rst INSTRUMENTS

Monitor
with
Confidence

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

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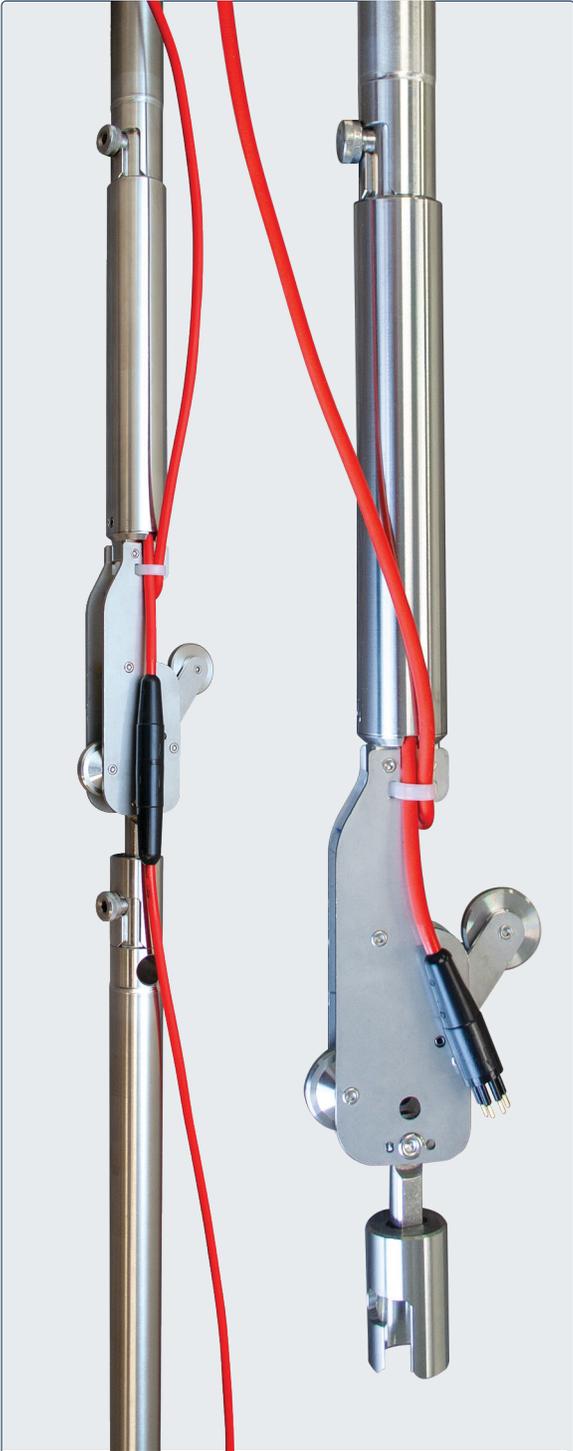Maple Ridge, BC V2X 0Z5 Canada

Certified System™
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

CE

> 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 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**

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-reading 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

PRODUCT CATEGORY:
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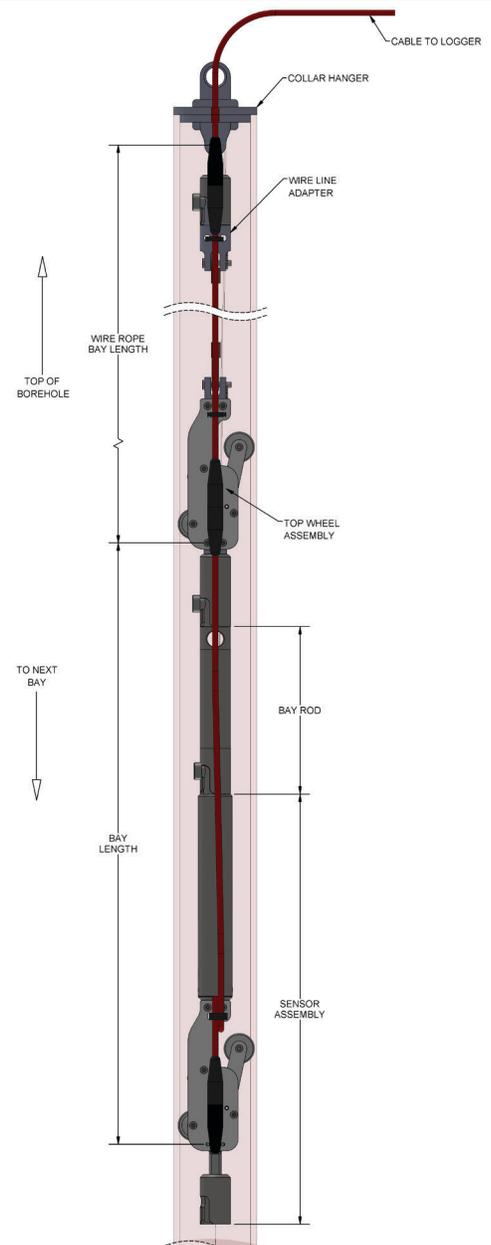
System Configurations

1. Standard

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

CABLE TO LOGGER

TOP BAY

BAY ROD

STANDARD BAY — BAY LENGTH

SENSOR ASSEMBLY

BOTTOM PLUG

A

LIFTING EYE

HANGER PLATE

FLEXIBLE JOINT

DETAIL A
SCALE 1 : 1

RIGID CONNECTION TO SENSOR ASSEMBLY

B

SENSOR WEEL ASSEMBLY

DETAIL B
SCALE 1 : 1
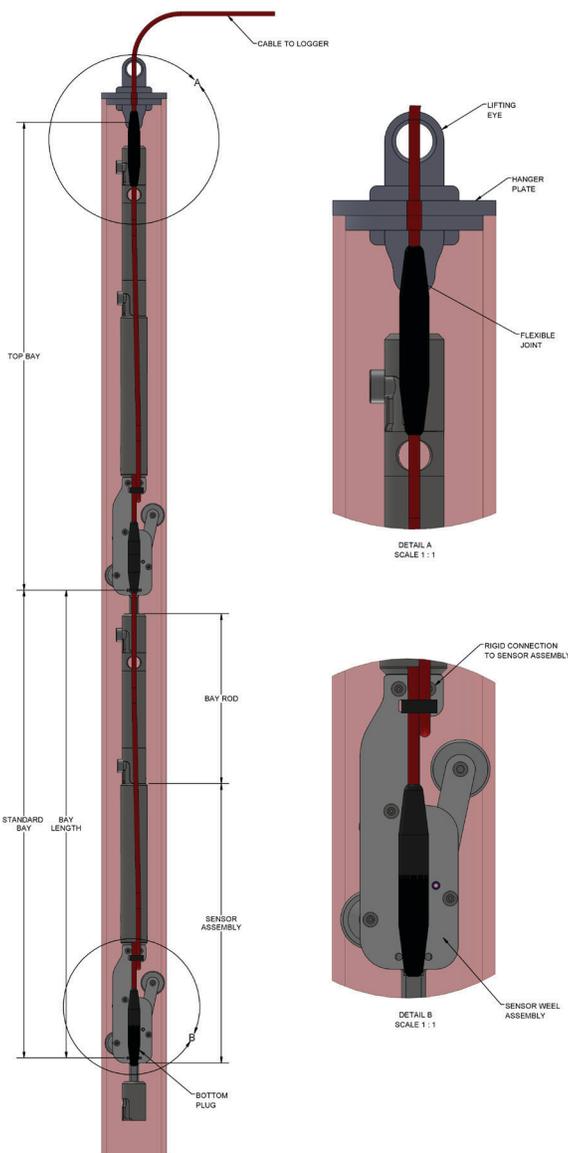
2. Wire Rope

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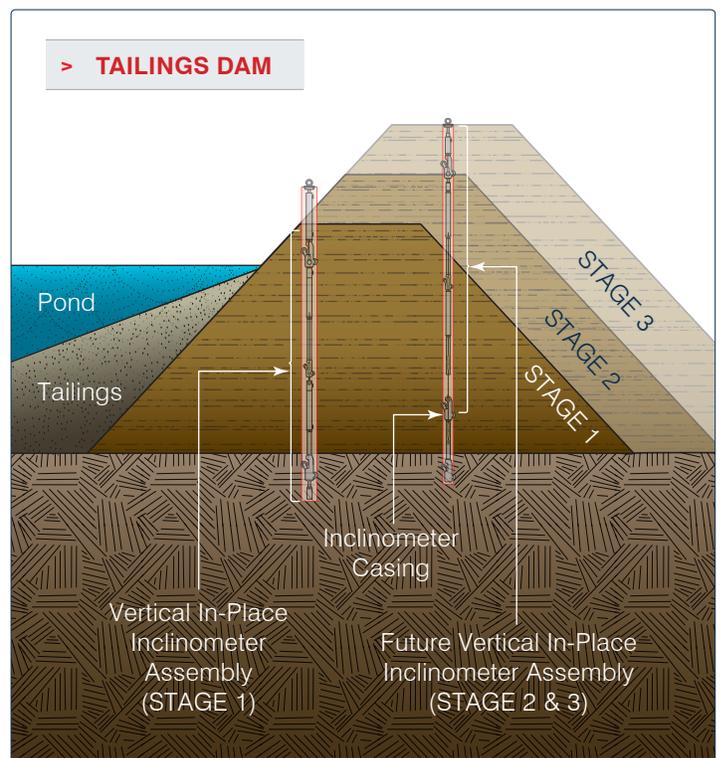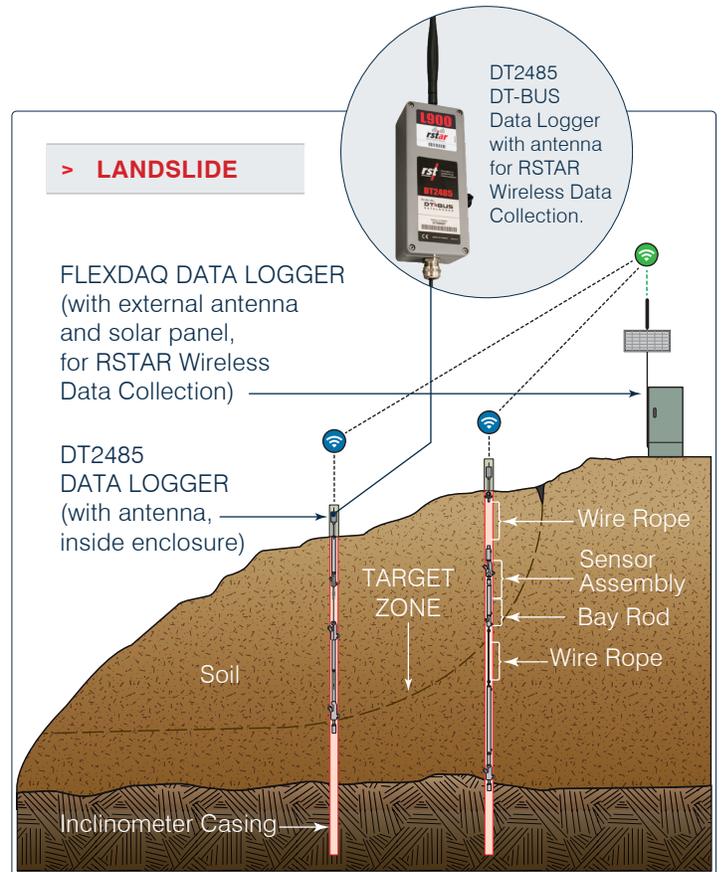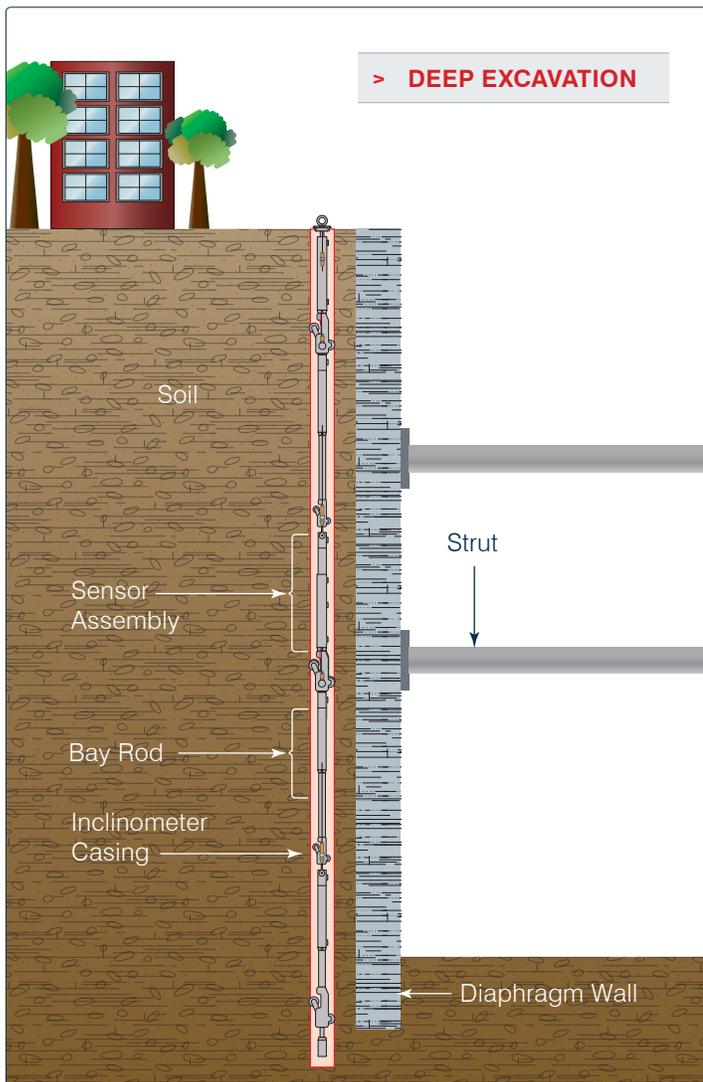

CABLE TO LOGGER

COLLAR HANGER

WIRE LINE ADAPTER

WIRE ROPE BAY LENGTH

TOP OF BOREHOLE

TOP WHEEL ASSEMBLY

TO NEXT BAY

BAY ROD

BAY LENGTH

SENSOR ASSEMBLY

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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 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.

> **LANDSLIDE**

DT2485
DT-BUS
Data Logger
with antenna
for RSTAR
Wireless Data
Collection.

FLEXDAQ DATA LOGGER
(with external antenna
and solar panel,
for RSTAR Wireless
Data Collection)

DT2485
DATA LOGGER
(with antenna,
inside enclosure)

Wire Rope
Sensor Assembly
Bay Rod
Wire Rope

TARGET ZONE

Soil

Inclinometer Casing

> **DEEP EXCAVATION**

Soil

Sensor Assembly

Bay Rod

Inclinometer Casing

Strut

Diaphragm Wall

> **TAILINGS DAM**

Pond

Tailings

STAGE 3
STAGE 2
STAGE 1

Inclinometer Casing

Vertical In-Place Inclinometer Assembly (STAGE 1)

Future Vertical In-Place Inclinometer Assembly (STAGE 2 & 3)

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SPECIFICATIONS + ORDERING

SPECIFICATIONS

SENSOR

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

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 80°C (-40 to 175°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

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
70 mm Wire Rope Wheel Assembly	IC8075
85 mm Wire Rope Wheel Assembly	IC8076
Male Adapter for Wire Rope	IC8080

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
Contact RST if a custom sensor is required.	

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
5 m Wire Rope Communication Cable Extension	IC8085

CE