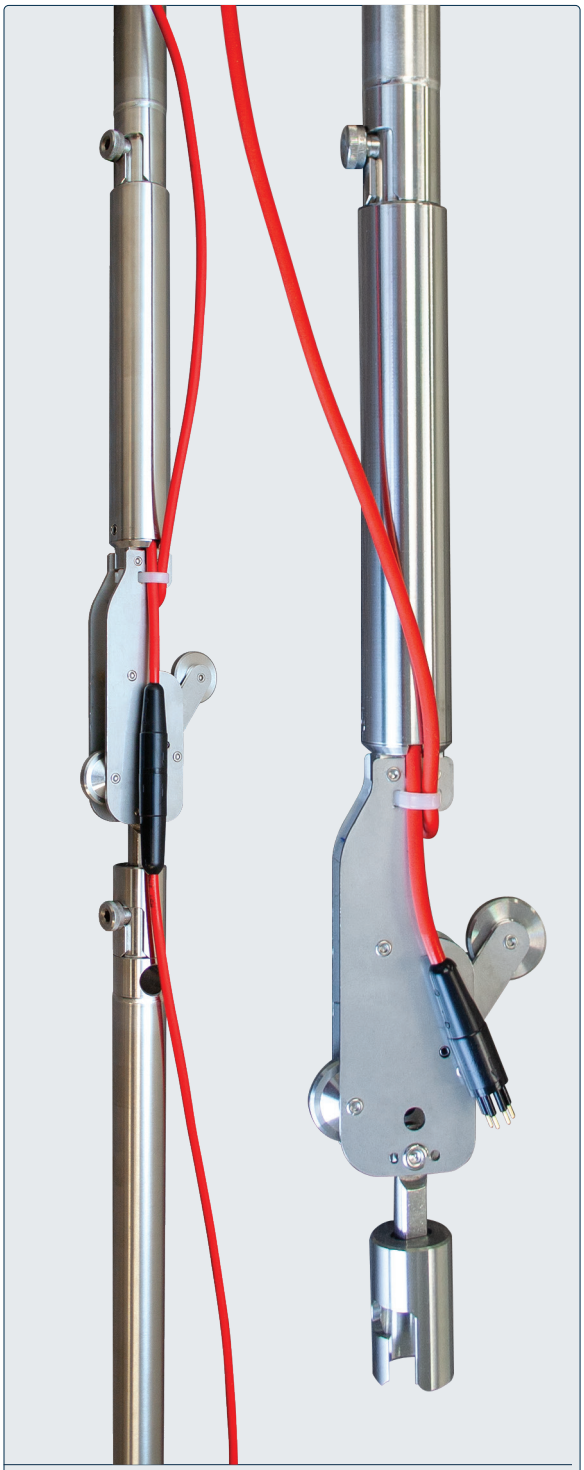
TEL 604 540 1100
info@rstinstruments.com
www.rstinstruments.com

RST Instruments Ltd.
11545 Kingston St.,
Maple Ridge, BC V2X 0Z5 Canada

ISO 9001



A close-up shows the signal cable which connects each sensor along the entire chain of inclinometer sensors forming a "digital bus"

WORKS WITH flexDAQ DATALOGGERS — READY TO RUN: pre-assembled, pre-wired, pre-tested, pre-programmed

PRODUCT CATEGORY:
INCLINOMETERS + TILT SENSORS

MEMS Digital In-Place Inclinometer System

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.

MEMS SERIES
TILT & INCLINATION

> WHY IT IS IMPORTANT

RST's MEMS Digital In-Place Inclinometer system typically uses rigid connecting bay rods between each sensor to achieve a continuous monitoring profile for your borehole and get a full understanding of the deformation.

Provides constant remote monitoring; early warning of movements is essential for protecting life and equipment.

> APPLICATIONS

Ideal for monitoring of:

Stability adjacent to excavations or underground workings	Deflection of piles, piers, abutments and retaining walls
Dams and embankments	Landslides

> FEATURES

Up to 70% reduction in installation time compared to RST's previous generation of IPIs - dependent on borehole configuration

IP68 (2 MPa), stainless steel enclosure	Wet-mate submersible connector
Precision locking & tools free bay rod connections	Reconfigurable bay lengths
Industry-leading system weight	Industry-leading low power consumption designed for battery powered datalogging

> BENEFITS

✓ **Increase safety**	✓ **Cost effective per sensor point**
✓ **High accuracy**	✓ **Custom options**

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MEMS Digital In-Place Inclinometer System

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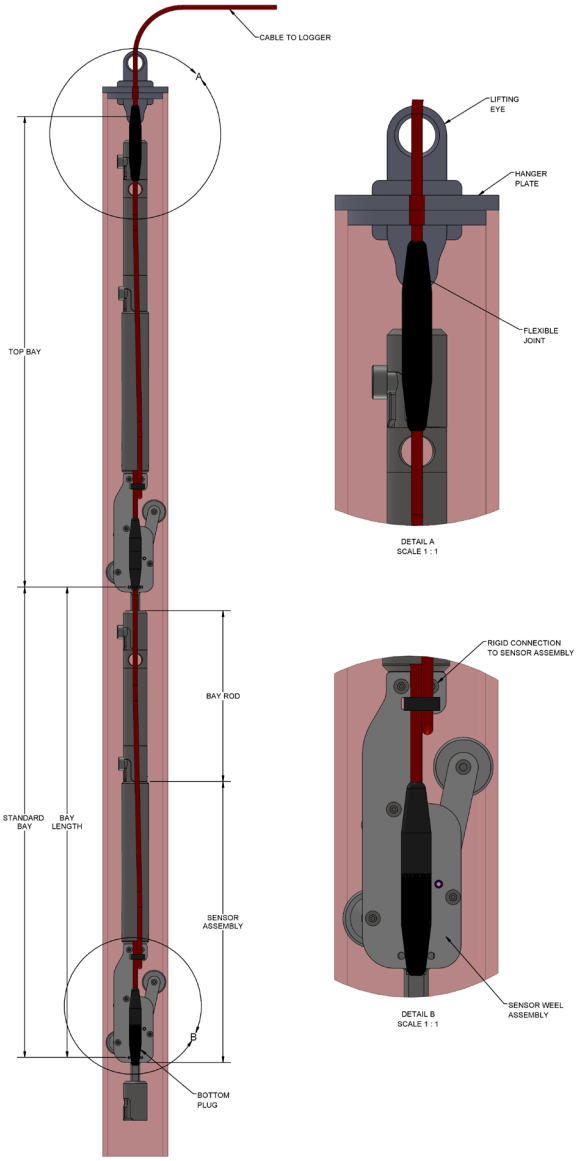
System Configurations

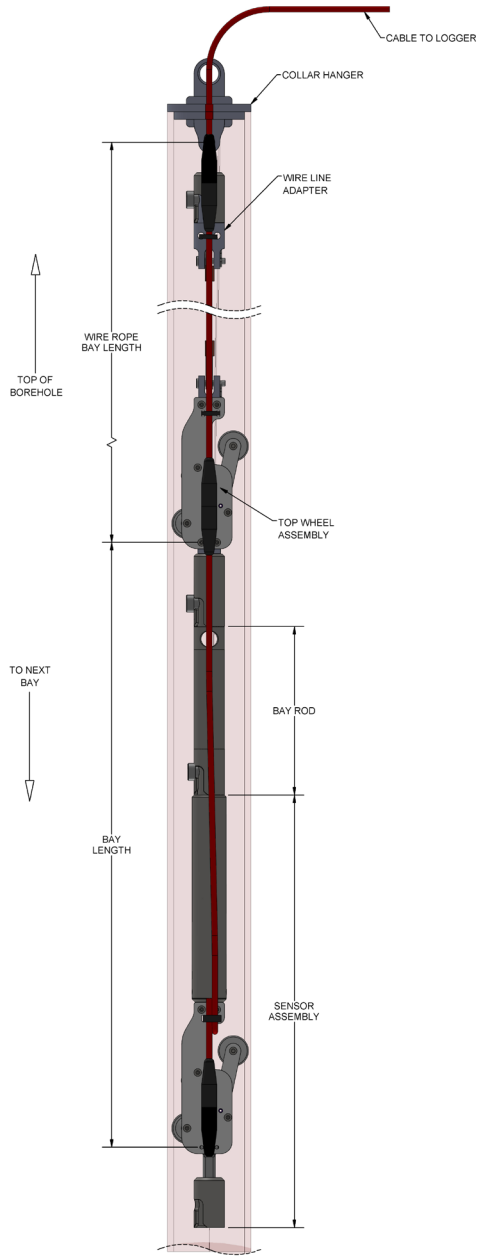
1. Standard

A standard configuration has sensors employed throughout the measured span of the inclinometer. The topmost bay is terminated by a collar hanger.



2. Wire Rope

Wire rope bays of configurable length can be inserted into the borehole configuration to omit measurement or place IPI sensors across a specific elevation.



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MEMS Digital In-Place Inclinometer System

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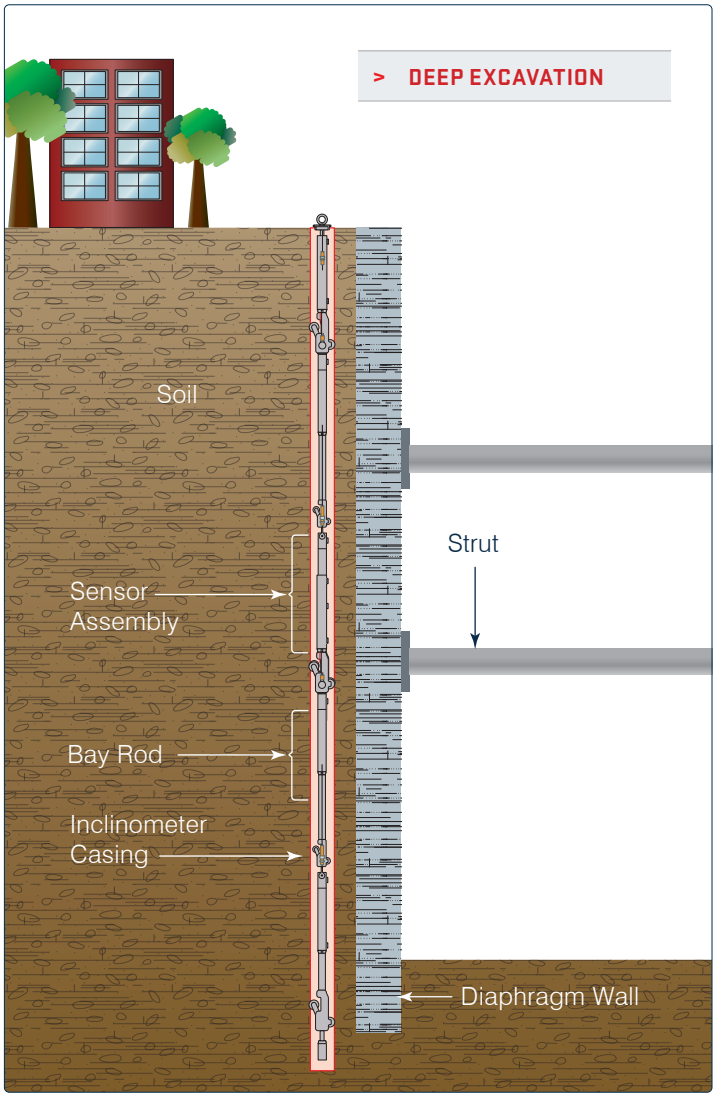
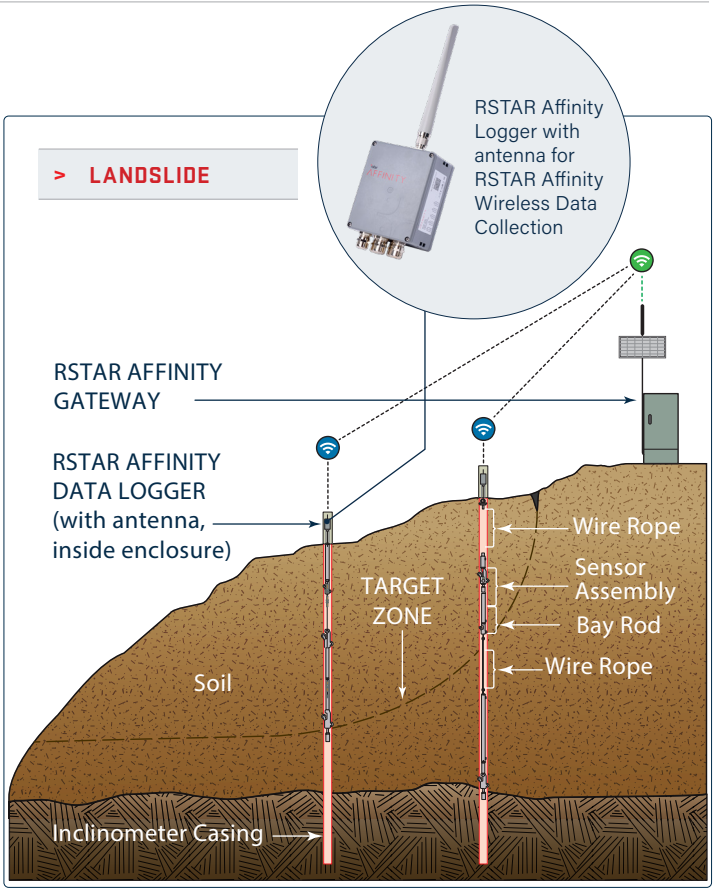
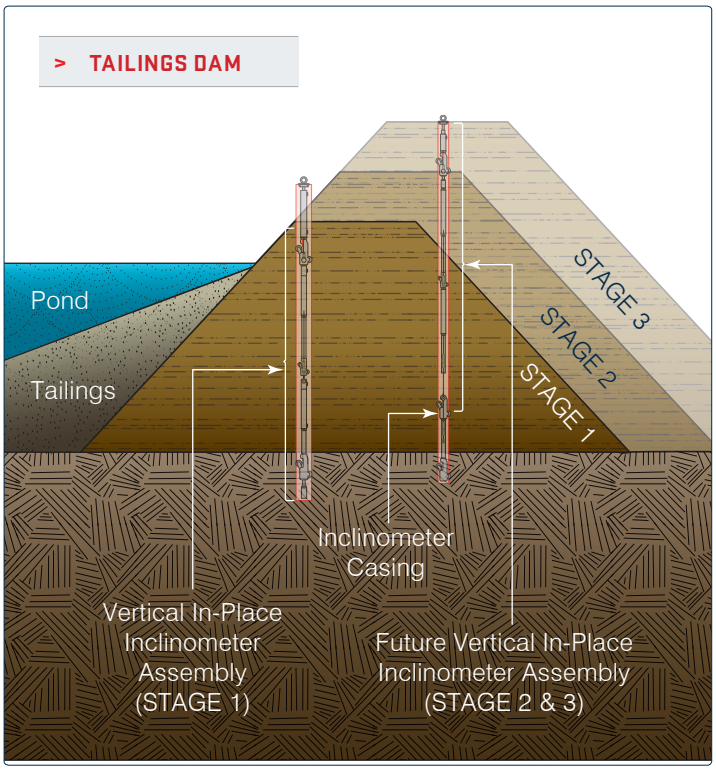
Installation Scenarios

The two main system setup types can all be installed interchangeably across all applications where lateral movement or deflection of structures can occur. The selection of the system setup type depends on site conditions and engineering requirements. As shown in the installation scenarios, the MEMS Digital In-Place Inclinometer System is ideal for long term installation in trenches, landslide areas, dams, and embankments.

Automated data collection methods can be made with the use of the RSTAR Affinity Data Logger, RST DT2485 DT-BUS Data Logger, or a FlexDAQ Data Logger System. For incorporating wireless data collection, the DT2485 is RSTAR and DT Link compatible and the RSTAR Affinity Data Logger forms part of the RSTAR Affinity Gateway and Digital Suite (see separate brochure(s) for details).







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MEMS Digital In-Place Inclinometer System

PRODUCT CATEGORY:
INCLINOMETERS + TILT SENSORS

SPECIFICATIONS + ORDERING

SPECIFICATIONS

SENSOR		
Range	± 30°	
Resolution	0.0002° (0.004 mm/m)	
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		
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		
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

OPTIONS >> CONTACT RST FOR DETAILS

Imperial lengths available upon request
Custom casing diameter wheel assemblies
Custom bay lengths available
DT2485: DT-BUS Data Logger
FlexDAQ Data Logger System
RSTAR Affinity Wireless Data Logger System

ORDERING: GENERAL INFO REQUIRED

Part number	Bay length
Number of boreholes	Wheel assembly size (70 or 85 mm casing)
Number of sensors per borehole	Optional wire rope bays and cables

ORDERING: BAY RODS

ITEM	PART #
0.5 m Bay Rod	IC8011
1.0 m Bay Rod	IC8012
1.5 m Bay Rod	IC8013
2.0 m Bay Rod	IC8014
3.0 m Bay Rod Bay Rod	IC8015
Custom Metric Length Bay Rod	IC8010
3.0 ft Bay Rod	IC8021
5.0 ft Bay Rod	IC8022
10.0 ft Bay Rod	IC8023
Custom Imperial Length Bay Rod	IC8020

ORDERING: BOREHOLE ACCESSORY KITS

ITEM	PART #
70 mm Borehole Accessory Kit (70 mm Collar Hanger, Bottom Plug, Safety Cable Attachment Kit, Extra Screws)	IC8000
85 mm Borehole Accessory Kit (85 mm Collar Hanger, Bottom Plug, Safety Cable Attachment Kit, Extra Screws)	IC8001

ORDERING: WIRE ROPE AND RELATED WIRE ROPE PRODUCTS

ITEM	PART #
Wire Rope (sold in meters)	IC8065
70 mm Wire Rope Accessory Kit (Wheel Assembly, Adapter)	IC8070
85 mm Wire Rope Accessory Kit (Wheel Assembly, Adapter)	IC8071

ORDERING: SENSORS

ITEM	PART #
Vertical 70 mm IPI	IPI27050-U-70mm
Vertical 85 mm IPI	IPI27050-U-85mm
Horizontal 70 mm IPI	IPI27050-D-70mm
Horizontal 85 mm IPI	IPI27050-D-85mm
Custom inclined sensors and models available on request.	

ORDERING: COLLAR HANGERS

ITEM	PART #
70 mm Hanger	IC8030
85 mm Hanger	IC8031

ORDERING: SAFETY LINE

ITEM	PART #
Safety Line (sold in meters)	IC8040
Safety Line Attachment Kit	IC8045

ORDERING: CABLES AND PLUGS

ITEM	PART #
5 m Top Cable	IC8051
10 m Top Cable	IC8052
20 m Top Cable	IC8053
Custom Length Top Cable	IC8050
Bottom Cable Male Plug	IC8060

SENSOR-TO-SENSOR COMMUNICATION CABLE FOR WIRE ROPE CONFIGURATION

ITEM	PART #
5 m	IC8085
10 m	IC8085-10M
15 m	IC8085-15M
20 m	IC8085-20M

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