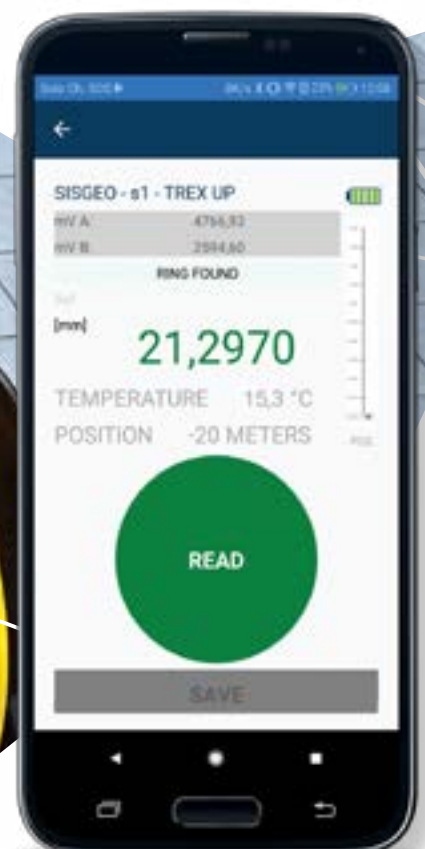


T-REX

T-REX

DIGITAL EXTENSOMETER

EXTENSOMETERS





T-REX

DIGITAL INCREMENTAL EXTENSOMETER

T-REX is a double-point probe-extensometer designed to measure the position of magnetic rings set along the axis of inclinometer casing. Measurements are later used to calculate changes in position, which indicate displacement.

The system is mainly composed by T-REX digital probe, B.R.A.IN bluetooth reel with control cable and APP compatible with Android and iOS mobile operative systems.

The electronics' readout is integrated into the reel and the BLE (Bluetooth Low Energy) wireless protocol permits a fast and safe communication.

The intuitive B.R.A.IN APP allows the user to manage the extensometer surveys and immediately share the readings with the most popular APP installed in the device (i.e. email, Dropbox, Whatsapp, Google DRIVE, OneDrive, iCloud Drive etc.)

Survey could be then imported in KLION software for data analysis and export professional and customizable reports.

APPLICATIONS

- Extrusion (detensioning) on tunnel face
- Vertical displacements in embankment dam
- Settlements along path of tunnelling machine
- Displacements related to consolidation activities

FEATURES

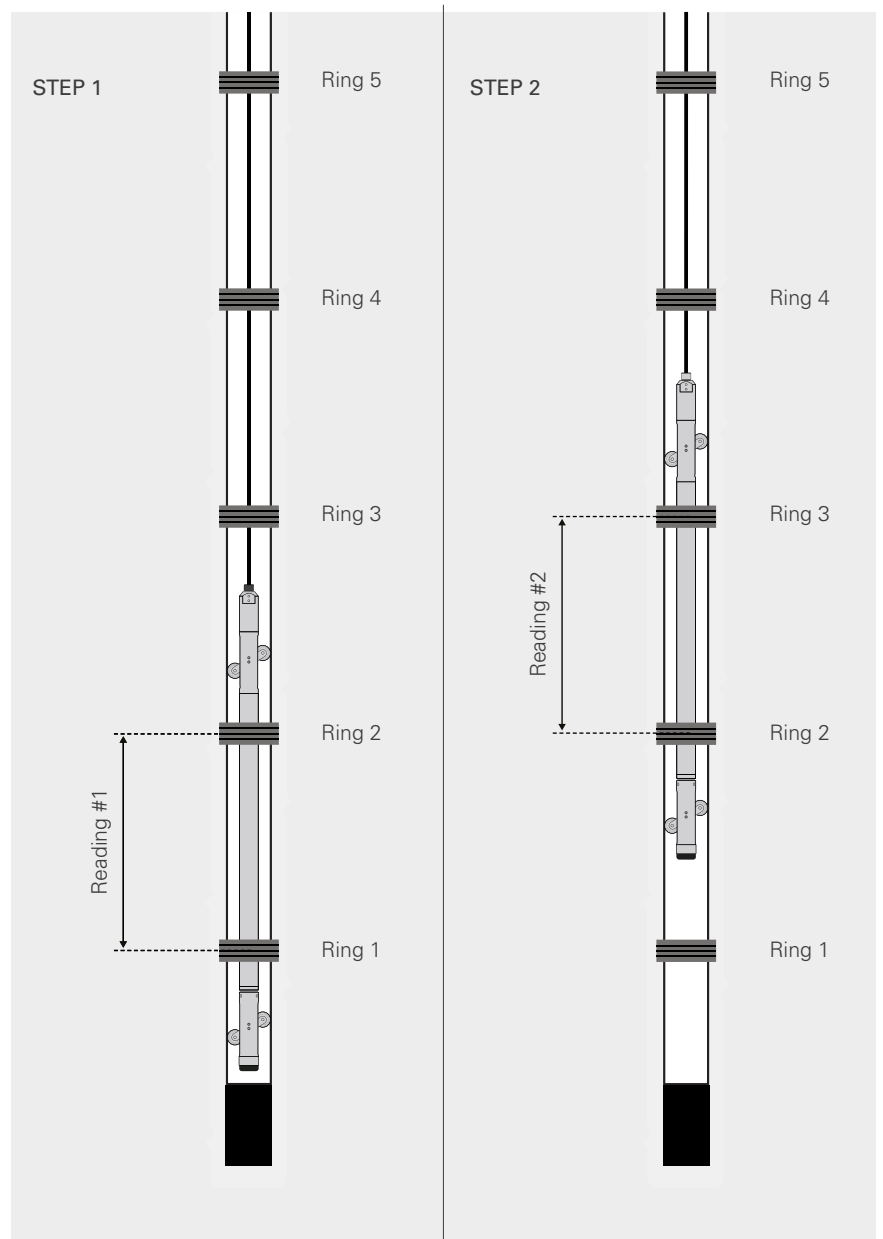
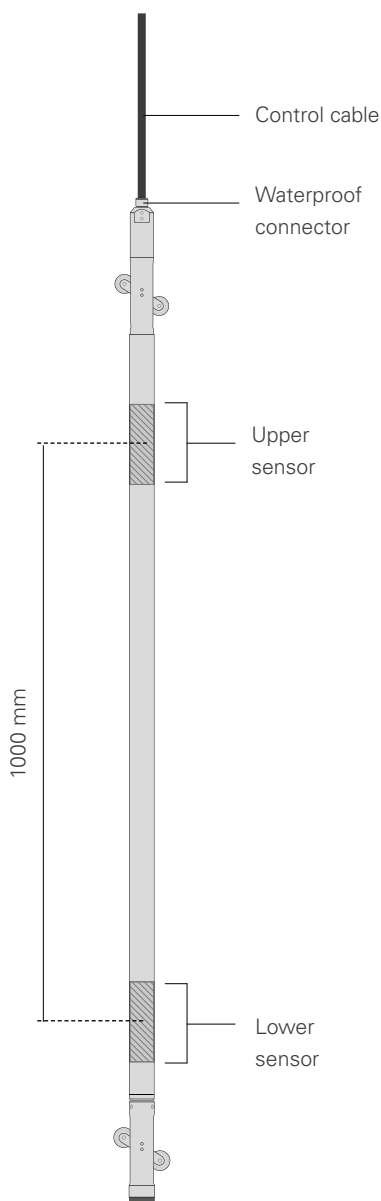
- Large measuring range for operation in both rock and soil
- High accuracy and repeatability
- Fully compatible with inclinometer components (casings' tubes, B.R.A.IN reels)
- On-site plots on APP



Meet the essential requirements of the EMC Directive 2014/30/UE

OPERATING PRINCIPLE

The T-REX system requires Sisgeo S143 ABS inclinometer casing installed with external magnet rings fixed at 1 meter intervals along the length of the casing. The T-REX probe has an aluminum body: two sensors inside the body are able to detect the magnetic field generated by the magnetic rings fixed to the casing. The sensors inside the probe are mounted exactly 1000 mm apart. The system is able to detect the relative distance between two rings with high accuracy. T-REX surveys usually start from the bottom of the casing, if the bottom is in stable ground. First, the operator reads the relative distance between the two lower rings (ring 1 and ring 2). Then, the operator pulls the probe 1000 mm upwards to read the relative distance between ring 2 and ring 3, then ring 3 and 4, and so on, until all rings have been read. The first complete survey of the ring positions serves as the reference (baseline) survey. Subsequent surveys are compared to the first. Changes in the distance between rings indicate settlements or heaves. It is possible to use the top ring as the reference, if the top of the casing is surveyed optically each time measurements are made.



B.R.A.I.N APP FOR T-REX SYSTEM MANAGEMENT



System information page allows you to have the entire system (device, probe and reel) always under control.



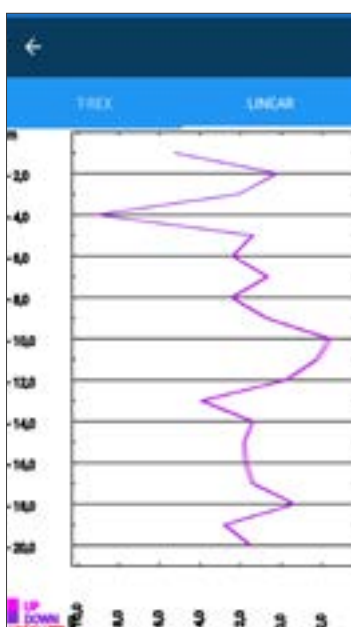
Various alarms can be settled in order to be always informed regarding the system health.



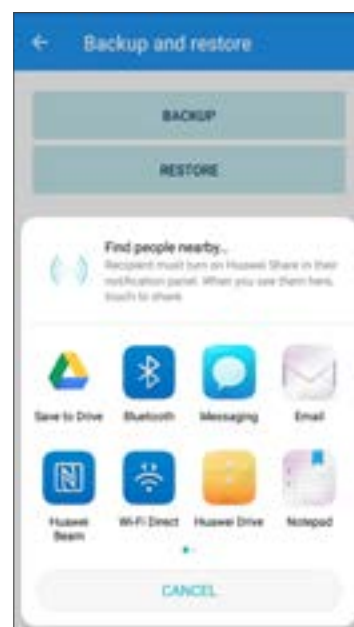
Reading page gives a lot of information such as actual position, data, probe internal temperature, etc.

	TREX	LINEAR
SISEO TEST DEMO T Rex level 18/12/2018 11:58:21		
#	UP	DOWN
-1.00	-5.2539	-5.2356
-2.00	-0.2497	-0.1616
-3.00	-2.0726	-2.0951
-4.00	-9.0958	-9.1243
-5.00	-1.3587	-1.4323
-6.00	-2.3515	-2.4272
-7.00	-0.6189	-0.7313
-8.00	-2.3699	-2.4896
-9.00	-0.6664	-0.7879
-10.00	2.5061	2.3092
-11.00	1.8315	1.6879
-12.00	0.3205	0.1579
-13.00	-3.8363	-3.9918
-14.00	-1.3349	-1.4701
-15.00	-1.7658	-1.8665
-16.00	-1.6658	-1.8267
-17.00	-1.3407	-1.4694

Data tables are available during and after the surveys.



Local displacement graph can be shown after the survey.



Survey data can be immediately sent through any sharing APP installed on your device such as Drive, email, etc.

Minimum Device Specifications
(device not supplied by SISGEO)

Bluetooth Low Energy BLE 4.2
ANDROID OS V. 7 or higher
APPLE iOS 11 or higher



BLUETOOTH REEL SPECIFICATIONS

Bluetooth module	band: 2.4 GHz ISM Band (2402-2480 MHz) - power: 4dBm Max		
Communication with device	BLE (Bluetooth Low Energy) 4.2		
On-board sensors ⁽¹⁾	Resolution	Accuracy	Range
- Temperature	0.01°C	±1°C (-10°C to +85°C)	-40°C to +125°C
- Humidity	0.025% RH	±5% (0 to 95% RH)	0 to 100% RH
- Battery voltage	0.01 V	±5% FS	0 to 36 V
Operating Temperature	-40 to 80°C (batteries -20 to 65°C)		
Communication with probe	RS485 Modbus RTU Protocol ⁽²⁾		
IP class and material	IP65, unbreakable synthetic rubber		
Environmental condition certification	certified for extended environmental conditions: altitude above 2000m		
Power supply	4 x 1.2 V - 5 Ah - Ni-MH rechargeable batteries		
Operating time with NiMH batteries ⁽⁴⁾	≈ 6 h with T-REX probe always on (APP in reading mode)		
Charger for NiMH batteries			
- Input voltage	90-264 Vac, 50-60 Hz		
- IP rate	IP41		
- Max output power	10 W		
- Temperature range	-20 +40 °C		
Led	Different colors for local notifications		
CE Directive compliance	2014/53/EU (RED)		

(1) On-board sensors are installed on the internal electronic board to give information in the event of BRAIN reel malfunction.

(2) RS485 not-optoisolated Modbus communication with RTU Protocol (4) Typical values



CONTROL CABLE

Control cable is used to move the probe incrementally and transmit readings from the probe to B.R.A.IN. bluetooth reel and then to the B.R.A.IN. APP.

The HD (Heavy Duty) cable is supplied assembled on B.R.A.IN. reel and includes a factory-attached connector for the probe.

B.R.A.IN. HD CABLE

HD cable has a stainless steel core wire to control stretching and a stainless steel torsion braid to prevent twisting. Yellow cable jacket has copper depth marks.

MODEL	0S2RC6000B0
Cable lengths	30,60,100,150, 200, 250 m
Conductors	6x0.50 mm ² (AWG 21)
Depth tactile marks	copper, every 500 mm
Max strength	370 kg
Outer jacket	yellow, polyurethane
Cable diameter	10.4 mm
Weight (cable+marks)	0.150 kg/m
Operating temp. range	-30 to 80 °C
Total weight with 60 m cable	14 kg with B.R.A.IN reel

T-REX PROBE TECHNICAL SPECIFICATIONS

MODELS

Applications

Measurement principle

Measuring range

Signal output and protocol

A/D converter

Probe resolution

Accuracy: Pol. MPE ⁽²⁾

Repeatability

Stability @24 hours ⁽³⁾

Temp. operating range

Power supply

Max consumption

On-board temperature sensor ⁽⁴⁾

- measuring range
- accuracy

On-board humidity sensor ⁽⁴⁾

- measuring range
- accuracy

On-board supply voltage monitor ⁽⁴⁾

- measuring range
- accuracy

Material

Body diameter

Measuring base length

Wheels carriage

IP class

Weight

CE compliant directive

OREX45100D0

vertical, horizontal, sub-horizontal

high performance displacement transducers

±40 mm

RS485 Modbus RTU ⁽¹⁾

sigma-delta 32 bit, 38-KSPS

0.0001 mm (with B.R.A.IN APP)

±0.2% FS (±0.16 mm/m)

±0.01 mm/m

±0.025 mm/m

-30°C to +75°C

from 8 to 28 V

127 mA@24Vdc

265 mA@12Vdc

- 40°C to +125°C

±1°C (-10°C to +85°C)

0 to 100% RH

±5% RH (0 to 95% RH)

0 to 36 V

±5% FS

aluminum body and steel parts

40 mm

1000 mm

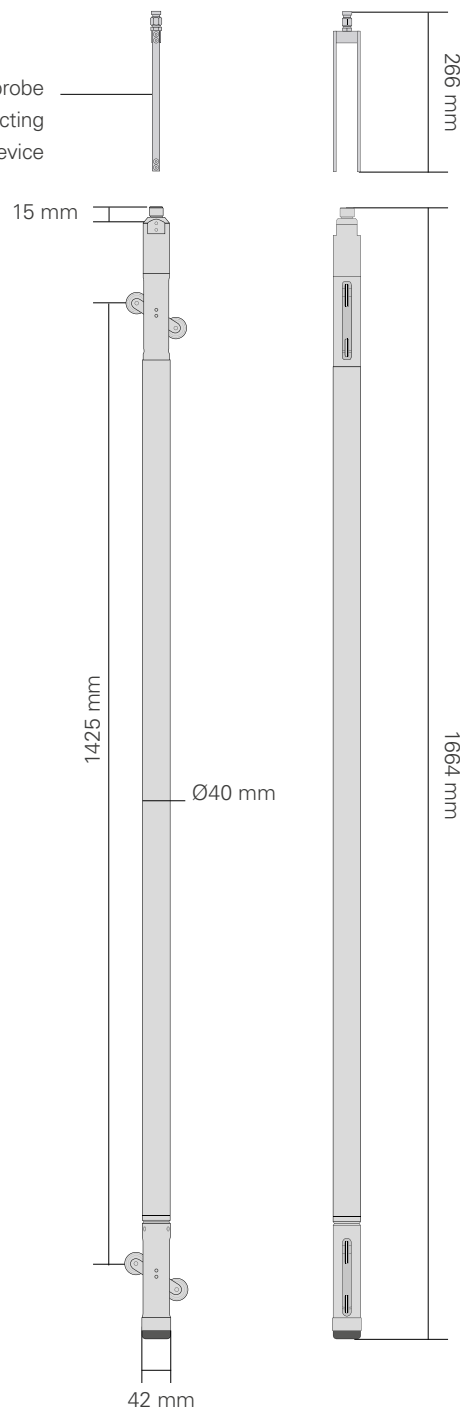
pair of wheels (Ø 32 mm) mounted on long-life sealed ball bearings

IP68 up to 2.0 MPa

5.4 kg (probe only)

2014/30/EU (EMC)

Rod-probe
connecting
device



(1) RS485 not-optoisolated Modbus communication with RTU Protocol

(2) MPE is the Maximum Permitted Error on the measuring range (FSR). In the Calibration Report, the accuracies of the gauge are calculated using polynomial correction (\leq Pol. MPE).

(3) Difference after a 24 h period under repeatability conditions, constant temperature, probe powered continuously.

(4) On-board sensors are installed on the internal electronic board to give information in the event of probe malfunction.

For any further information not inserted in this datasheet please refer to ISO 18674-3 international standard.

ACCESSORIES AND SPARE PARTS

T-REX POSITIONING DEVICE OREXOCS1000

Improves accuracy of vertical surveys. Required if measurements are critical. The positioning device has clamps for T-REX top cap (product code OREXOTS2350).

REPLACEMENT CARRYING CASE OREXOCASE00

Replacement shock-resistance carrying case for T-REX probe, made in aluminium.

SET OF 10 POSITIONING RODS OREXROD10BX

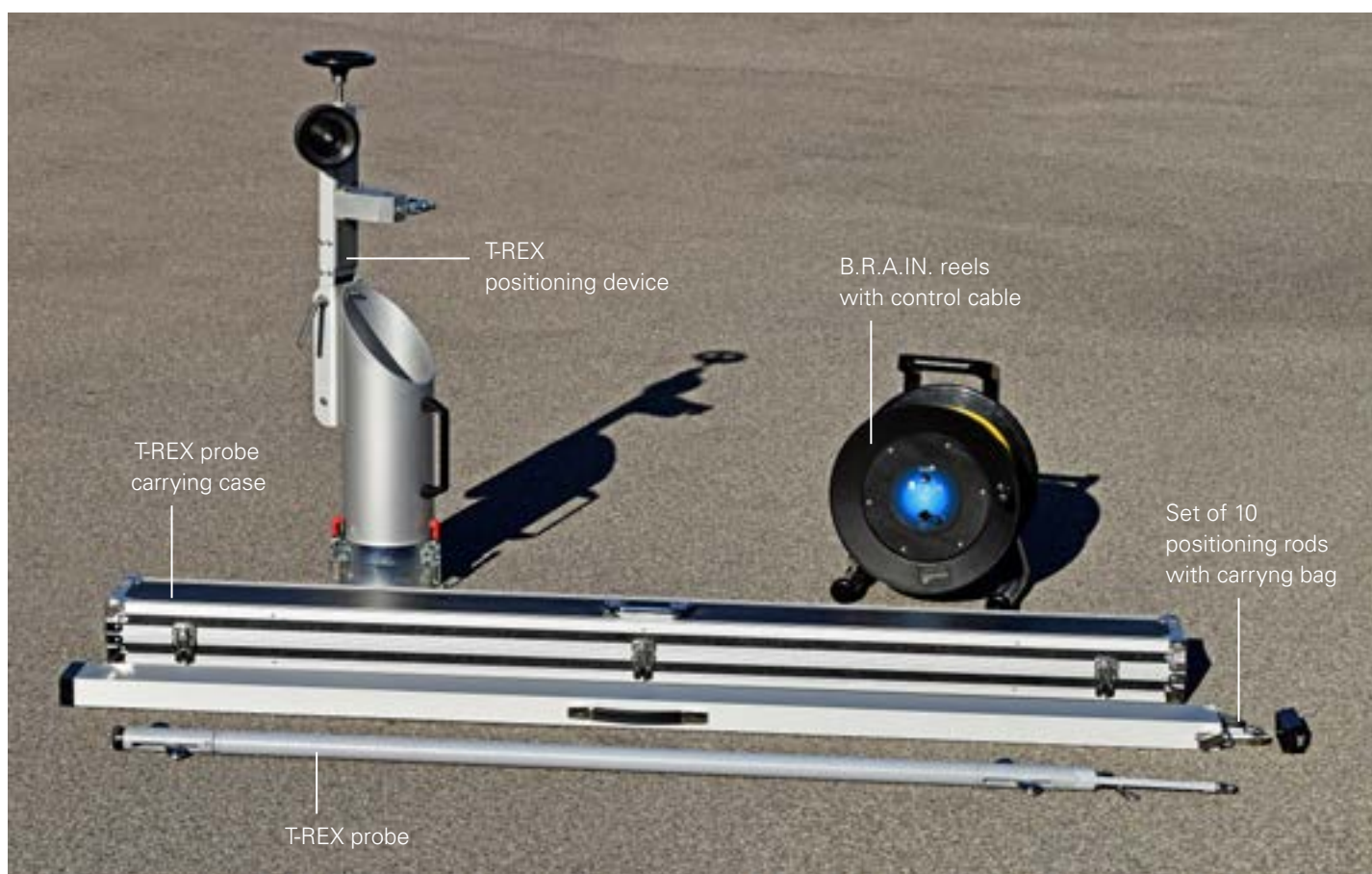
The positioning rods are needed for horizontal measurements with T-REX system. The aluminum rods are 2 meters long and have nickel-plated connectors. Supplied with carrying bag.

POSITIONING ROD OREXROD2000

Aluminum rod, 2 meters long, with nickel-plated connectors.

klion ANALYSIS SOFTWARE OSWKLION000

Klion Software processes measurements from T-REX system, providing incremental or cumulative displacements. For more information refer to the relevant datasheet.



T-REX complete system

MEASURING TUBES

The T-REX probe operates in S143 ABS inclinometer casings with magnet target rings externally attached every meter. In vertical applications, the T-REX top cap is needed to hold the positioning device. For horizontal applications, Sisgeo suggests to install the lockable top cap on the accessible end of the tube. For further information refer to S143 casing datasheet.

ABS INCLIN. CASING OS143107000

Easy-lock ABS inclinometer casing model S143, 3 m length, OD 70 mm, ID 58 mm.

BOTTOM CAP OS143TF7000

Simple bottom cap for Easy-lock casings, made of ABS. Suitable for inclinometer column or extenso-inclinometer column.

REPAIRING KIT FOR CASING OS143KITR00

Repairing kit for S143 Easy-lock casings composed by five spare couplings, mounting jig and glue.

ASSEMBLING KIT FOR 100 M OS143KIT000

Assembling set composed by 5 O-rings, locking wire and Sisgeo adhesive tape. (Mandatory)

RING SETTING ROD OREXODIMA00

Setting rod for positioning the rings 1 m apart.

LOCKABLE TOP CAP OS100CH1000

Lockable cap for horizontal application with survey pin permits topographical surveying in order to define and check the borehole coordinates.

MAGNET REFERENCE RING OREXORING93

Magnet ring for T-REX incremental extensometer OD 93 mm, ID 71 mm. Material: PVC with permanent magnet

T-REX TOP CAP OREXOTS2350

Lockable top cap for vertical application ready with fixing plate for T-REX positioning device.



FUNCTIONAL CHECK DEVICE (FCD)

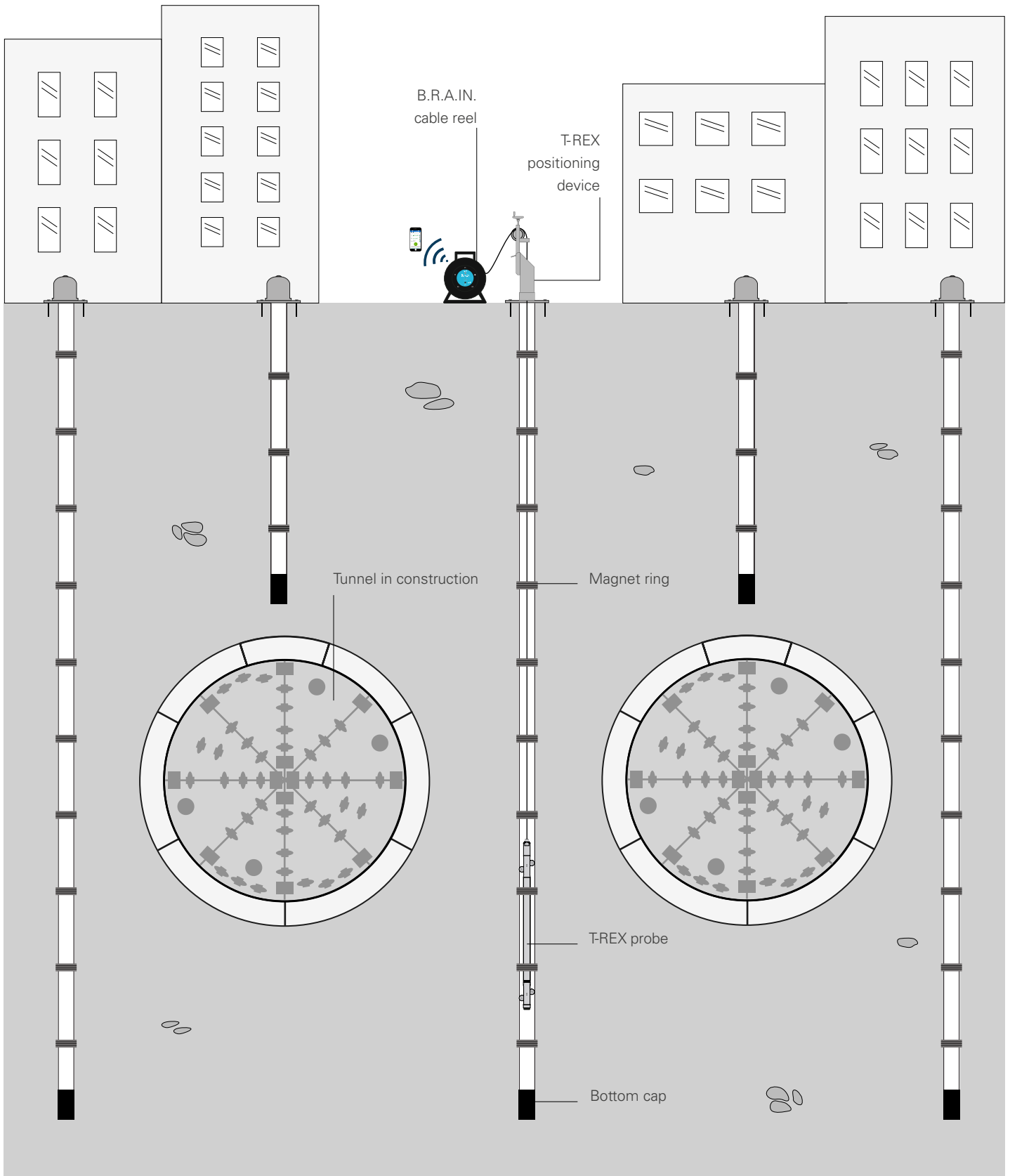
The aim of the Functional Check Device (FCD, product code **OREX0CAL0FR**) is to have a stable reference to verify that the T-REX probe, before and after the campaign readings, has the same check-value without offset caused by improper use of the probe (e.g., mechanical shock, electrical shock, etc.). This test is very important when very accurate readings are needed, i.e. within concrete or rocks.

FCD is NOT a tool to verify the probe calibration. The T-REX extensometer should be calibrated at least once a year, as required by the standard ISO 18674-2.

The test with FCD shall be done at constant temperature, so that we recommend to stock and use the FCD in a temperature-controlled room with a maximum $\pm 1^\circ\text{C}$ temperature gradient (e.g., $20^\circ\text{C} \pm 1^\circ\text{C}$).



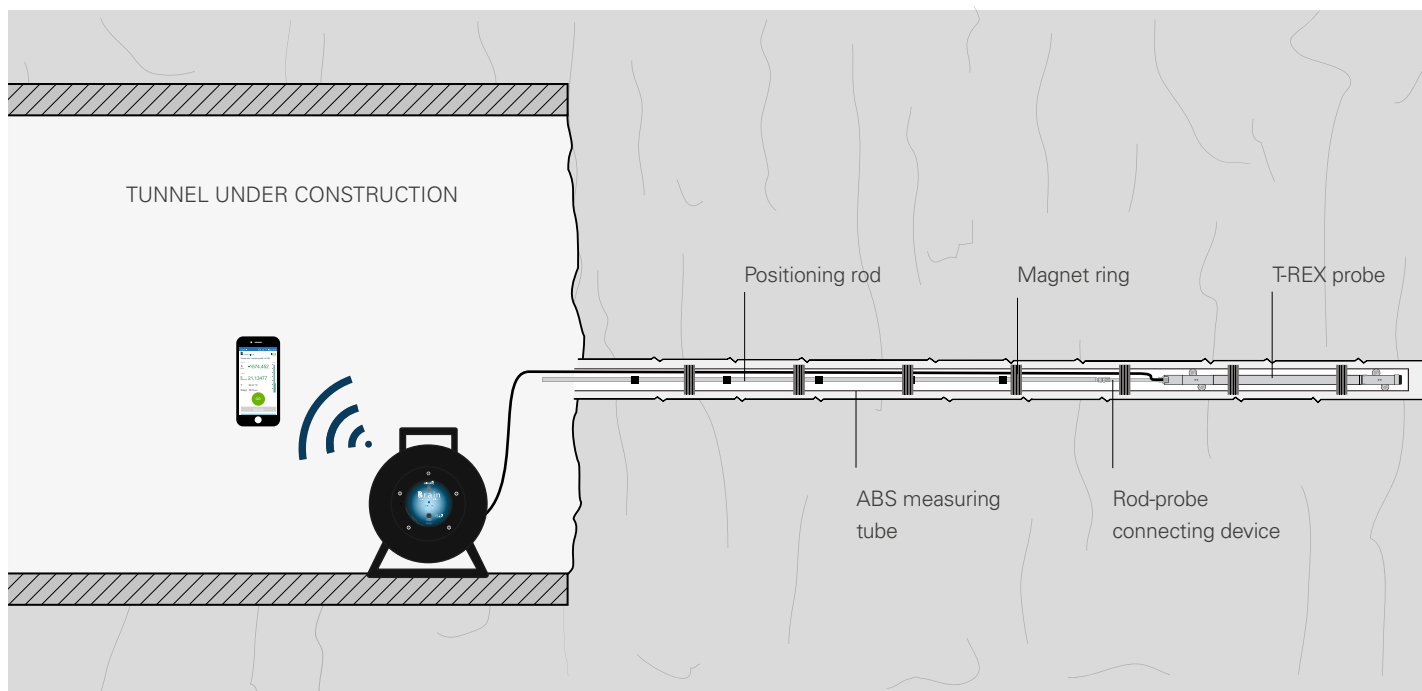
AN EXAMPLE OF 3-D (INCLINOMETER AND EXTENSOMETER) SURVEY IN TUNNEL APPLICATION



AN EXAMPLE OF TUNNEL FACE EXTRUSION

T-REX incremental extensometer is often used in tunnelling to monitor the tunnel face detensioning and ground displacement vs distance from the face.

The system consists of a measuring tube with pre-attached magnet target rings installed in a horizontal borehole drilled from the tunnel face. Usual tube lengths are 15 m to 30 m. The probe is inserted into the tube and pushed to reach the farthest magnetic ring. The first survey will give the zero position of all the magnetic targets. Subsequent surveys are performed after each tunnel excavation step (the exposed portion of the tube is destroyed at each step). These surveys are compared to the reference survey to calculate displacements of the face.



Preparing T-REX probe for horizontal surveying

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SISGEO S.R.L.

VIA F. SERPERO 4/F1
20060 MASATE (MI) ITALY
PHONE +39 02 95764130
FAX +39 02 95762011
INFO@SISGEO.COM

TECHNICAL ASSISTANCE

SISGEO offers customers e-mail and phone assistance to ensure proper use of instruments and readout and to maximize performance of the system.

For more information, email us: assistance@sisgeo.com