MEMS Digital In-Place Inclinometer System

Description

MEMS Digital In-Place Inclinometer Systems (IPI) are designed to measure lateral movement when remote and continuous monitoring is required. Each IPI employs MEMS accelerometer sensors housed inside a 28.1 mm (1.125 in) diameter, water-tight, stainless steel enclosure. The sensor body is rigidly connected to a 25.4 mm (1.0 in) diameter bay rod which establishes the length of the IPI. Multiple IPIs are assembled with pivots allowing sensing of displacement over discreet, configurable intervals. Wheel assemblies centralize the pivot point and establish the azimuth of each IPI. They are available in sizes to fit 70 mm (2.75 in) or 85 mm (3.34 in) OD inclinometer casing. The sensors are read through a connectorized signal cable which chains together multiple sensors. A data logger is used to monitor the deflection of each sensor on the digital bus. If necessary, an alarm can be triggered when movement reaches a threshold rate or magnitude.

SPECIFICATIONS

MEMS Digital In-Place Inclinometer Sensor Specifications

Range	± 30°
Resolution	0.0002° (0.004 mm/m)
Sensor Accuracy	± 0.002° (0.03 mm/m)[1]
Sensor Precision	± 0.0013° (0.02 mm/m)1 ± 0.0005° (0.01 mm/m)2
Sensor 24 h Stability	± 0.03° mm/m[1] ± 0.01° mm/m[2]
System Precision	± 0.5 mm for 30 m IPI (15 sensors @ 2 m, 6 months, repeatability conditions in borehole)
Sensor	MEMS (Micro-Electro-Mechanical Systems) Accelerometer
Temperature Dependent Uncertainty	± 0.016 mm/m/°C (±0.001°/°C) , for ± 5° from vertical ± 0.033 mm/m/°C (±0.002°/°C) , for ± 15° from vertical
Temperature Accuracy	± 0.5 °C (0°C to 60°C) ± 1.0 °C (-40°C to 60°C)
Temperature Resolution	0.06°C

Electrical Specifications

Supply Voltage	5 to 15V DC
Operating Current	490 uA (Reading Average, per sensor)
Standby Current	<20uA (per sensor)
Signal Output	RS485 Digital Bus (MODBUS RTU Protocol)
Operating Temp.	-40 to 60°C (-40 to 140°F)

Mechanical Specifications

Ingress Protection	IP68 (2 MPa)
Gauge Length	0.5 to 3 m
Sensor Diameter	28.6 mm (1.125 in)
Bay Rod Diameter	25.4 mm (1.0 in)
Wheel Assembly	70 mm (2.75 in) 85 mm (3.34 in)
System Maximum Weight	180 kgf
Sensor & Bay Rod Assembly Weight (dry, submerged H20)	0.5m: 1.25, 1.00 kgf 1.0m: 1.63, 1.12 kgf 1.5m: 2.00, 1.24 kgf 2.0m: 2.37, 1.36 kgf 3.0m: 3.11, 1.60 kgf

[1]:99% Confidence Interval, [2]:68% Confidence Interval