GEOSmart HORIZONTAL IN-PLACE INCLINOMETER (METRIC)

Description

The GeoSmart system is a string of closely spaced MEMS sensors ideal for geotechnical applications such as tracking ground movements induced by tunnel construction, embankment settlement in roadways, levees, and retaining walls, subsurface conditions beneath large diameter storage tanks, and landslide activity in areas above dams, highways, and railroads to provide early warning of slope failure.

Advantages

Real Time Monitoring: The GeoSmart system is ideal for continuous, unattended monitoring and can deliver readings in near-real time.

Single-Cable Installation: Each sensor connects to the previous sensor above, requiring only one signal cable for each string and making data logger wiring easy.

Convenient Shipping and Transport: GeoSmart systems are made easy to ship. Five segments, each 0.5 m long, easily fit in a carton measuring approximately 64 x 64 x 64 cm and weighing less than 2.13 kilograms.

This makes the logistics of a GeoSmart installation easy. You can send the packages to a job site through overnight mail, carry a GeoSmart array in the trunk of your car, or even strap it to the cargo rack on an ATV and haul it to a remote job location.

We also offer placement rods to install at the end of the system, letting you save money by only monitoring the zone of interest.

Durable Components: Nodes, cables, connectors and gage rods are exceptionally durable, making it practical to remove the systems at the end of the project and redeploy them on other projects.

Data Reduction: The GeoSmart system outputs the displacement as engineering units, requiring less computing power and a lighter load on your data acquisition system. No need to keep track of what node has what calibration coefficients or what order you installed the segments in – the data logger detects and configures this automatically.

Complete Solutions: We offer complete monitoring solutions that include data loggers and web-based monitoring software that can check for alarm conditions in near-real time and can plot data immediately after retrieving the readings.

MICROELECTROMECHANICAL SYSTEMS (MEMS)

MEMS

Microelectromechanical Systems, or MEMS, is a technology that uses miniaturised mechanical and electromechanical elements that are made using the techniques of microfabrication. The physical dimensions of MEMS devices can vary from well below one micron all the way to several millimetres.

Our MEMS microsensor is a small discrete device that converts a measured mechanical signal, gravity (g) into a voltage signal.

Operation

The system can contain up to 200 sensor nodes in a string installed in 85 mm or up to 50 nodes in a 70 mm inclinometer casing.

The casing provides access for subsurface measurements. The joints between sensors are robust, allowing the system to maintain a consistent orientation of all the nodes.

The GeoSmart is typically installed in a horizontal casing that passes through a suspected zone of movement. The nodes are spaced at 50 cm and provide a reading resolution similar to a traversing probe. The system spans the zone of movement and when the ground moves, the casing moves with it, changing the inclination of the nodes inside.

Cumulating the deflections along the string produces a graph of the casing profile. Changes indicate settlement or heave.

The GeoSmart system uses a data acquisition system to transmit readings to a data logger or cloud processing software that can trigger alarms based on displacements.

GEOSmart System Configuration

A GeoSmart system requires casing, GeoSmart Segments, a suspension kit, a bottom/terminal plug and a jumper cable.

- **Casing:** Choose 70 mm or 85 mm diameter inclinometer casing.
- **GeoSmart Segments:** Choose the number of GeoSmart Segments required, and casing diameter.
- **Suspension Kit:** Order one suspension kit for each installation. The kit includes the suspension gate and hardware for securing the first segment.
- **Signal Cable:** Each string requires a bottom plug to seal the end of the signal cable and a jumper cable to connect to the data logger.
- **Data Logger:**
- **Campbell Scientific:** The GeoSmart system works with many Campbell Scientific data loggers. The CR6 or CR1000Xe can log two GeoSmart systems per logger directly. The CR350 can log two GeoSmart strings.
- **GTecLink Wireless Dataloggers:** Use the GTecLink data loggers for easy wireless data monitoring. The GeoSmart Node works with up to 50 GeoSmart nodes with an external power source or 10 GeoSmart nodes with internal power.
- **Data Reduction Software:** Process the GeoSmart data with a spreadsheet or the Sensly web-based monitoring system.

THE TECHNICAL RATING FOR THIS PRODUCT: **INTERMEDIATE**

As the correct installation of any monitoring sensor or system is vital to maximise performance and accuracy, Soil Instruments makes the following recommendations, for the skill level of the installation contractor.

ADDITIONAL SUPPORT

We offer installation and monitoring services to support this system. For more information please email : **sales@soilinstruments.com** or call **+44 (0) 1825 765044**

ADVANCED

The installer is trained and experienced in the installation of this type of instrument or systems, and is ideally a specialist Instrumentation and Monitoring contractor. Soil Instruments can support installation of advanced systems and provide training.

INTERMEDIATE

The installer already has previous experience and/or training in the installation of this instrument or system.

BASIC

As a minimum the installer has read and fully comprehends the manual, and if possible has observed these instruments or systems being installed by others.

Specifications

Sensor Type	MEMS (Micro Electro-Mechanical Systems) tilt sensor for inclination readings in two axes.
Requirements	Minimum supply voltage of 10 Vdc. Maximum supply voltage of 30 Vdc. Digital RS485 signal requires Campbell Scientific or GTecLink data logger.
Weight	0.426kg per 50cm gauge length.
Calibrated Range	±30 degrees from horizontal over a temperature range of -10°C to +40°C.
Resolution	9 arc seconds or 0.04 mm/m using the CR1000XE data logger.
Repeatability	±82 arc seconds or ±0.4 mm/m.
Required Casing	Fits 70 mm or 85 mm outer diameter inclinometer casing.
Waterproof	Waterproof to 2 MPa.

Sensors per Chain

Number of Nodes	Max Jumper Cable Length, m (12V Supply)	Max Jumper Cable Length, m (24V Supply)
10	320	-
25	122	-
50	52	215
75	24	139
100	5	97
125	-	69
150	-	47
175	-	28
200	-	12

Ordering Information

70 mm Inclinometer Casing

C2-SEG2.5-70H	GeoSmart Segment, 2.5M length, 5 nodes
C2-SEG2.0-70H	GeoSmart Segment, 2M length, 4 nodes
C2-SEG1.5-70H	GeoSmart Segment, 1.5M length, 3 nodes
C2-SEG1.0-70H	GeoSmart Segment, 1M length, 2 nodes
C2-DUM1.5-70H	GeoSmart Dummy Segment, 1.5M length
C2-DUM0.5-70H	GeoSmart Dummy Segment, 0.5M length
C2-SUS-C	GeoSmart Suspension Kit for 70mm casing

85 mm Inclinometer Casing

C2-SEG2.5-85H	GeoSmart Segment, 2.5M length, 5 nodes
C2-SEG2.0-85H	GeoSmart Segment, 2M length, 4 nodes
C2-SEG1.5-85H	GeoSmart Segment, 1.5M length, 3 nodes
C2-SEG1.0-85H	GeoSmart Segment, 1M length, 2 nodes
C2-SEG0.5-85H	GeoSmart Segment, 0.5M length, 1 nodes
C2-DUM1.5-85H	GeoSmart Dummy Segment, 1.5M length
C2-DUM0.5-85H	GeoSmart Dummy Segment, 0.5M length
C2-SUS-85	GeoSmart Suspension Kit for 85mm casing

Jumper Cables/Terminal Plug

C2-END-6P	GeoSmart Cable End Plug
C2-JUM-10M	Jumper cable, 10m, GeoSmart to Logger
C2-JUM-25M	Jumper cable, 25m, GeoSmart to Logger
C2-JUM-50M	Jumper cable, 50m, GeoSmart to Logger

Pull Cable*

C2-PULL	Pull Cable
C2-CARA	Extra Carabiner
C2-SADD	Extra Saddle Clamp

Pull cable is 1/8" stranded stainless steel cable and is used to draw probe to far end of casing.
Order one pull cable for each casing installation. If using a dead-end pulley, length of pull cable should be at least twice the length of the casing.

Data Loggers

D1	Cambell Scientific Data Logger System
D9-DIGITAL	GTecLink Digital Node
D1-GEO-BOX	Geosomart Box

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