HORIZONTAL
IN-PLACE INCLINOMETERS
**Horizontal In-Place Inclinometers**

Horizontal IPI gauge consists of a stainless steel body with on one side the connection for carbon fibre extension rod and on the other side a stainless steel carriage with spring-loaded wheels.

IPI string is composed by a chain of IPI gauges with carbon fiber extension rods and a terminal wheels assembly. A string of horizontal IPIs is usually installed inside inclinometer casing buried within trenches, foundations or horizontal drill hole for automatic monitoring of settlement or heave.

The string is connected to readout or datalogger with single digital bus cable.

**Applications**

- Embankment vertical displacements
- Settlement/heave in oil and gas tanks
- Slope deformation in earth and rockfill dams

**Features**

- Removable and modular system for multiple installation
- Nearly real-time monitoring with OMNIalog and miniOMNIalog
- Internal humidity and power supply sensor permit to have more information in the event of gauge malfunction

*Meet the essential requirements of the EMC Directive 2014/30/UE*
TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>0S441HD15S0</th>
<th>0S441HD30S0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement principle</td>
<td>self-compensated digital MEMS inclinometer</td>
<td></td>
</tr>
<tr>
<td>Axis</td>
<td>Uniaxial</td>
<td></td>
</tr>
<tr>
<td>Measuring range</td>
<td>±10°, ±15°</td>
<td>±20°, ±30°</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>see calibration report</td>
<td></td>
</tr>
<tr>
<td>Sensor accuracy</td>
<td>±0.025% FS</td>
<td>±0.070% FS</td>
</tr>
<tr>
<td>Lin. MPE</td>
<td>±0.010% FS</td>
<td>±0.015% FS</td>
</tr>
<tr>
<td>Pol. MPE</td>
<td>&lt; ±0.04 mm / m</td>
<td></td>
</tr>
<tr>
<td>Sensor 24h stability</td>
<td>±0.002° / °C</td>
<td></td>
</tr>
<tr>
<td>Offset temperature dependancy</td>
<td>from 8 to 28 Vdc</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>RS-485 with Modbus RTU protocol</td>
<td></td>
</tr>
<tr>
<td>Signal output and protocol</td>
<td>sigma-delta 32 bit, 38-KSPS</td>
<td></td>
</tr>
<tr>
<td>A/D converter</td>
<td>4.3 mA @ 24 Vdc, 8 mA @ 12 Vdc</td>
<td></td>
</tr>
<tr>
<td>Average consumption</td>
<td>from -30°C to +70°C</td>
<td></td>
</tr>
<tr>
<td>Temperature operating range</td>
<td>Temperature sensor (embedded in electronic board)</td>
<td></td>
</tr>
<tr>
<td>Built-in temperature sensor</td>
<td>from -40°C to +125°C / ±1 °C (-10°C + 85°C)</td>
<td></td>
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</tbody>
</table>

PHYSICAL FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>GAUGE AND WHEELS ASSEMBLY</th>
<th>EXTENSION ROD</th>
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</thead>
<tbody>
<tr>
<td>Material</td>
<td>stainless steel</td>
<td>stainless steel joint tips and carbon fiber rod</td>
</tr>
<tr>
<td>IP class</td>
<td>IP68 up to 1.0 MPa (2.0 MPa on request)</td>
<td></td>
</tr>
<tr>
<td>Casing compatibility (7)</td>
<td>Min. casing ID 58 mm - Max casing ID 83 mm</td>
<td></td>
</tr>
<tr>
<td>Gauge length / Total weight (8)</td>
<td>1.0 m length / 2.30 kg - 1.5 m length / 2.40 kg - 2.0 m length / 2.50 kg</td>
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</tbody>
</table>

1. Performance are granted for instruments installed in vertical casing installations where borehole inclination should be kept within ±2° of vertical, at any point along the borehole (ISO 18674-3).
2. Sensitivity is a specific parameter different for every gauge. The sensitivity is calculated during gauge calibration test and inserted into the Calibration Report.
3. MPE is the Maximum Permitted Error on the measuring range (FSR). In the Calibration Report, the accuracies of the gauge are calculated using both linear regression (≤ Lin. MPE) and polynomial correction (≤ Pol. MPE).
4. Stability calculated as difference after a 24 h period under repeatability conditions (ISO 18674-3).
5. 60 days test, reference reading taken 96 hours after installation, system composed by 15 BH-Profile gauges with 2m elongation rod. Test performed in nearly-repeatability conditions.
6. RS485 not-optoisolated Modbus communication with RTU Protocol. Default output is sen α, other units available are degree, mm/m and inch/feet (to be requested at order). Sisgeo Modbus protocol manual is available for download at this page.
7. We strongly suggest to use Sisgeo ABS casing.
8. As for ISO 18674-3 standard, total length should not exceed 2 m. Longer instruments available on request (performances of longer instruments could be worst).
EMBANKMENT APPLICATION

- push/fasten rod
- terminal carriage
- IPI gauge
- carbon fiber extension rod
- spring-loaded wheel
- support carriage

LNG TANK APPLICATION

- push/fasten rod
- terminal carriage
- IPI gauge
- carbon fiber extension rod
- spring-loaded wheel
- FOUNDATION CONCRETE SLAB
ACCESSORIES AND SPARE PARTS

CARBON FIBRE EXTENSION ROD 0S430EX00ORD
Extension rod rigidly connected to the IPI probe at factory. Available in different dimensions to reach a total probe length of 1.0 m, 1.5 m, 2.0 m and 3.0 m (length to be specified).

HORIZ. IPI TOP CAP 0DEXDT52350
Special cap with No.3 anchor that permits to fasten the horizontal IPI chain and fix it into the inclinometer tube.

TERM. WHEEL 0S44WHE2SS0
Composed by one fixed wheel and one spring loaded wheel. It permits to end the IPI chain.

PUSH/FASTEN RODS 0S4ROAD0AC00
Threaded steel bar with special ends for pushing IPI chain into the tube and fasten it to the top cap. Available in 1.0, 2.0 and 3.0 m lengths.

HORIZ. RODS SUPPORT CARRIAGE 0S4ROD0OSUP
Additional carriage to be inserted every 2m length of steel pushing rods in order to support the steel rod chain and to do not have any bending.

DIGITAL INCLINOMETER CABLE 0WE6061PDZH
LSZH cable for connecting digital BH profile chain to OMNIAlog datalogger.

UPPER CABLE WITH CONNECTOR 0S40OHD0OCT
Available in different lengths (2m, 5m, 10m, 15m), it is composed by a signal cable with IP68 connector to link the upper inclinometer probe to the junction box or local logger.

TERMINATION RESISTANCE 0ETERMRESI0
Resistance ending device with connector, needed to close every digital IPI chain. The value of resistor depends on the layout of the system. For more detail see the FAQ#076.

READABLE BY

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For further information refer to their own datasheets

SISGEOL offers on-line assistance service to the Customers in order to maximize the performance of the system and training on the correct use of the instrument/readout.

For more information contact mail: assistance@sisgeo.com