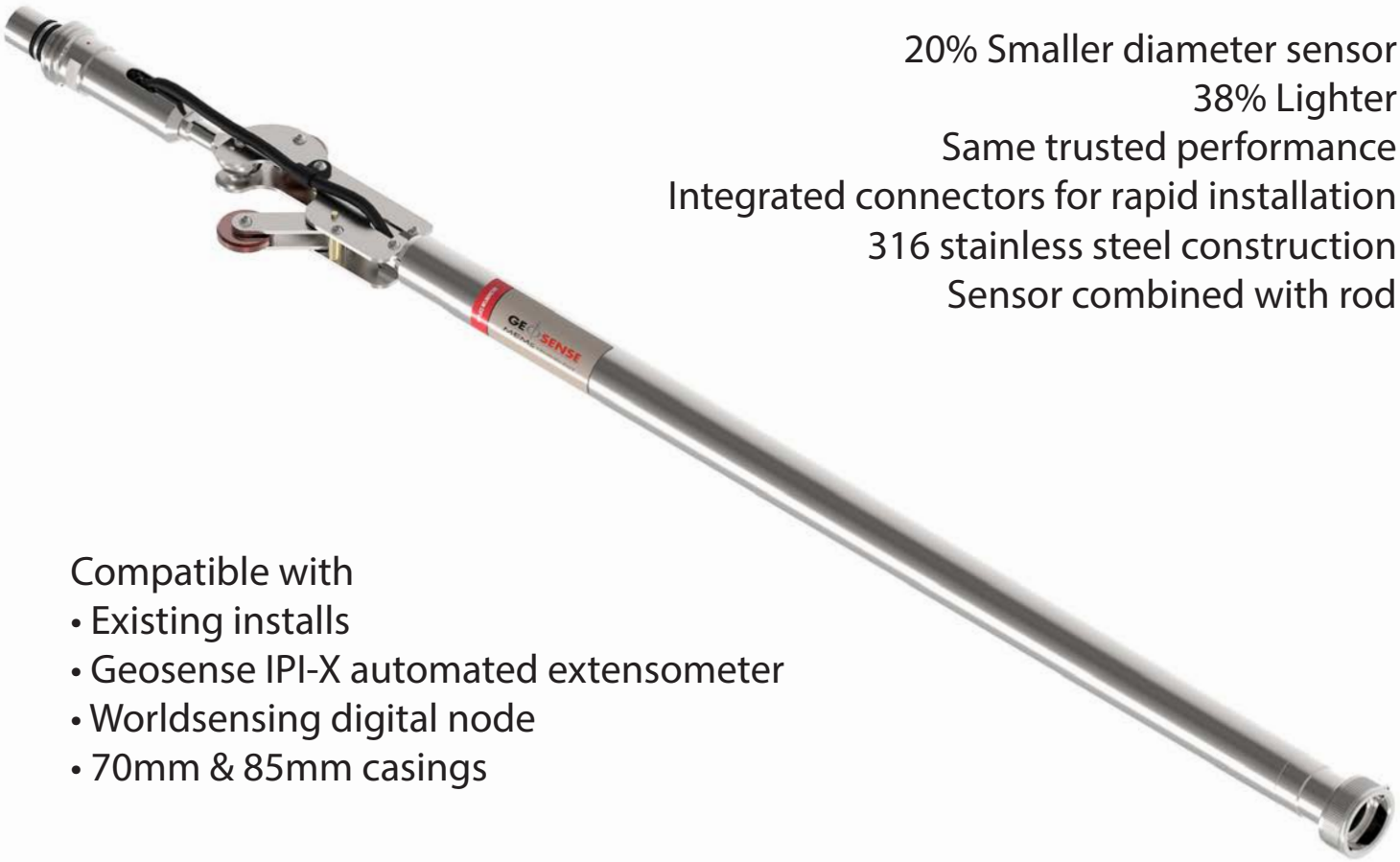
DATASHEET

IPI
In-Place Inclinometer



NEW & IMPROVED

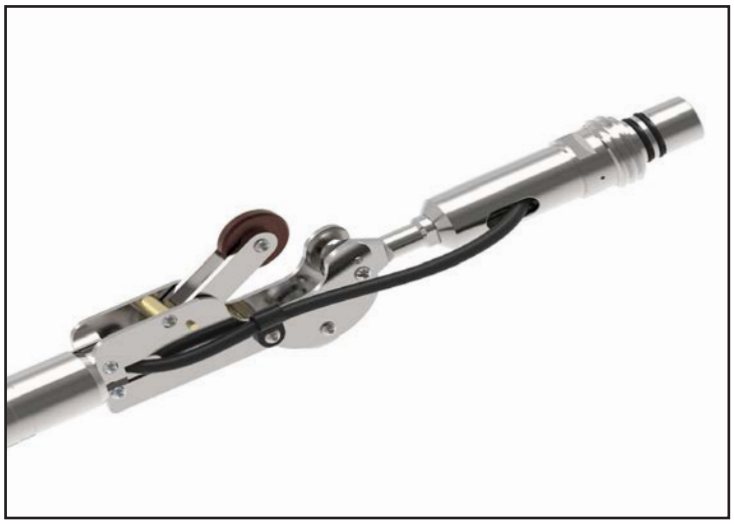
20% Smaller diameter sensor
38% Lighter
Same trusted performance
Integrated connectors for rapid installation
316 stainless steel construction
Sensor combined with rod

Compatible with
- Existing installs
- Geosense IPI-X automated extensometer
- Worldsensing digital node
- 70mm & 85mm casings

GEOSENSE

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 with either Uniaxial or Biaxial sensors and as a rigid rod or wire rope system.

It consists of a series of wheeled sensors of varying lengths, connected together and set at the required depths within the inclinometer casing.

This rigid rod system (IPI-RR) has specially-designed connections which link the sensors, allowing them to move independently to each other without influencing those above or below. This provides a profile of displacement over the complete length of the installation. The sensor gauge lengths can be varied to suit individual requirements. For example, more sensors can be concentrated in areas where movement is expected.

The wire rope system (IPI-WR) is designed for use where only specific zones are of interest rather than the profile of the entire borehole. In this system, sensors are linked with a wire rope rather than rods.

In both systems, a digital BUS runs the length of the chain of connected sensors eliminating the need for a separate cable for each sensor. 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
- 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

CE MEMS

In-Place Inclinometer

Specifications

MODELS

Orientation	Range	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[1]

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

Sensor diameter	25mm
Sensor weights	0.9kg (0.5m) , 1.3kg (1.0m), 1.8kg (1.5m), 2.3kg (2.0m), 2.7kg (2.5m), 3.2kg (3.0m)
Compatible casing sizes	70-85mm
Sensor gauge lengths	0.5m, 1.0m, 1.5m, 2.0m, 2.5m, 3.0m
Enclosure rating	IP68 (20 bar)

MATERIALS

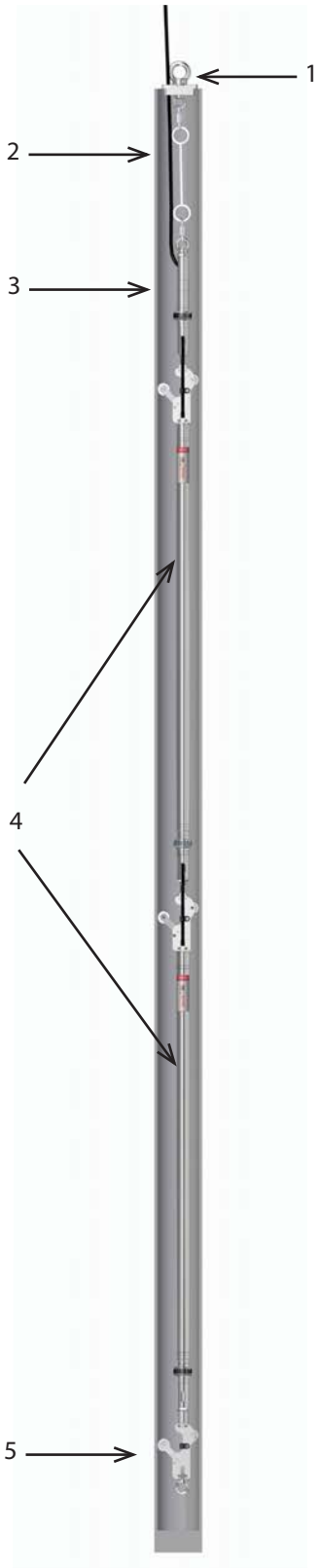
Sensor body	316 stainless steel
Wheels	Heat-treated 17/4 stainless steel
O-rings	Viton®

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] Results under laboratory conditions
[2] Using 3rd order polynomial

System Components - Rigid Rod



SECURITY COVERS

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

1 - TOP HANGER

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

INSTALLATION FORK

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

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 (IPI - RR)

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. Specially designed quick connecting fittings on each end, together with an integral internal signal cable. Available in 0.5m, 1m, 1.5m, 2m, 2.5m & 3m gauge lengths.
The output from the sensors is digital RS-485 BUS so that several IPIs can be connected together on one single cable.
Weights: 0.9kg (0.5m) , 1.3kg (1.0m), 1.8kg (1.5m), 2.3kg (2.0m), 2.7kg (2.5m), 3.2kg (3.0m)

5 - 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.

System Components - Wire Rope

SECURITY COVERS

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

1 - TOP HANGER

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

INSTALLATION FORK

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

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 SENSOR

Instrument fitted with one (Uniaxial) or two (Biaxial) MEMS sensors which is placed at the top of the system from which all other sensors 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 0.9kg

4 - IN-PLACE INCLINOMETER (IPI -WR) SENSOR

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 0.9kg

5 - 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

In-Place Inclinometer

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 IPI sensors.

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

10" Windows Tablet - Manual data display.

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

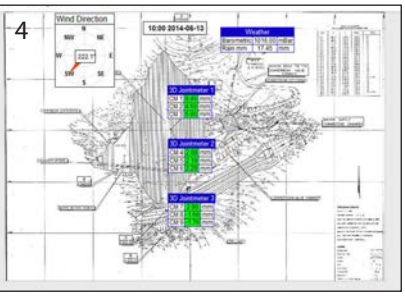
EMC Splice Kit

1

2

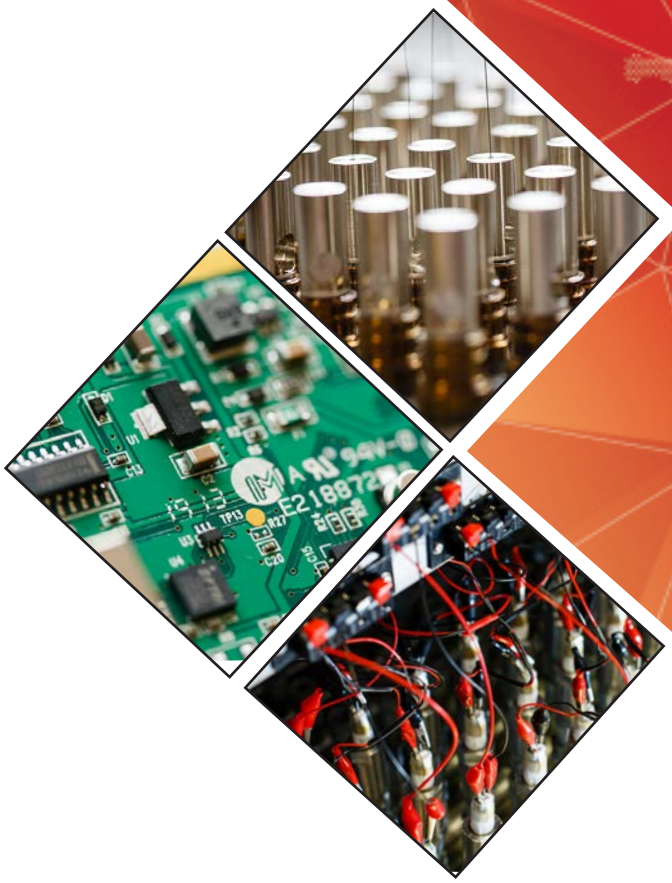
3

4



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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