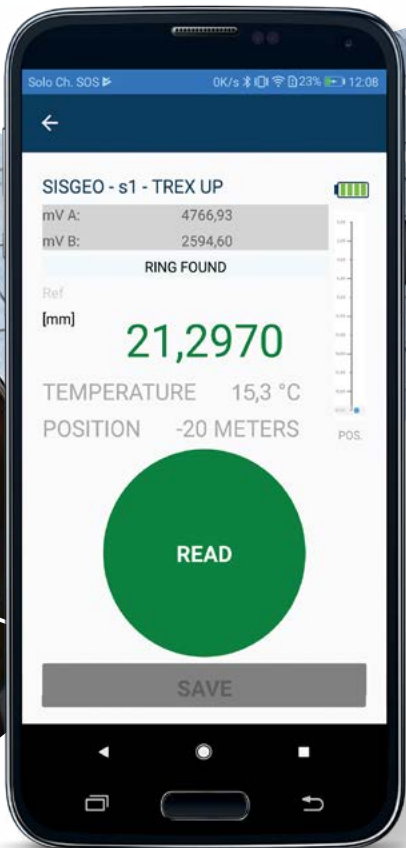


T-REX

T-REX

DIGITAL EXTENSOMETER

EXTENSOMETERS





T-REX

DIGITAL INCREMENTAL EXTENSOMETER

SISGEO designed the T-REX incremental extensometer 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

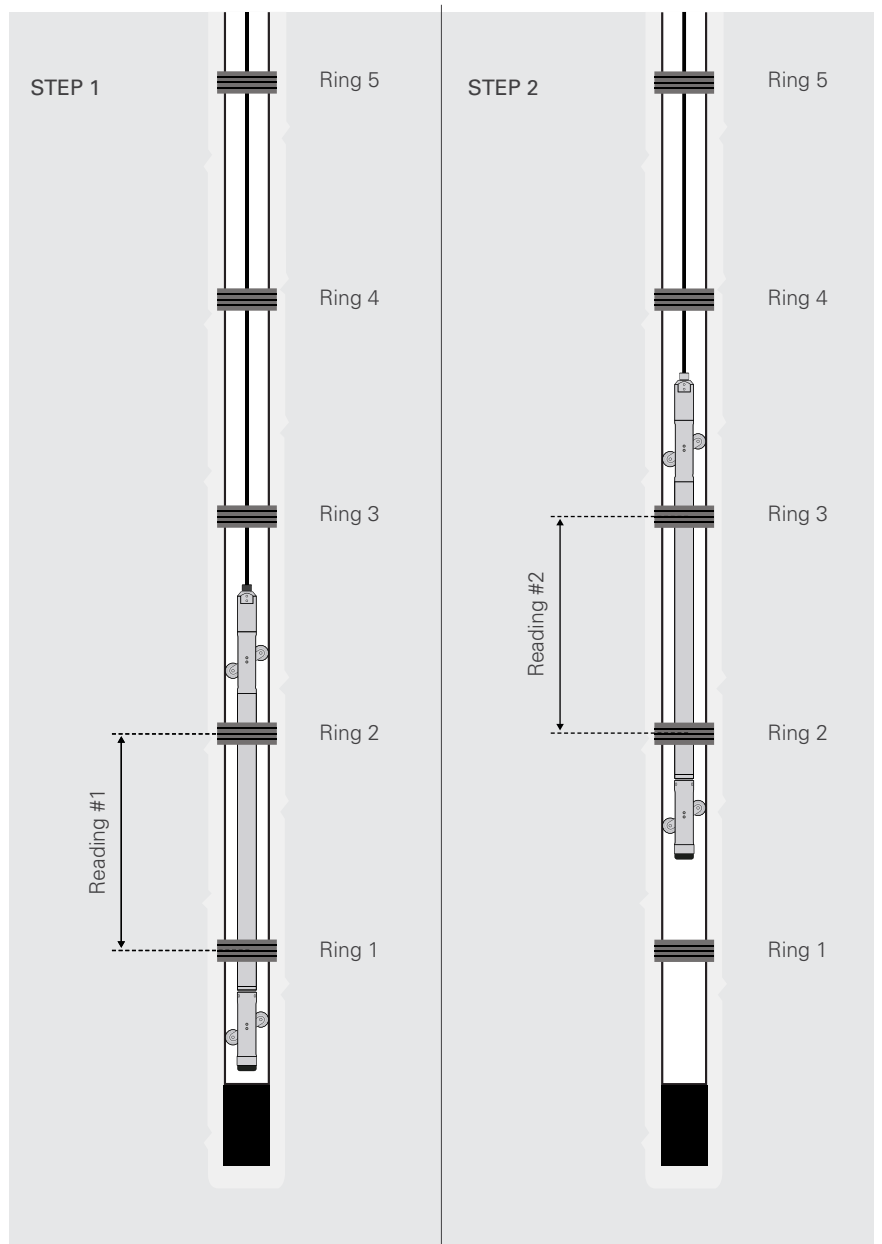
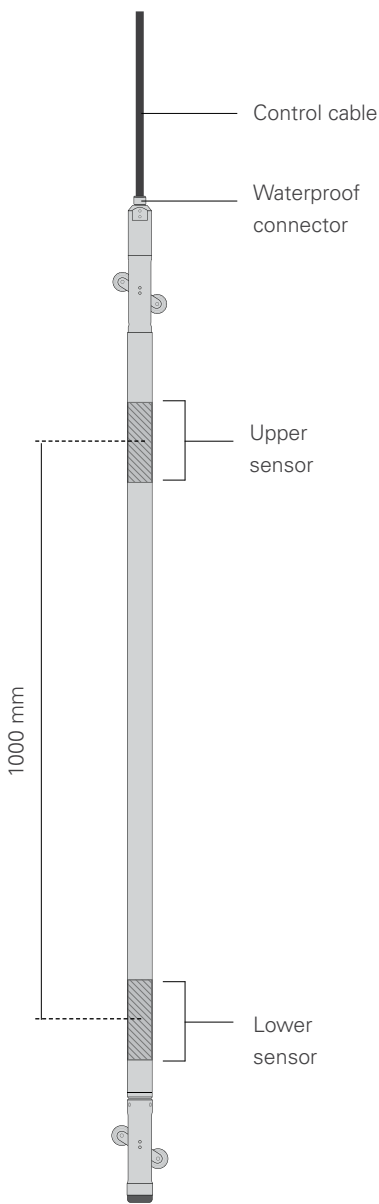


Meet the essential requirements of the EMC Directive 2014/30/UE

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 great 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.

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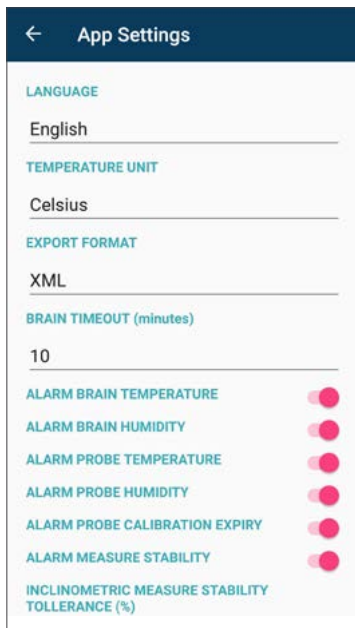


B.R.A.I.N APP FOR T-REX SYSTEM MANAGEMENT

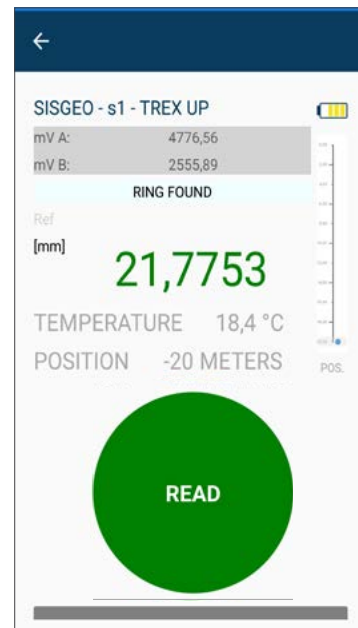
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System information page allows you to have the entire system (device, probe and reel) always under control.



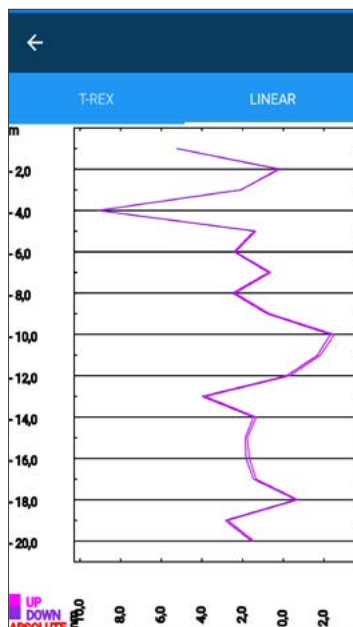
Various alarms can be settled in order to be always informed regarding the system health.



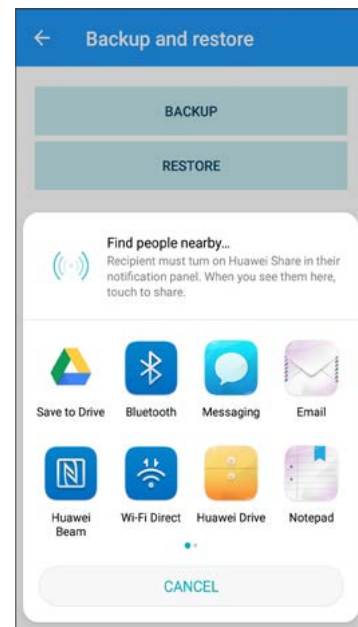
Reading page gives a lot of information such as actual position, data, probe internal temperature, etc.

#	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⁾	<table border="1"> <thead> <tr> <th>Resolution</th> <th>Accuracy</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>0.01°C</td> <td>±1°C (-10°C to +85°C)</td> <td>-40°C to +125°C</td> </tr> <tr> <td>0.025%RH</td> <td>±5% (0 to 95%RH)</td> <td>0 to 100%RH</td> </tr> <tr> <td>0.01 V</td> <td>±5% FS</td> <td>0 to 36 V</td> </tr> </tbody> </table>	Resolution	Accuracy	Range	0.01°C	±1°C (-10°C to +85°C)	-40°C to +125°C	0.025%RH	±5% (0 to 95%RH)	0 to 100%RH	0.01 V	±5% FS	0 to 36 V
Resolution	Accuracy	Range											
0.01°C	±1°C (-10°C to +85°C)	-40°C to +125°C											
0.025%RH	±5% (0 to 95%RH)	0 to 100%RH											
0.01 V	±5% FS	0 to 36 V											
- Temperature													
- Humidity													
- Battery voltage													
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												
 Directive compliance	2014/53/EU (RED)												



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(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

B.R.A.IN. REELS WITH CONTROL

Control cables are 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. Probe-end connectors are watertight up to 20 bar.

B.R.A.IN. HD CABLE

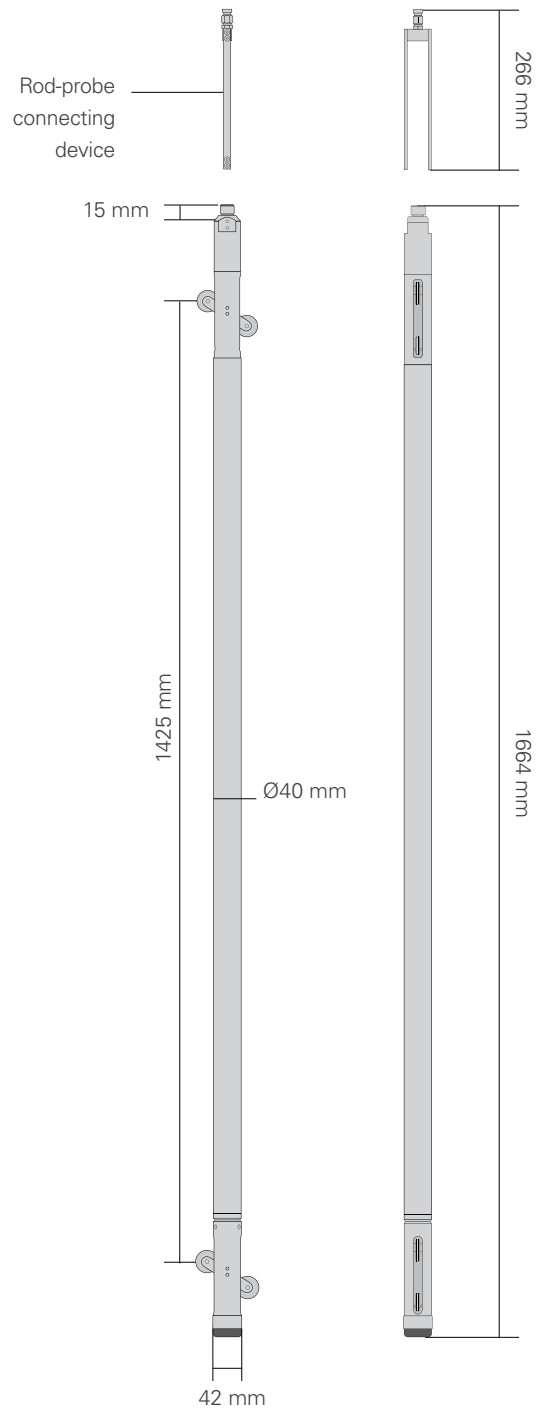
HD cable has a stainless steel core wire to control stretching and a stainless steel torsion braid to prevent twisting. Yellow cable jacket has copper depth marks.

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	OREX45100D0 vertical, horizontal, sub-horizontal
Measurement principle	high performance displacement transducers
Measuring range	±40 mm
Signal output and protocol	RS485 Modbus RTU ⁽¹⁾
A/D converter	sigma-delta 32 bit, 38-KSPS
Probe resolution	0.0001 mm (with B.R.A.IN APP)
Accuracy: Pol. MPE ⁽²⁾	±0.2% FS (±0.16 mm/m)
Repeatability	±0.01 mm/m
Stability @24 hours ⁽³⁾	±0.025 mm/m
Temp. operating range	-30°C to +75°C
Power supply	from 8 to 28 V
Max consumption	125 mA@24Vdc 260 mA@12Vdc
On-board temperature sensor ⁽⁴⁾	<ul style="list-style-type: none"> measuring range - 40°C to +125°C accuracy ±1°C (-10°C to +85°C)
On-board humidity sensor ⁽⁴⁾	<ul style="list-style-type: none"> measuring range 0 to 100% RH accuracy ±5% RH (0 to 95% RH)
On-board supply voltage monitor ⁽⁴⁾	<ul style="list-style-type: none"> measuring range 0 to 36 V accuracy ±5% FS
Material	aluminum body and steel parts
Body diameter	40 mm
Measuring base length	1000 mm
Wheels carriage	pair of wheels (Ø 32 mm) mounted on long-life sealed ball bearings
IP class	IP68 up to 2.0 MPa
Weight	5.4 kg (probe only)
CE compliant directive	2014/30/EU (EMC)



(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).

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.

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.

REPLACEMENT CARRYING CASE OREXOCASE00

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

POSITIONING ROD OREXROD2000

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



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.

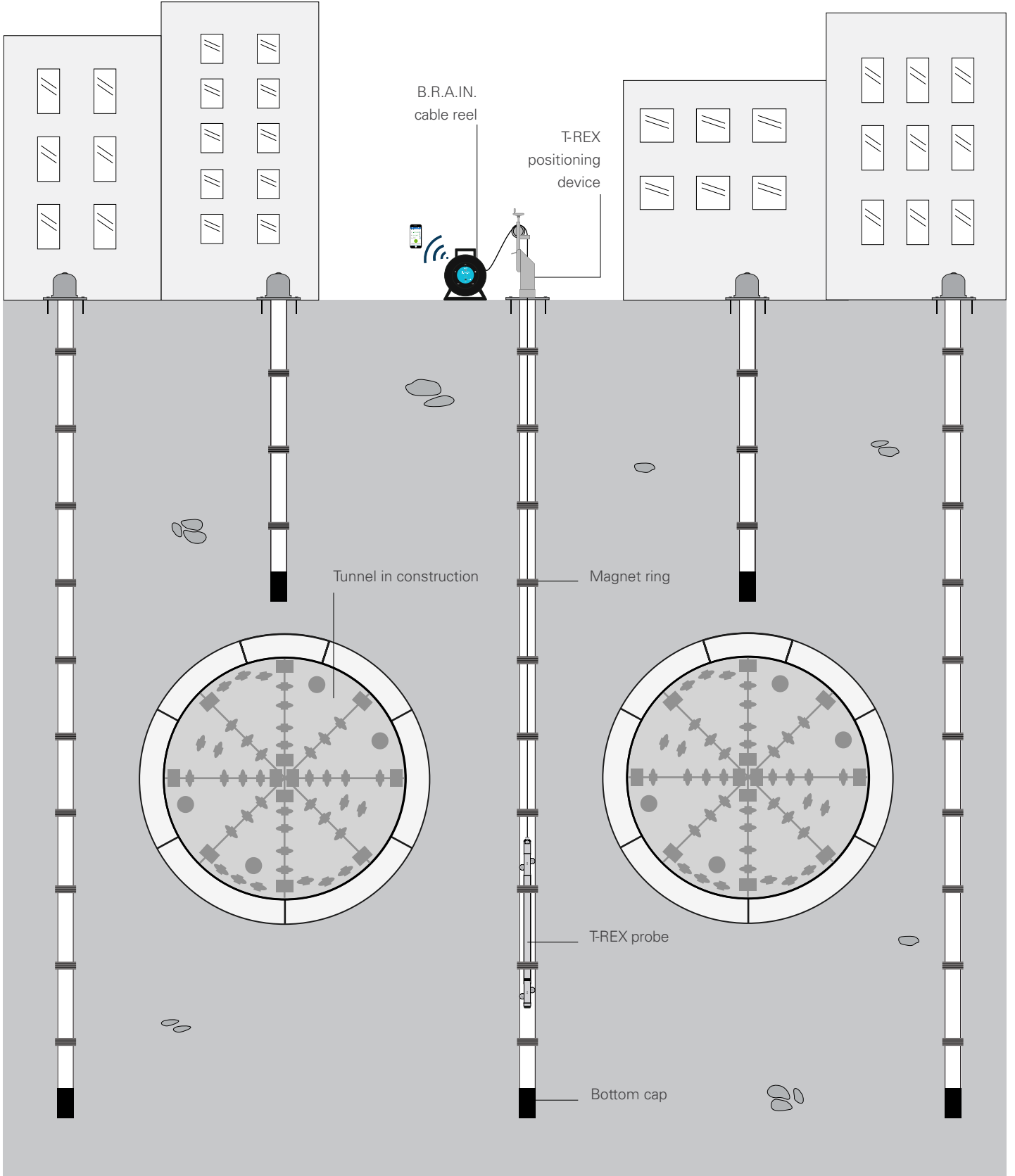


CALIBRATION DEVICE

The calibration device (product code **OREXOCAL0FR**) is used to check the calibration of the probe in the office before and after surveying. The calibration device is mainly ceramic with a low thermal coefficient of expansion. It is supplied with two magnetic rings and support legs. One ring is fixed to the tube, the other one can be moved in a range of ± 25 mm. The calibration device is supplied with aluminium carrying case. Probe and calibration device should be maintained at $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$ for calibration.



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

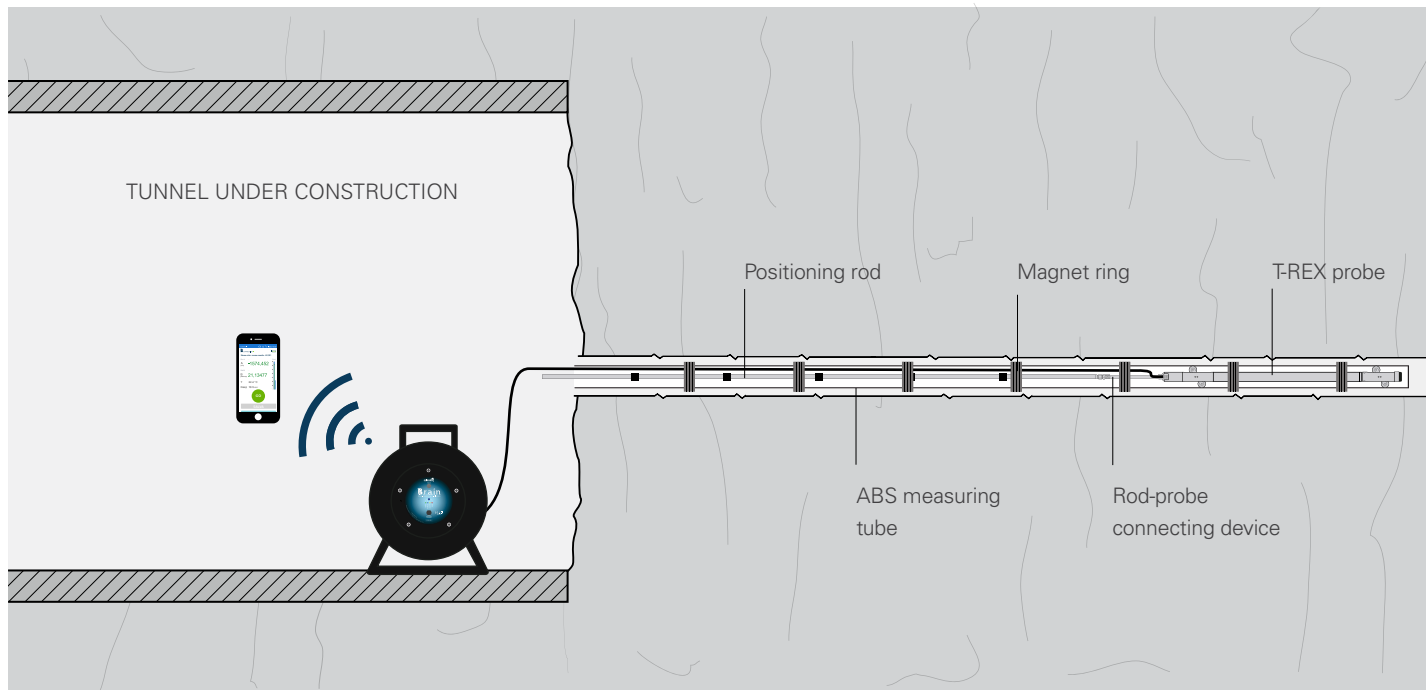


AN EXAMPLE OF TUNNEL FACE EXTRUSION

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.

T-REX_EN_07_09/2020



Preparing T-REX probe for horizontal surveying

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TECHNICAL ASSISTANCE

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