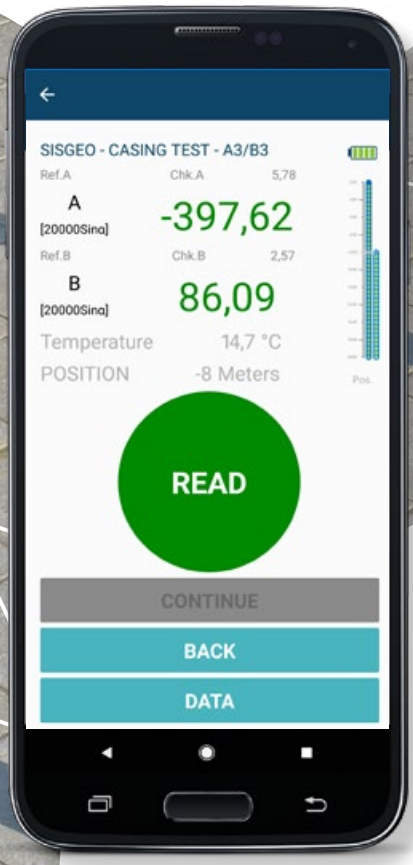
B.R.A.IN.

B.r.a.in

INCLINOMETER SYSTEMS

INCLINOMETERS
& PENDULUMS



SISGEO®

DRAFT BRAIN_EN_01_02/2019

B.R.A.IN APP
compatible with:

B.R.A.IN

INCLINOMETER SYSTEMS

MEMS

B.R.A.IN (Borehole Readout Array for INclinometers) system is mainly composed by MEMS inclinometer probe, bluetooth reel with control cable and B.R.A.IN APP compatible with Android and iOS mobile operative systems.
The electronic readout is integrated into the reel and the BLE (Bluetooth Low Energy) wireless protocol permits a fast and safe communication with the management device, with a very low batteries' consumption.
The intuitive B.R.A.IN APP allows the user to manage the inclinometer and spiral meter surveys, and immediatelly share the readings with the most popular APP installed on 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

- Landslides and unstable slopes
- Dams and embankments
- Diaphragm walls
- Tunneling
- Deep excavations
- LNG tanks

FEATURES

- The readout is your mobile
- User friendly mobile APP available for both Android and iOS
- Built-in electronics
- Low consumption Bluetooth interface
- Available in metric and imperial/USCS of measurement

B.R.A.IN INCLINOMETER SYSTEM IS MAINLY COMPOSED BY:

B.R.A.IN APP
(device not included)

BLUETOOTH REEL
WITH LIGHT CONTROL CABLE

INCLINOMETER PROBE

PRODUCT CODE	Description
0BRAIN03000	Vertical inclinometer system composed by biaxial MEMS probe (gauge length 500 mm), 30m light control cable mounted on B.R.A.IN bluetooth reel and B.R.A.IN APP.
0BRAIN06000	Vertical inclinometer system composed by biaxial MEMS probe (gauge length 500 mm), 60m light control cable mounted on B.R.A.IN bluetooth reel and B.R.A.IN APP.
0BRAIN10000	Vertical inclinometer system composed by biaxial MEMS probe (gauge length 500 mm), 100m light control cable mounted on B.R.A.IN bluetooth reel and B.R.A.IN APP.
0BRAIN100FT	Vertical inclinometer system composed by biaxial MEMS probe (gauge length 2 ft), 100 ft light control cable mounted on B.R.A.IN bluetooth reel and B.R.A.IN APP.
0BRAIN200FT	Vertical inclinometer system composed by biaxial MEMS probe (gauge length 2 ft), 200 ft light control cable mounted on B.R.A.IN bluetooth reel and B.R.A.IN APP.
0BRAIN300FT	Vertical inclinometer system composed by biaxial MEMS probe (gauge length 2 ft), 300 ft light control cable mounted on B.R.A.IN bluetooth reel and B.R.A.IN APP.

VERTICAL INCLINOMETER SYSTEM PERFORMANCE

	With 0S242DV3000 probe (500 mm gauge length)	With 0S242DV3010 probe (1000 mm gauge length)	With 0S242DV300F probe (2 ft gauge length)
Readout value	20000 sin alpha (K*sin alpha, degree or mm/m on request)	20000 sin alpha (K*sin alpha, degree or mm/m on request)	20000 sin alpha (K*sin alpha, degree, in/ft on request)
Resolution	0.011 mm / 500 mm	0.023 mm / 1000 mm	0.0005 in / 2 ft
Repeatability (precision) of a complete survey along a measuring line [1]	± 1.5 mm / 30 m (reading step every 500 mm)	± 2 mm / 30 m (reading step every 1000 mm)	± 0.079 in / 100 ft (reading step every 2 ft)

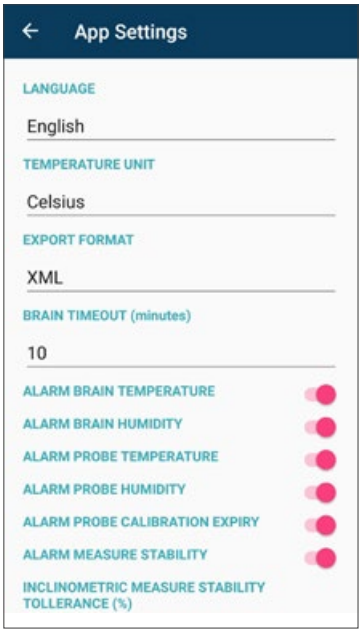
HORIZONTAL INCLINOMETER SYSTEM PERFORMANCE

	With 0S241DH3000 probe (500 mm gauge length)	With 0S241DH3010 probe (1000 mm gauge length)
Readout value	20000 sin alpha (K*sin alpha, degree, mm/m on request)	20000 sin alpha (K*sin alpha, degree, mm/m on request)
Resolution	0.011 mm / 500 mm	0.023 mm / 1000 mm
Repeatability (precision) of a complete survey along a measuring line [1]	± 7 mm / 30 m	± 10 mm / 30 m

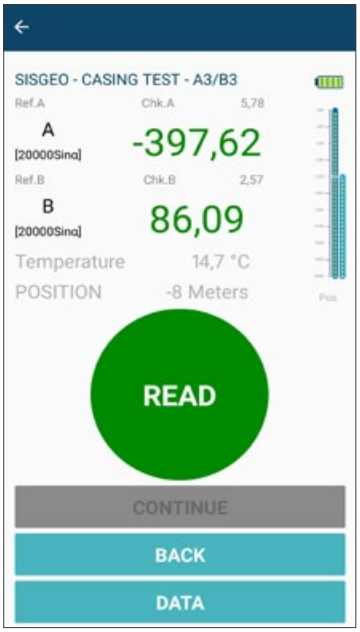
[1] As for ISO 18674-3, this is the "difference between the cumulated displacements of a measuring point relative to a reference point 30 m apart, when repeatedly carrying out the survey under repeatability conditions. (...) The values are specified for measurements in the A-axis. The B-axis measurements are commonly less accurate."

B.R.A.IN APP

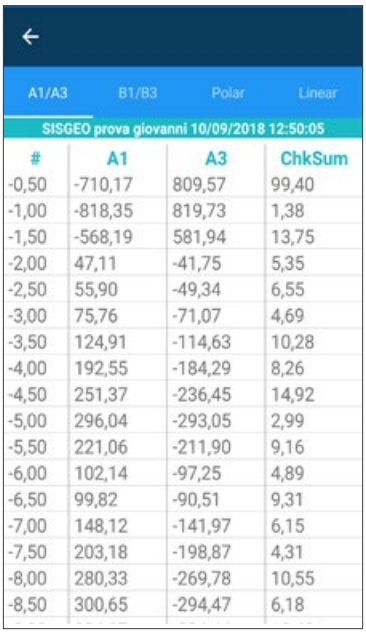
The system information page allows you to have the entire system always under control (device, probe and reel).



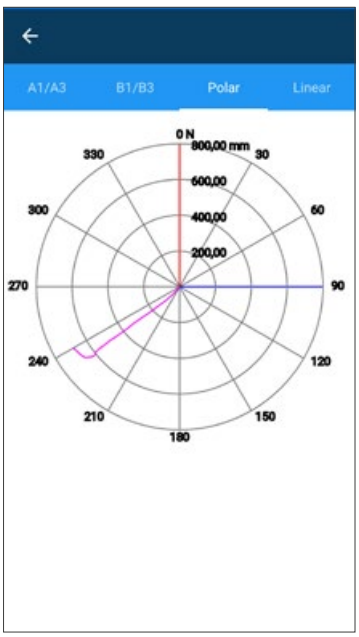
Various alarms can be settled in order to be always informed about the system health.



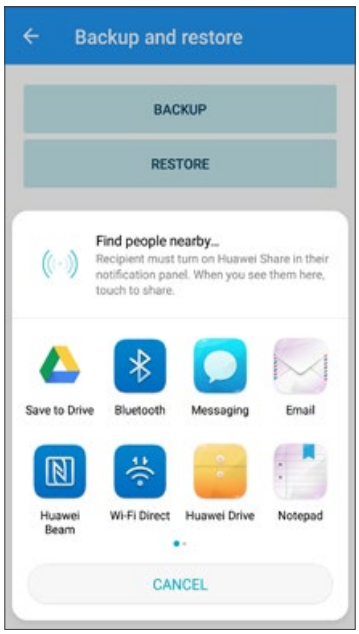
Reading page gives a lot of information such as actual position, data and checksums, probe internal temperature, etc.



Data tables are available during and after the surveys.



Polar graph and cumulative displacement graph can be shown after the survey.



Survey data can be immediately send 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

iOS

Google play

Available on the App Store

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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 [3]		
IP class and material	IP65, unbreakable sysnthetic 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]	≈ 96 h with inclinometer and spiral probe		
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) Derated above 60°C

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

CONTROL CABLES

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 Light and the HD (Heavy Duty) cables are supplied assembled on B.R.A.IN reel and include a factory-attached connector for the probe. Probe-end connectors are watertight to 20 bar.

B.R.A.IN LIGHT CABLE (STANDARD)

Light cable has a steel stress member. Blue cable jacket has aluminum depth marks.

B.R.A.IN HD CABLE (OPTION)

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	0S2RD6000B0	0S2RC6000B0
Cable lengths	30, 60, 100, 150, 200 m 100, 200, 300 ft	30,60,100,150 m
Conductors	2x0.50mm² (AWG 21)+ 2x0.24mm² (AWG 24)	6x0.50 mm² (AWG 21)
Depth tactile marks	AL, every 500mm±0.5mm or 2ft±0.0016ft	Copper, every 500mm±0.5mm
Max strength	150 kg (330 lb)	370 kg (816 lb)
Outer jacket	blue, polyurethane	yellow, polyurethane
Cable diameter	6.5 mm (0.25 in)	10.4 mm (0.41 in)
Weight (cable+marks)	0.054 kg/m (0.036 lb/ft)	0,150 kg/m (0.30 lb/ft)
Operating temp. range	-30°C to 80 °C (-22°F to +176°F)	-30°C to 80 °C (-22°F to +176°F)
Total weight with 60m/200ft cable	6 kg (13.2 lb) with B.R.A.IN reel	14 kg (30.9 lb) with B.R.A.IN reel

PROBES TECHNICAL SPECIFICATIONS

MODELS	**0S242DV3000 (500mm gauge length)** **0S242DV3010 (1000mm gauge length)** **0S242DV300F (2 ft gauge length)**	**0S241DH3000 (500mm gauge length)** **0S241DH3010 (1000mm gauge length)**
Applications	**vertical casings**	**horizontal casings**
Measurement principle	biaxial MEMS inclinometers	uniaxial MEMS inclinometers
Measuring range	±30°	±30°
Signal output and protocol	RS485 Modbus RTU(1)	RS485 Modbus RTU(1)
A/D converter	sigma-delta 32 bit, 38-KSPS	sigma-delta 32 bit, 38-KSPS
Sensor resolution (reading frequency 2 Hz)	0.00056°	0.00056°
Accuracy: Lin. MPE(2) Pol. MPE (2)	±0.07% FS ±0.01% FS	±0.07% FS ±0.01% FS
Repeatability	±0.0009°	±0.0009°
Stability after 24 hours (3)	±0.004°	±0.004°
Temp. operating range	–30°C to +70°C (-22°F to +158°F)	–30°C to +70°C (-22°F to +158°F)
MEMS shock resistance	20000 g	20000 g
Power supply	from 8 to 28 Vdc	from 8 to 28 Vdc
Max consumption	4 mA@24Vdc 8 mA@12Vdc	4 mA@24Vdc 8 mA@12Vdc
On-board temperature sensor (4) • measuring range • accuracy / resolution	 - 40°C to +125°C ±1°C (-10°C to +85°C) / 0.01 °C	 - 40°C to +125°C ±1°C (-10°C to +85°C) / 0.01 °C
On-board humidity sensor (4) • measuring range • accuracy / resolution	 0 to 100% RH ±5% RH (0 to 95% RH) / 0.025% RH	 0 to 100% RH ±5% RH (0 to 95% RH) / 0.025% RH
On-board supply voltage monitor (4) • measuring range • accuracy / resolution	 0 to 36 V ±5% FS / 0.01 V	 0 to 36 V ±5% FS / 0.01 V
Material	stainless steel	stainless steel
Body diameter	28 mm (1.1 in)	28 mm (1.1 in)
Total length (without connector)	750 mm (with 500 mm gauge length) 1250 mm (with 1000 mm gauge length) 33.9 in (with 2ft gauge length)	810 mm (with 500 mm gauge length) 1310 mm (with 1000 mm gauge length)
Wheels carriage	pair of wheels (Ø 32 mm / 1.26 in) mounted on long-life sealed ball bearings	2 fixed wheels and 2 spring-loaded wheels mounted on long-life sealed ball bearings
Wheel diameter	32 mm (1.26 in)	32 mm (1.26 in)
IP class	IP68 up to 2.0 MPa	IP68 up to 2.0 MPa
Weight	2.0 kg (with 500mm gauge length) 4.0 kg (with 1000mm gauge length) 5.5 lb (with 2 ft gauge length)	2.0 kg (with 500mm gauge length) 4.0 kg (with 1000mm gauge length)
CE compliant directive	2014/30/EU (EMC)	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 both linear regression (≤ Lin. MPE) and polynomial correction (≤ 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.

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ACCESSORIES AND SPARE PARTS

kxion SOFTWARE
OKLIONSW000

Klion software is designed for data elaboration of inclinometer and T-REX systems.
For more information refer to the relevant datasheet.

DUMMY PROBE
OS21ST00000

Used to check the integrity of the inclinometer casings before measurements. Supplied with graduated steel wire on reel.
Available with 500 mm, 1000 mm or 2 feet probe.

PULLEY ASSEMBLY
OS1CSU10000

Assists depth control and eliminates cable abrasion.
It includes cable stop, pulley for guiding the cable and adaptors to fit different sizes of casing.

CALIBRATION FRAME
OSOWCAL1000

The calibration frame consists of an anodized aluminium frame with a pivoting arm made by a length of epoxy painted inclinometer casing.
The pivoting arm permits probe check at –11°, -6°, zero, +6° and +11°.
The frame is ready for wall mounting.
Overall dimensions: 350x800x127 mm (compatible with 500mm probe only)
Material: epoxy painted aluminium.

WHEELS FOR INCLINOMETER PROBE (SPARE)
OS2SET04WHE

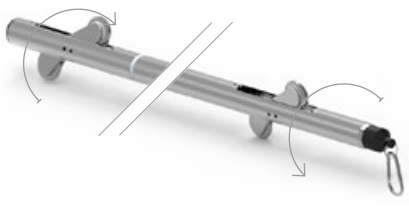
Spare set of four stainless steel wheels with screws for vertical/horizontal inclinometer probe.

BAG FOR INCLINOMETER PROBE (SPARE)
OS2RD0BAG00

Spare shoulder bag for inclinometer probe. It allows to accomodate dummy probe too.

DIGITAL SPIRAL METER

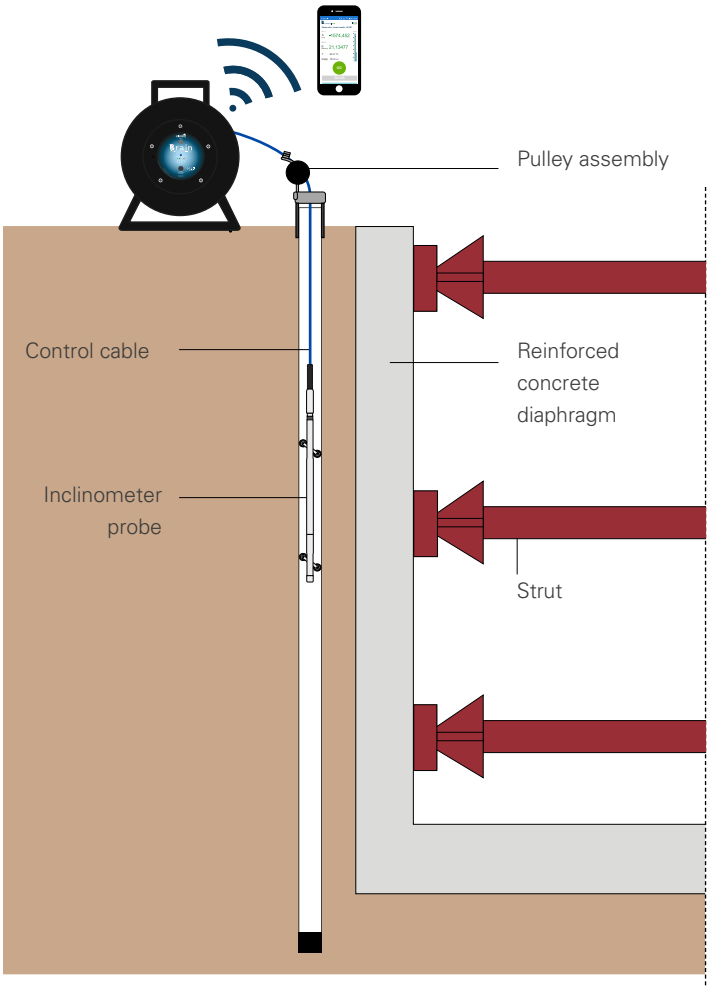
The Spiral meter is used to measure twist in installed inclinometer casings (tubes). The measurements can be used for compensating readings taken from twisted casings. SISGEO recommends to take the spiral surveys at the same time as the initial inclinometer reading. The digital spiral probe is compatible with B.R.A.IN reel.
KLION software is required to process spiral data and applies compensations to inclinometer readings.



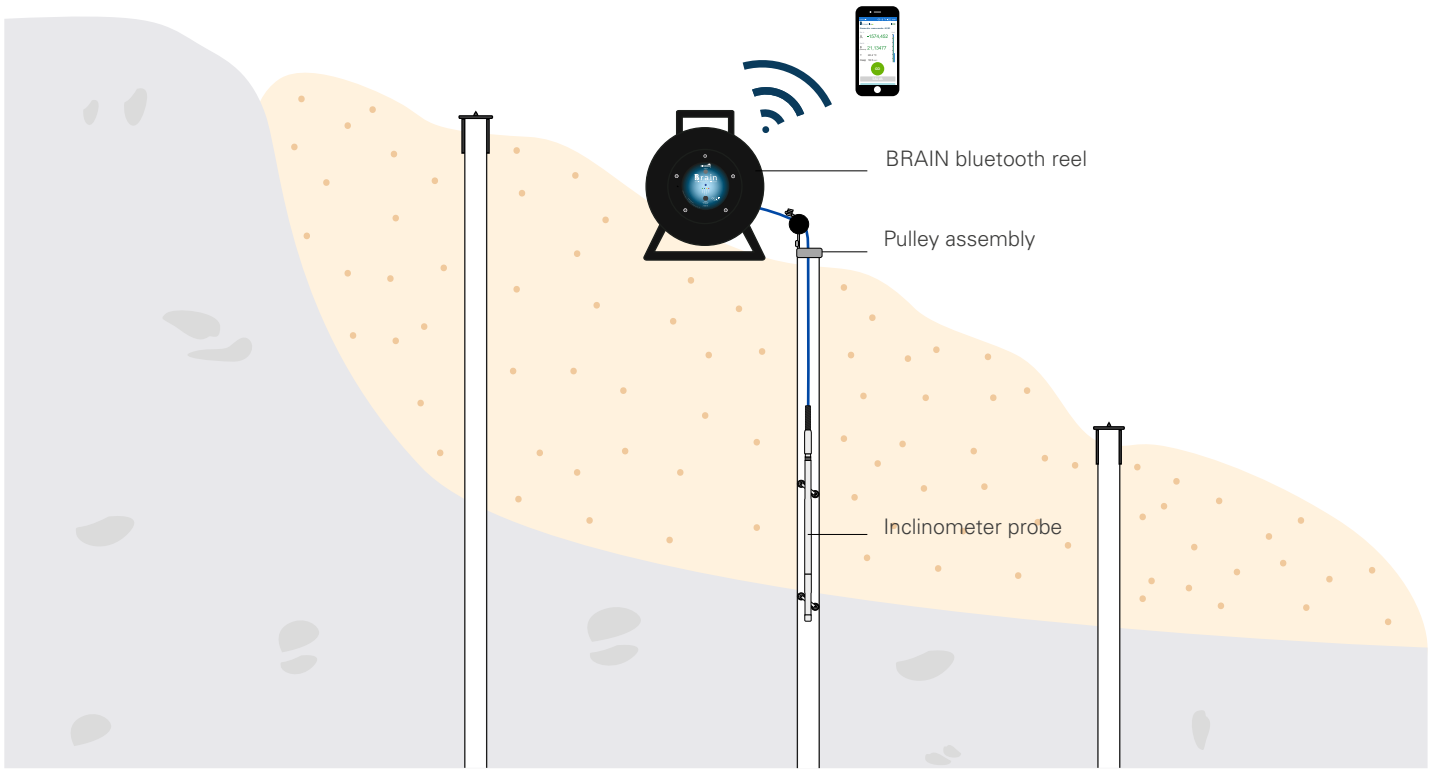
Spiral probe: twisting on the probe axis to measure the inclinometer casing torsion

	0S30PR12D00
Type of sensor	rotary contactless potentiometer (magneto-resistive)
Measuring range (FS)	±5 degrees over the wheel base (1 meter)
Resolution	0.001% FS
Repeatability	± 0.01% FS
Stability	± 0.025% FS
Accuracy	< 0.5% FS
Connector	watertight, 6 pins compatible with heavy-duty cable
Body diameter	28 mm (1.1 in)
Total length	1250 mm (49.2 in) without connector
Gauge length (distance between wheels)	1000 mm (39,4 in)

EXAMPLE OF APPLICATION IN DEEP EXCAVATION



EXAMPLE OF APPLICATION IN LANDSLIDE



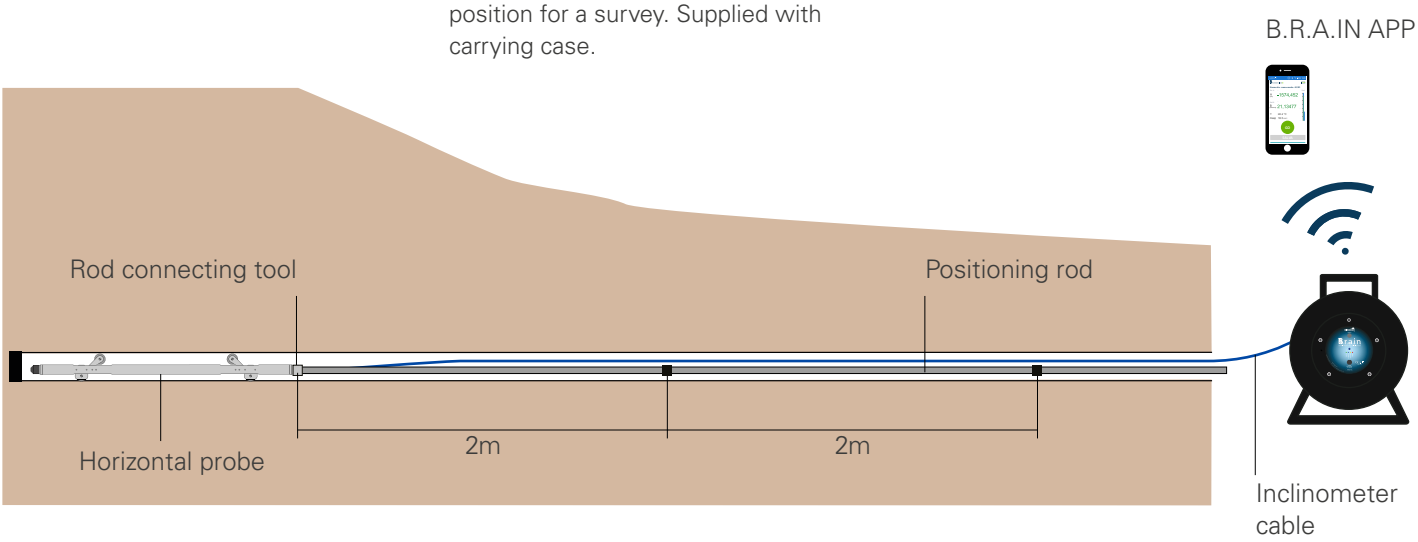
ACCESSORIES FOR HORIZONTAL INCLINOMETERS

ROD CONNECTING TOOL
OS20HORODOO

This device permits to connect the positioning rods to the inclinometer cable connector.

SET OF POSITIONING RODS
OREXROD10BX

The set includes 10 positioning rods, each 2m long. Used to push inclinometer probe into the starting position for a survey. Supplied with carrying case.

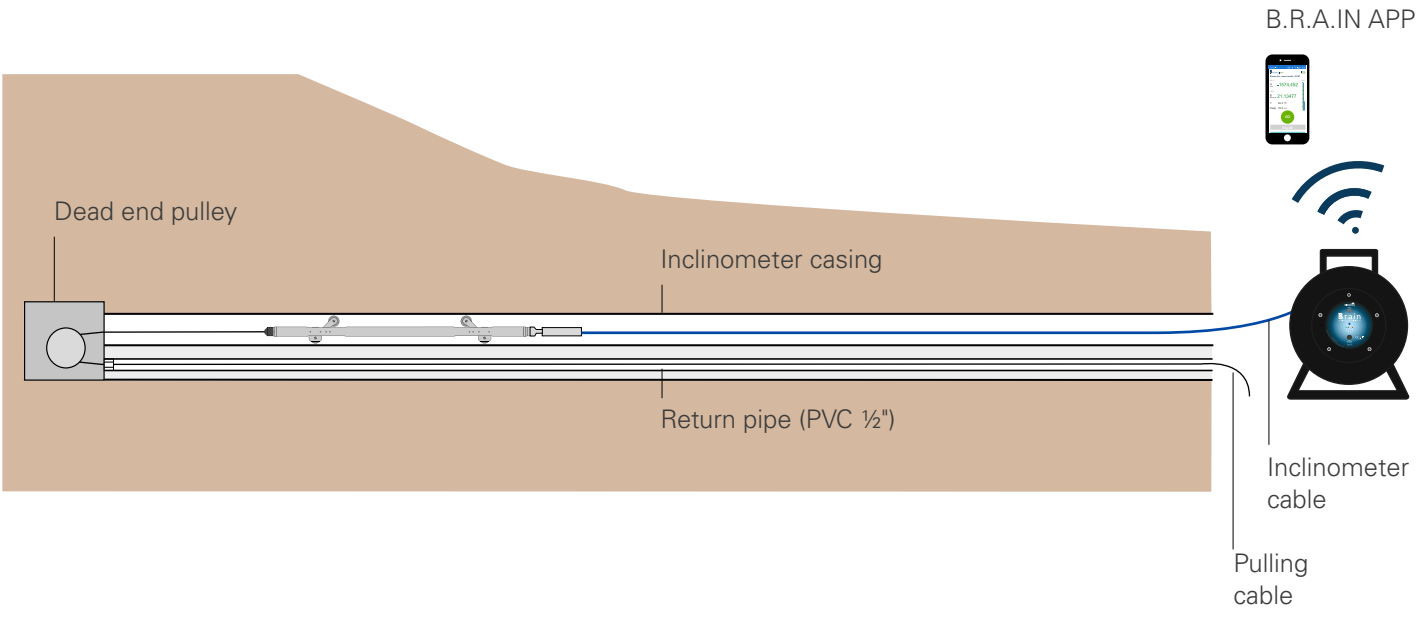


PULLING CABLE
OWRACPVC000

Stainless steel cable with PVC jacket. Used to pull the horizontal inclinometer probe into the starting position for a survey. If dead-end pulley is used, order double length of positioning cable.

DEAD-END PULLEY
OS1RINV7000

Used when inclinometer casing is not accessible at both ends. Requires return pipe for pull cable. Available for S131 casing and also 3" casing. (code OS1RINV7500).



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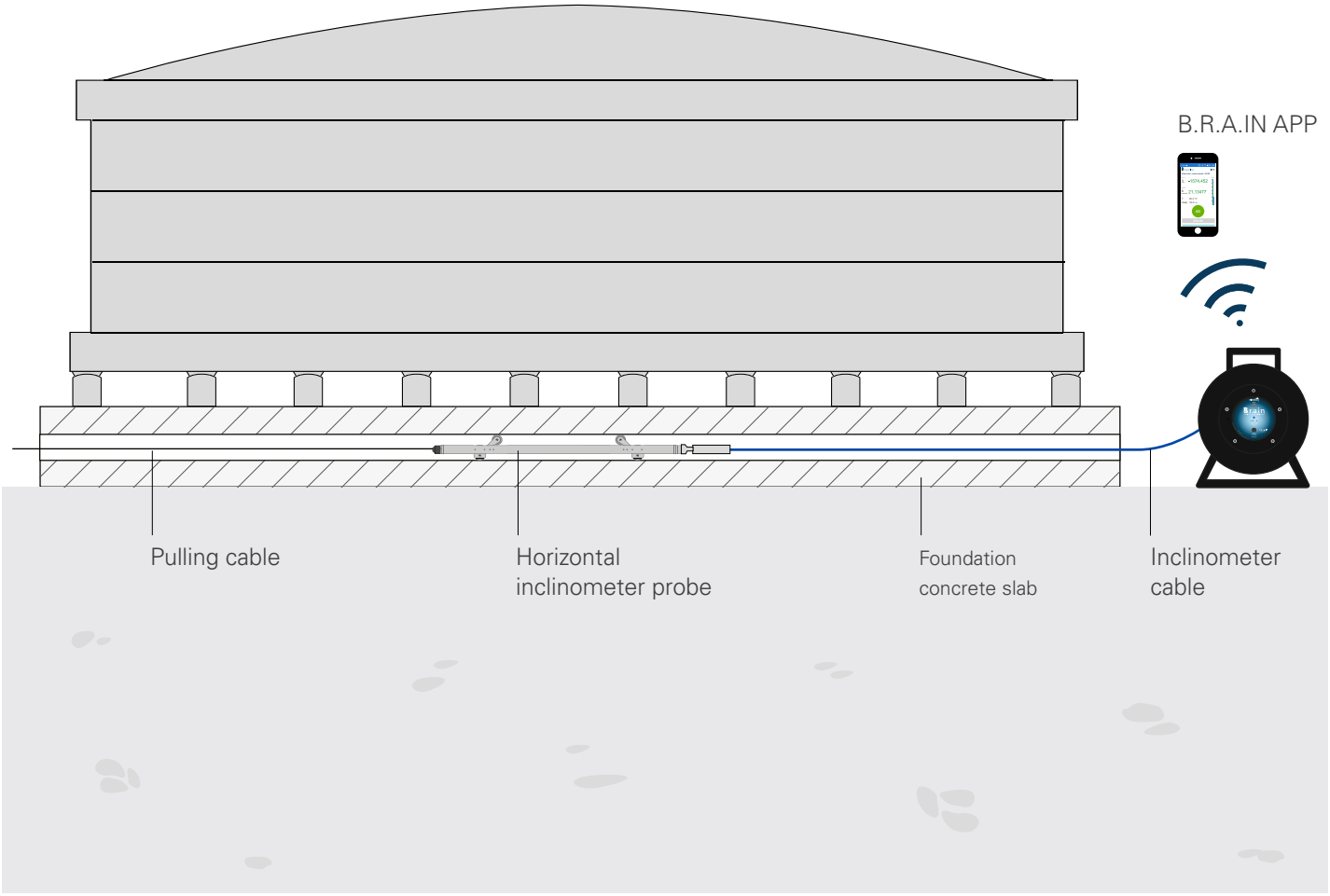
EXAMPLE IN LNG TANK APPLICATION



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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***