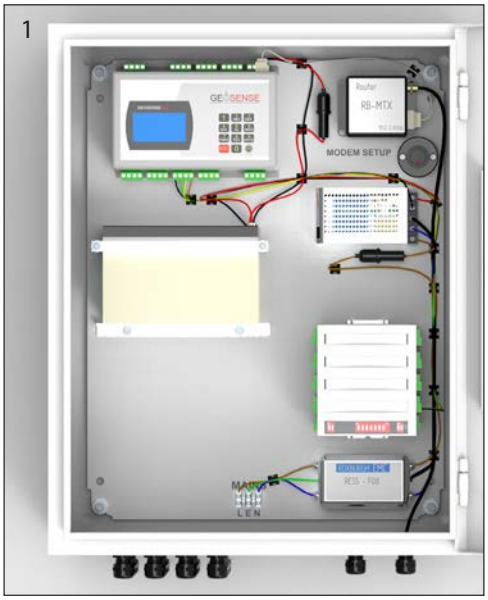
ELECTRICAL

Extension Cable Type - 800/TP/04/050/PUR/GY/8.0 (Q10-150)

End of line resistor (Q12-103)

EMC Splice Kit (Q12-105)

1



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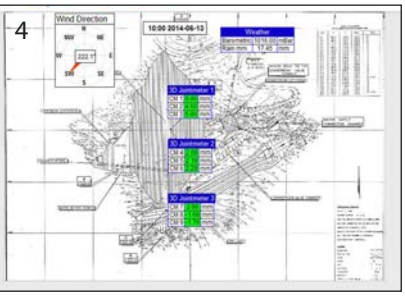

ORDERING INFORMATION

Number of installations	Safety support rope
Depth to first & last sensor	Data acquisition type
Sensor spacing per installation	Data visualisation
Casing diameter	Extension Cable