



— DELIVERING
SOLUTIONS



CATALOGUE



— **GEOTECHNICAL INSTRUMENTS
AND STRUCTURAL HEALTH MONITORING**

COMPANY PROFILE



EXPERIENCE AND INNOVATION

SISGEO was founded in 1993 inheriting the abilities of "SIS Geotecnica", the leading company in Italy in geotechnical engineering. Over the years, SISGEO has distinguished itself internationally thanks to a tight and highly motivated working group, that devoted itself with passion and creativity to design and manufacture high quality instruments to meet the broader needs in the field of civil engineering.

Experience is the solid foundation from which we start to develop our products and services with a constant focus on continuous innovation and attention to the sector's future needs.

Over the years, SISGEO has become a recognized brand for quality, reliability and innovation.

1



Experience is the solid foundation from which we start to develop our products and our services with a constant focus on continuous innovation and attention to the sector's future needs

MADE IN ITALY



SISGEO is based in Masate, in the industrial area located east of Milan. A three storey building of more than 2.000 sq.m, with offices, laboratories, manufacturing department, warehouse and a separate building dedicated to the production of fibreglass extensometers and over 500 sq.m of outside area for exclusive use.

"Made in Italy" is the heart of our business and at the same time a legacy of history, creativity, style and passion we are proud to bring to the world with our products and services, through a network of international engineers with proven skills.

1 **VK40** vibrating wire strain gauges

WE DELIVER THE FUTURE

We listen to the earth with our instruments and we respect it with our manufacturing processes designed to reduce any environmental impact.

"Tracciamo soluzioni" (delivering solutions) is how we introduce ourselves because it is what we do, giving prominence to people. Acquiring skills and taking note of the ideas of those who work with us, enable ourselves to satisfy our Clients' needs. This is the basis on which we trace our route. Planning, design and build are our ways to improve and simplify the work of our Clients. We believe that the interaction between Clients and ourselves is essential to feed our experience and stimulate our creativity.

We listen to the earth with our instruments and we respect it with our manufacturing processes designed to reduce any environmental impact.

2



2 **BH Profile** inclinometer





OUR GROUP OF COMPANIES



3

The establishment of the foreign companies has allowed us to expand the presence of SISGEO abroad offering solutions focused to the needs of individual markets.

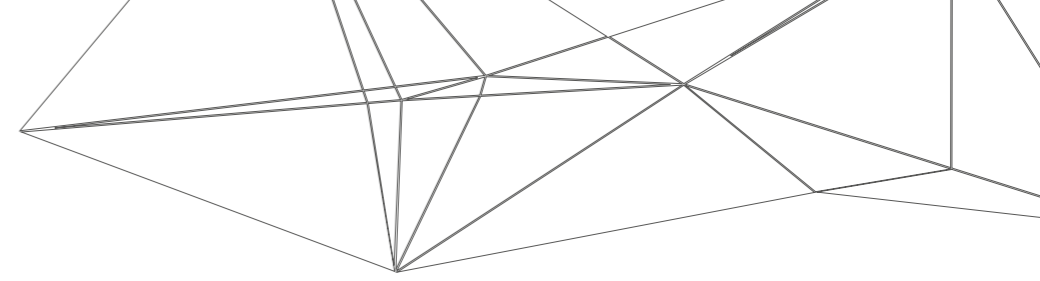
SISGEO is the head of a Group of Companies that includes FIELD S.r.l., NEXT Industries S.r.l., and the subsidiaries SISGEO France, SISGEO Asia Pacific, SISGEO Latinoamerica, SISGEO Australia.

FIELD, founded in 2000, specializes in providing integrated and customized solutions from design, installation and management of geotechnical and structural monitoring systems. Its services include on-site tests and a qualified service of real time data management thanks to the innovative WMS (Web Monitoring System) software.

NEXT is the Technical Partner of Sisgeo for designing and developing software and electronic parts.

The establishment of the foreign companies such as SISGEO Asia Pacific (Thailand), SISGEO Latinoamerica (Colombia) and SISGEO Australia (Australia), has allowed us to expand the presence of SISGEO abroad offering solutions focused to the needs of individual markets.

3 PK45I push-in vibrating wire piezometer



4

SISGEO considers manufacturing procedures, Client feedback and good organization to be the fundamental concepts to achieve quality.

**COMPANY WITH
QUALITY SYSTEM
CERTIFIED BY DNV GL
= ISO 9001 =**

100% RELIABLE QUALITY

SISGEO considers manufacturing procedures, Client feedback and good organization to be the fundamental concepts to achieve quality. In 1997 SISGEO obtained the ISO 9001 Certification and since then, the constant and continuous application of our Quality System, widespread at all levels of the company, is a source of improvement, evolution and growth.

4 B.R.A.IN cable reel

TECHNOLOGICAL PASSION

SISGEO, thanks to innovative automated solutions, has optimized the efficiency of its manufacturing process. This, together with our passion, ensures the highest standard of products to the Client.



5

Research and development are hallmarks of SISGEO.

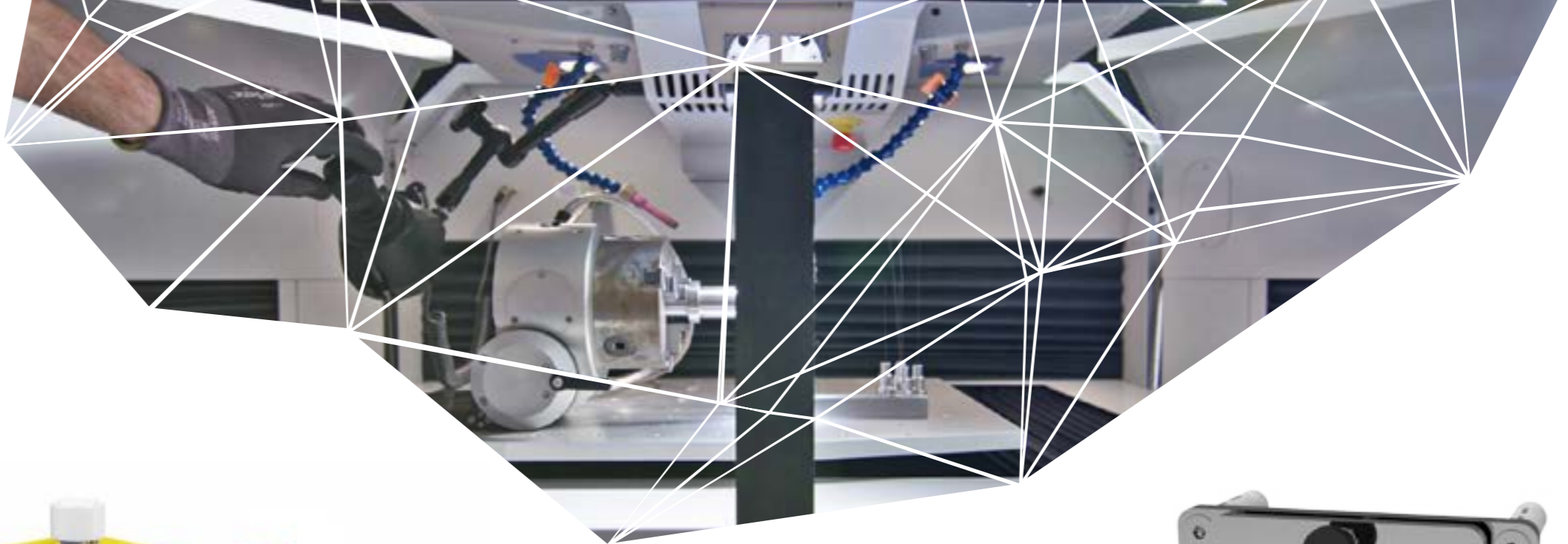
A continuous commitment is reflected both in the design of new and innovative products and in the optimization of equipment used in the manufacturing process, which results in our product line always being technologically up to date.

Following its steady growth in sales, SISGEO, thanks to innovative automated solutions, has optimized the efficiency of its manufacturing process. This, together with our passion, ensures the highest standard of products to the Client.

SISGEO's wide range of products employ various technologies including vibrating wire and other industrial sensors such as MEMS which we have tailored to suite many different applications.

5

H-LEVEL Liquid Level System



A team of SISGEO qualified and experienced engineers, technicians, hardware specialists and software programmers are constantly involved in production, calibration and research activities



6

PRODUCTION HEART

SISGEO utilizes, in its production department and laboratory, quality equipment including:

- assembly jigs for the production of vibrating wire sensors;
- automated calibration tables for inclinometers, displacement and pressure transducers;
- climate chambers for heat treatment including the ageing of vibrating wire sensors;
- TIG welding;
- semi automatic device for de-airing oil and filling under vacuum load/pressure cells;
- in line assembling of multipoint borehole extensometers up to 60m length;
- hydraulic press, up to 3000 KN capacity;
- pressure vessels for waterproofing tests;
- automatic tool for mixing epoxy used for sealing instruments.

The calibration tables are electronically controlled to automatically generate calibration reports.

A team of SISGEO qualified and experienced engineers, technicians, hardware specialists and software programmers are constantly involved in production, calibration and research activities.

6

S5HD digital tilt meter with adjustable plate

GEOTECHNICAL INSTRUMENTS AND STRUCTURAL HEALTH MONITORING

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PIEZOMETERS

- _GROUND WATER LEVEL
- _PORE WATER PRESSURE
- _EARTHFILL DAMS AND EMBANKMENTS
- _UP-LIFT PRESSURE IN DAM FOUNDATIONS
- _SEEPAGE MONITORING
- _WATER PRESSURE BEHIND TUNNEL LININGS
- _POTENTIAL LANDSLIDES
- _DEWATERING AND PUMP TESTS
- _FOUNDATIONS AND DIAPHRAGM WALLS



VIBRATING WIRE PIEZOMETERS

VW piezometers consist of a vibrating wire sensing element enclosed in a protective stainless steel housing a filter tip. VW piezometers offer an excellent long-term reliability as a result from the use of the latest developments in vibrating wire technology. Heavy duty model PK45 is recommended for use in earthfill dams with armoured cable.

STANDARD VW PIEZOMETERS

MODEL PK20A	with HAE value filter unit
MODEL PK20S	with LAE value filter unit
Standard ranges	0 - 170 kPa 0 - 5.0 MPa
Sensitivity	0.025% FS
Accuracy (MPE*)	< ±0.25% FS
Temp. operating range	-20°C +80°C
Filter unit features:	
- HAE	0.25 µ ceramic stone
- LAE (100kPa)	40 µ synthesized s/steel 50 µ synthesized PE
Diameter / length	20 mm / 177 mm

HEAVY DUTY PIEZOMETERS

MODEL PK45A	with HAE value filter unit
MODEL PK45S	with LAE value filter unit
Standard ranges	0 - 170 kPa 0 - 5.0 MPa
Sensitivity	0.025% FS
Accuracy (MPE*)	< ±0.25% FS
Temp. operating range	-20°C +80°C
Filter unit features:	
- HAE stone	1 µ ceramic stone
- LAE (100 kPa)	40 µ synthesized s/steel 50 µ synthesized PE (Vyon®)
Diameter / length	27 mm / 201 mm

(*) 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).

S I S G E O . C O M



TITANIUM PIEZOMETERS

Titanium piezometers have been specifically designed for installation in high corrosive environments and aggressive soils. All the exposed surfaces are made of titanium and the ceramic membrane (diaphragm) is also chemically inert. Titanium piezometers are recommended for use in landfills and aggressive mine tailings.

TECHNICAL SPECIFICATIONS

MODEL P235TI	with HAE or LAE value filter
Standard ranges	200, 500 kPa, 1.0, 2.0 MPa
Signal output	4-20 mA current loop
Sensitivity	0.01% FS
Accuracy (MPE*)	< ±0.15% FS < ±0.20% FS (for 200 kPa FS)
Power supply	12 - 24 V DC
Temp. Operating range	-20°C +80°C
Filter unit characteristics:	
- HAE	0.25 µ ceramic stone
- LAE (100 kPa)	40 µ synthesized PE (Vyon®)
Diameter / length	27 mm / 193 mm

Sisgeo tests have verified that titanium piezometers do not have functionality or corrosion problems after one year in a solution with pH = 1 and temperature 20 °C.

OPF01SAT000 SATURATION DEVICE

The filter saturation is a decisive factor for a successful installation of embedded piezometers. Sisgeo provides a device for field use for the saturation of the HAE value filter (ceramic stone). It consists of a stainless steel pump with manometer and a threaded port to fit the filter unit.



PIEZO-RESISTIVE PIEZOMETERS

Piezo-resistive piezometers and pressure transducers combine mechanical robustness, capacity to withstand aggressive environments and performance reliability. Piezo-resistive piezometers are suitable for dynamic measurements of water level or pore water pressure, and when data acquisition system is not compatible with vibrating wire technology

TECHNICAL SPECIFICATIONS

MODEL P235S1	with HAE value filter
MODEL P235S4	with LAE value filter
Standard ranges	200, 500 kPa 1.0, 2.0, 5.0 MPa
Signal output	4-20 mA current loop
Sensitivity	0.01% FS
Accuracy (MPE*)	< ±0.15% FS < ±0.20% FS (for 100 and 200 kPa FS)
Temp. Operating range	-20°C +80°C
Filter unit characteristics:	
- HAE	0.25 µ ceramic stone
- LAE (100 kPa)	40 µ synthesized s/steel 50 µ synthesized PE
Diameter / length	27 mm / 193 mm

ACCESSORIES

OPXPUMP0020	Pneumatic hand pump for checking the pore pressure transducers calibration.
OPX20CHECK0	Tools for OPXPUMP0020 to allow PK20 connection

SPARE PARTS

OPF20D16000	HAE filter stone for PK20
OPF20D2000P	LAE Vyon® filter for PK20
OPF20D20000	LAE s/steel filter for PK20
OPF01D16000	HAE filter stone for PK45
OPF40D2000P	LAE Vyon® filter for PK45
OPF40D20000	LAE s/steel filter for PK45



Project:
Saint Helena Airport,
Saint Helena Island

PIEZOMETERS

_GROUND WATER LEVEL

_PORE WATER PRESSURE

_EARTHFILL DAMS
AND EMBANKMENTS

_UP-LIFT PRESSURE
IN DAM FOUNDATIONS

_SEEPAGE MONITORING

_WATER PRESSURE BEHIND
TUNNEL LININGS

_POTENTIAL LANDSLIDES

_DEWATERING AND PUMP TESTS

_FOUNDATIONS
AND DIAPHRAGM WALLS



DRIVE-IN PIEZOMETERS

Drive-in piezometers have the transducer mounted inside a cylindrical body with a conical nose and housing for the push-in rod. The large diameter of the conical nose prevents any chance of overpressure during the installation into the soil (push-in). The push-in rod allows installation using conventional cone penetrometer or drilling rod with adapters.

AVAILABLE MODELS CE

MODEL PK45I	VIBRATING WIRE
Standard ranges	0 - 350 kPa, 0 - 2.0 MPa
Sensitivity	0.025% FS
Accuracy (MPE*)	< ±0.25% FS
Temp. operating range	-20°C +80°C

MODEL P235I	PIEZORESISTIVE
Standard ranges	0 - 200 kPa, 0 - 5.0 MPa
Signal output	4-20 mA current loop
Sensitivity	0.01% FS
Accuracy (MPE*)	< ±0.15% FS
	< ±0.20% FS (for 200 kPa FS)
Temp. operating range	-10°C +55°C
Filter unit	Ceramic HAE filter. Filter on request should be saturated at factory.
Diameter / length	27 mm / 256 mm
Nose diameter	30 mm

ACCESSORIES

SPUSH - IN ROD OP235I ROD00	Stainless steel 430 mm long tube which allows the junction with standard CPT rods. The push-in rod shall be threaded at job site and it must be reused. Length: 430 mm OD/ID: 33.7 / 29.1 mm
SATURATION DEVICE OPF01SAT000	Stainless steel pump for saturating HAE ceramic filters. Includes pump, 10 bar pressure gauge, and a threaded connection for the filters.

(* 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 (\leq Lin. MPE) and polynomial correction (\leq Pol. MPE).

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REMOVABLE PRESSURE TRANSDUCERS

The removable pressure transducers are specially designed for long-term monitoring of soil pore pressure. They can be removed for calibration checks, maintenance or re-used in other boreholes. The removable pressure transducers is installed in a Casagrande piezometer with the P101 porous filter unit which mates to the conical tip of the transducer housing.

AVAILABLE MODELS CE

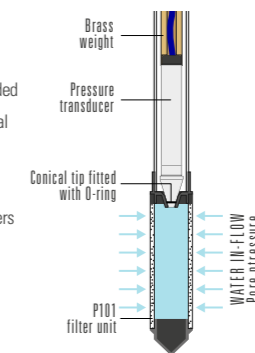
MODEL PK45C2	VW range 0-200 kPa
MODEL PK45C5	VW range 0-500 kPa
Signal output	frequency (VW), resistance (T)
Sensitivity	0.025% FS
Accuracy (MPE*)	< ±0.25% FS
Temp. operating range	-20°C +80°C
Diameter / length	27 mm body - 30 mm head / 230 mm

MODEL P252C00200	PIEZORESISTIVE range 0-200 kPa
MODEL P252C00500	PIEZORESISTIVE range 0-500 kPa
Signal output	4-20 mA current loop
Sensitivity	0.01% FS
Total accuracy	< ±0.20% FS for P252C00200 < ±0.15% FS for P252C00500
Temp. operating range	-10°C +55°C
Diameter / length	27-30 mm / 230 mm

OP101002000 CASAGRANDE POROUS TIP

INSTALLATION DETAIL

The transducer tip, fitted with an 'O' ring, is designed to mate to the conical port of P101 Casagrande filter unit. Sealing is maintained by ballasting weights inserted on the electric cable. A small hole on the conical tip allows pore pressure to act on the diaphragm sensor. P101 porous filter is normally installed and the transducer is then lowered into the access tube suspended by its own electro-mechanical cable until the piezometer assembly rest on the piezometer. All the transducers can be removed from the borehole by means of the electro-mechanical cable.



MULTIPOINT PIEZOMETER STRING

Multi-point piezometer consists of a string of vibrating wire piezometers connected by single multicore cable, ideal when more than one piezometer is requested at various depth in the same borehole. The PK45M piezometer string - fully grouted in borehole - prevents the formation of channels for migration of water between different soil levels.

TECHNICAL SPECIFICATIONS CE

Standard ranges	0 - 350 up to 3.5 MPa
Signal output	frequency (VW), resistance (T)
Sensitivity	0.025% FS
Accuracy (MPE*)	< ±0.25% FS
Temp. operating range	-20°C +80°C
Filter unit	40 μ synthesized s/steel
Diameter / length	48.3 mm / 252 mm

SIGNAL CABLES

OWE1160LSZH	LSZH or PVC multicore cable (8 pairs). It permits the realization of a string of 4 VW piezometers.
OWE1160PVC	
OWE1320LSZH	LSZH or PVC multicore cable (16 pairs). It permits the realization of a string of 8 VW piezometers.
OWE1320PVC	

FULLY GROUTED INSTALLATION METHOD

The fully-grouted method is gaining popularity because it is a simple, economical and accurate procedure to monitor pore water pressure in the field. The working principle is based on the idea that a diaphragm piezometer embedded directly in a large mass of low permeability cement-bentonite grout should respond instantly to a pore water pressure change. Grout mixes (water-cement-bentonite) are controlled to give the desired strength of the set grout. Appropriate permeability of the cement-bentonite grout is crucial for the success of the fully-grouted method.

For more details, refer to: "Piezometers in Fully Grouted Boreholes" by Mikkelsen and Green, FMGM proceedings Oslo 2003.



Project:
Roodbar Lorestan Dam
I.R of Iran

- _ GROUND WATER LEVEL
- _ PORE WATER PRESSURE
- _ EARTHFILL DAMS AND EMBANKMENTS
- _ UP-LIFT PRESSURE IN DAM FOUNDATIONS
- _ SEEPAGE MONITORING
- _ WATER PRESSURE BEHIND TUNNEL LININGS
- _ POTENTIAL LANDSLIDES
- _ DEWATERING AND PUMP TESTS
- _ FOUNDATIONS AND DIAPHRAGM WALLS



VENTED PRESSURE TRANSDUCERS

The model P252R is a level transducer equipped with a relative vented piezoresistive pressure sensor which provides automatic compensation of the barometric changes. This transducer provides ground water table monitoring in standpipe and Casagrande piezometers.

TECHNICAL SPECIFICATIONS

Standard ranges	100, 200, 500 kPa, 1.0 MPa
Signal output	4-20 mA current loop
Sensitivity	0.01% FS
Accuracy (MPE*)	< ±0.25% FS
Power supply	12 - 24 V DC
Overpressure	1.3 x FS
Thermal zero shift	0.00025% FS / °C
Temp. Operating range	-10°C +55°C
Filter unit	synthesized stainless steel or Vyon®
Body material	stainless steel
Diameter / length	27 mm / 191,5 mm
Cable	OWE203KEOZH

ACCESSORIES

SUPPORT HEAD OP200CH1000	Lockable support head assembly with data plate. Positioned on the top of the standpipe permits to suspend the transducer by a secure cable stop.
VENTED BOX OEPDP002W00	Vented IP67 plastic box equipped with overvoltage protections and cable glands.

(*) 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).



STAFF GAUGES

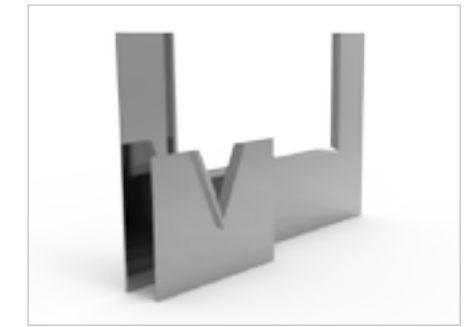
The staff gauge is used for a quick visual indication of the surface level in reservoirs, rivers, streams and open channels. These environmentally rugged iron gauges are finished with porcelain enamel to ensure easy reading and resist to rust or discoloration. Each gauge is accurately graduated and has holes for easy fastening to walls, piers and other structures.

STANDARD COMPONENTS

STAFF GAUGE OHIDR1000S0	Hydrometric rod 1 meter long, black and white colors. It is divided into centimeters with each decimeter numbered. Rods for any elevation may be assembled. Separate number plates are available to show elevation. Available also in different colors on request.
FIGURE PLATE OHIDR1310P0	Number plate with three (3) figures which represent elevation. The three figures are on white porcelain enameled plate. Using a combination of these figures any elevation may be represented. Available also in different colors on request.

SPECIAL PARTS

INCLINED STAFF GAUGES	They are customized gauges for installation on inclined surface such as upstream face of dams or concrete lined irrigation channels. Mounted flush on the sloped sides, these staff gauges give a direct reading of the vertical stage height.
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SEEPAGE MEASUREMENTS WEIR MONITORING

V-notch weirs are typically installed in open channels such as streams to determine discharge (flowrate). The basic principle is that the discharge is directly related to the water depth above the bottom of the "V". Leakage measurement is one of the most important indicators of the overall performance of dikes and dams.

V-NOTCH WEIRS

The purpose of the weir is to transform the instantaneous flow values into the pressure/level by means of specific measuring equipment. V-notch weirs are preferred for low discharges as the head above the weir crest is more sensitive to changes in flow compared to rectangular weirs.

0QV45LS1000	10 litre/sec, V-angle 45°
0QV60LS2000	20 litre/sec, V-angle 60°
0QV90LS5000	50 litre/sec, rectangular

WATER LEVEL TRANSDUCER

The V-notch water level transducer consists of a highly sensitive relative pressure sensor with 2 m vented cable and junction box with 3 levels of overvoltage protection.

0QVML0500EX	Level transducer, range 0-500mm
0QVML1000EX	Level transducer, range 0-1000mm
Transducer type	relative pressure transducer
Measuring range	500 or 1000 mm H ₂ O
Accuracy	±0.1 mm H ₂ O
Output signal	4-20 mA current loop
Power supply	12 - 24 V DC
Operating temperature	-10°C to +80°C

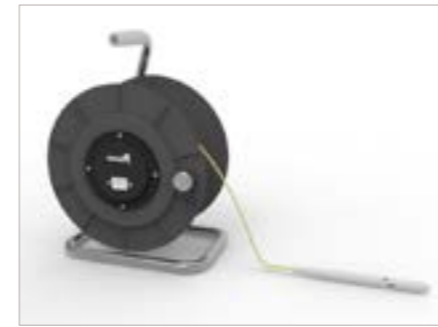
ACCESSORIES AND SPARE PARTS

0QVHI030000	Staff gauge for V-notch 300 mm long, millimetre division
0QVHI050000	Staff gauge for V-notch 500 mm long, millimetre division
0P252Q000000	Spare pressure transducer 500 or 1000 mm H ₂ O
0EPDP002W00	Spare junction box with OVP

PIEZOMETERS



- _GROUND WATER LEVEL
- _PORE WATER PRESSURE
- _EARTHFILL DAMS AND EMBANKMENTS
- _UP-LIFT PRESSURE IN DAM FOUNDATIONS
- _SEEPAGE MONITORING
- _WATER PRESSURE BEHIND TUNNEL LININGS
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- _DEWATERING AND PUMP TESTS
- _FOUNDATIONS AND DIAPHRAGM WALLS



WATER LEVEL INDICATORS (WLI)

The WLI or Dipmeters are used to measure the water level in standpipes piezometers. WLI is a battery powered portable device equipped with a stainless steel sensor probe connected to a graduated flat cable rolled up on a hand reel containing audio and visual indicators, and battery. The model C112T includes a digital indicator for temperature readings.

AVAILABLE MODELS

MODEL C112	flat cable with marks at every millimetre
Probe	water level detector
Cable lengths	30, 50, 100 m 150, 200, 300, 400, 500 m
Probe diameter	16 mm
Battery	1 x 9V DC disposable
MODEL C112T	flat cable with marks at every millimetre
Probe	water level detector and temperature sensor
Cable lengths	30, 50, 100 m 150, 200, 300, 400, 500 m
Reel diameter	260 mm, 320 mm, 420 mm
Probe diameter	16 mm
Display	3.5 LCD (only for C112T)
Battery	2 x 9V DC disposable

PROBE SPARE PARTS




OC112KITR00	Probe spare set for the model C112 including sensor probe weights and epoxy.
OC112TKITR0	Probe spare set for the model C112T including sensor probe weights and epoxy.



STANDPIPE AND CASAGRANDE PIEZOMETERS

Standpipe and Casagrande piezometers are open piezometers widely used to monitor piezometric water levels in vertical boreholes. Open piezometer consists of two parts: a porous tip and a riser pipe which continues upwards out of the top of the borehole. The porous tips are located within a sand filter zone and a bentonite seal is required between the sand filter zone and the backfill.

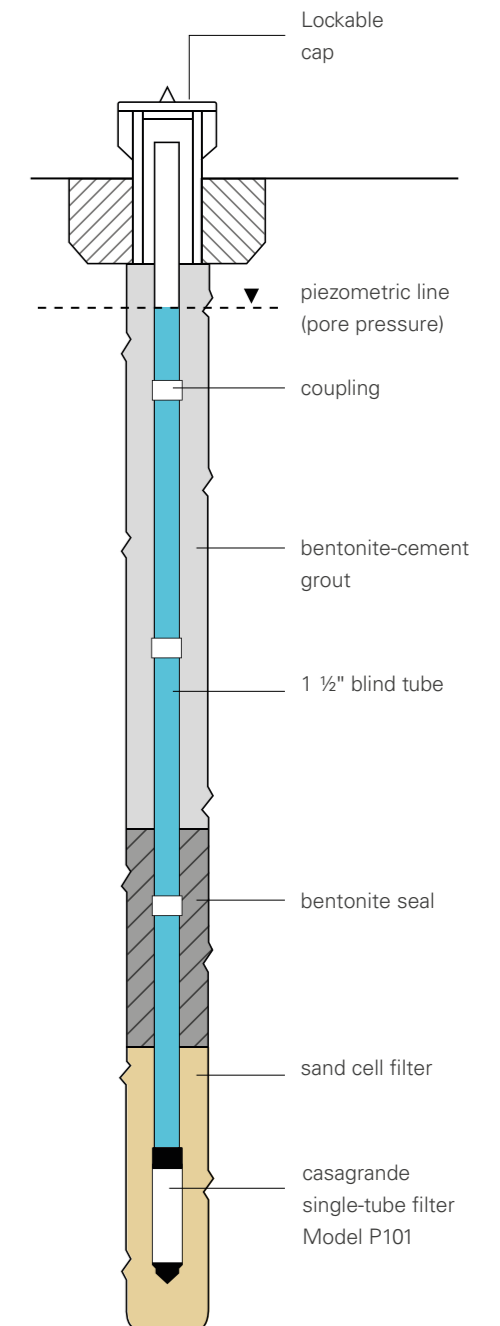
AVAILABLE MODELS

P101		Casagrande/standpipe 40 µ porous tip 1-half inch single tube connection Length: 200 mm Outer diameter: 61.5 mm
P112		Casagrande 40 µ porous tip half inch twin tubes connection Length: 200 mm Outer diameter: 61.5 mm
TFH		Standpipe filter unit PVC slotted tube with fabric Available diameters: 1, 1 1/2 and 2-inch Length: 3 meter

ACCESSORIES

LOCKABLE CAP OP100CH1000	Equipped with an identification plate and a topographic pin, the lockable cap ensures protection at the top end of Casagrande and standpipe piezometers.
BENTONITE PELLETS 1000BE20025K	Supplied in 25 Kg bags, the pellets work as a watertight sealant inside the borehole of the piezometer filter unit.

EXAMPLE OF CASAGRANDE PIEZOMETERS



INCLINOMETERS

- _LANDSLIDES
- _DAMS
- _UNSTABLE SLOPES
- _PILES
- _DIAPHRAGM WALLS
- _TUNNELING
- _DEEP EXCAVATIONS
- _BRIDGES AND VIADUCTS
- _EMBANKMENTS

Project:
Sogamoso HPP
Colombia



B.R.A.IN INCLINOMETER SYSTEMS

B.R.A.IN (Borehole Readout Array for INclinometers) system is mainly composed by digital inclinometer probe, bluetooth reel with control cable and B.R.A.IN APP compatible with Android and iOS devices. The intuitive B.R.A.IN APP allows the user to manage the inclinometer and spiral meter surveys and immediately share the readings with the most popular APP installed on the device.

VERTICAL SYSTEMS PERFORMANCES

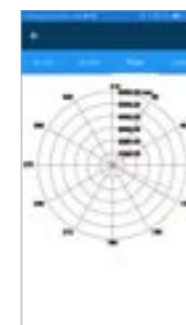
Readout value	20000 sin alpha (other values available on request)
System resolution:	
- with 500 mm gauge length	0.011 mm / 500 mm
- with 1000 mm	0.023 mm / 1000 mm
- with 2 ft gauge length	±0.0005 in/2 ft
Repeatability (precision) ¹	
- with 500 mm gauge length	± 1.5 mm / 30 m
- with 1000 mm	± 2.0 mm / 30 m
- with 2 ft gauge length	±0.079 in/100 ft

HORIZONTAL SYSTEMS PERFORMANCES

Readout value	20000 sin alpha (other values available on request)
System resolution:	
with 500 mm gauge length	0.011 mm / 500 mm
with 1000 mm gauge length	0.023 mm / 1000 mm
Repeatability (precision) ¹	
with 500 mm gauge length	± 7.0 mm / 30 m
with 1000 mm gauge length	± 10.0 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."

B.R.A.IN APP



Two example of screenshot

SISGEO.COM



VERTICAL MEMS PROBE

The vertical inclinometer probe is composed by a high performance MEMS sensors and a digitalizing electronic board, mounded inside a stainless steel body with 4 spring-loaded wheels and a waterproof connector. The probe is available with 500 mm and 1000 mm gauge length. It is commonly used to measure horizontal displacements in landslides, embankments, diaphragm walls, etc...

OS242DV3000 VERTICAL PROBE

Measuring range	±30°
Sensor type	biaxial digital MEMS
Signal output	RS-485 with Modbus RTU protocol
Sensor resolution @ 2 Hz	0.00056°
Repeatability	±0.0009°
Probe accuracy (MPE*)	±0.01% FS
Temp. operating range	-30°C to +70°C
Body material and diam.	stainless steel, 28 mm
Gauge length	500mm 1000mm, 2 ft
Wheels	2 spring-loaded carriages with 2 wheels each
IP rate	IP68 up to 2.0 MPa

OPERATIONS

At the beginning of a survey, the probe shall be brought to the point furthest from the collar of the inclinometer tube and left there to adjust to the ambient temperature. The probe shall then be moved sequentially to each respective measuring point in the direction of collar of the tube. On reaching the collar of the guide tube, the probe is removed from the guide tube, rotated by 180°, returned to the measuring point that is furthest from the collar of the guide tube and the sequence is repeated in the reversed position to complete the inclinometer survey.

ACCESSORIES

OS1S1T00000	Test (dummy) probe
OS1CSU10000	Pulley assembly and cable stop
OKLIONS000	KLION data analysis software

(*) 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 (\leq Lin. MPE) and polynomial correction (\leq Pol. MPE).



HORIZONTAL MEMS PROBE

The digital horizontal probe permits the monitoring of horizontally installed casings. It is available with 500 mm and 1000 mm gauge length. The horizontal inclinometer provides more accurate and repeatable readings than any other settlement profiling system. It is used to measure settlement or heave under embankments, tanks and roadways.

OS241DH3000 HORIZONTAL PROBE

Measuring range	±30°
Sensor type	uniaxial digital MEMS
Signal output	RS-485 with Modbus RTU protocol
Sensor resolution @ 2 Hz	0.00056°
Repeatability	±0.0009°
Probe accuracy (MPE*)	±0.01% FS
Temp. operating range	-30°C to +70°C
Body material and diam.	stainless steel, 28 mm
Gauge length (total length)	500mm (810mm), 1000mm (1310mm)
Wheels	2 fixed wheels and 2 spring-loaded wheels
IP rate	IP68 up to 2.0 MPa

OPERATIONS

The survey may be taken within a horizontal inclinometer casing installed either with "both sides open" or with "one end closed" by means of a dead end pulley. The initial measure establishes the profile of the casing and the subsequent measures detect changes in the profile related to the ground movements. Settlement and heave are calculated at each measurement interval, and the settlement profile is generated by summing displacements.

ACCESSORIES

OS20HOR0D00	Inclinometer connecting rod
OREXROD10BX	Set of 10 positioning rod (2 m)
OREXROD2000	Positioning rod, 2 m
OWRACPVC000	Dragging steel wire, PVC jacket
OS1RINV7000	Dead end pulley, 70 mm OD casing
OS1RINV7500	Dead end pulley, 3" casing

INCLINOMETERS

- _LANDSLIDES
- _DAMS
- _UNSTABLE SLOPES
- _PILES
- _DIAPHRAGM WALLS
- _TUNNELING
- _DEEP EXCAVATIONS
- _BRIDGES AND VIADUCTS
- _EMBANKMENTS



Project:
Lyon-Turin high speed railway tunnel
Border France-Italy



B.R.A.IN BLUETOOTH CABLE REEL

B.R.A.IN electronics readout is integrated in the cable reel, available with HD heavy duty cable or light cable. The BLE (Bluetooth Low Energy) wireless protocol permits a fast and safe communication with the management device with a very low batteries' consumption.

B.R.A.IN REEL SPECIFICATIONS

Communication with device	BLE (Bluetooth Low Energy) 4.2
On-board sensors	Temperature, humidity, voltage
Operating Temperature	-40 to 80°C (batteries -20 to 65°C)
Communication with probe	RS485 Modbus RTU Protocol
IP rate	IP65
Operating time	≈96 h (with inclinometer and spiral probe)
Notification LED	Different colors for local notifications

Minimum device specifications (not provided by SISGEO)	Bluetooth Low Energy BLE 4.2 ANDROID OS V. 7 or higher APPLE iOS 11 or higher
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AVAILABLE MODELS

OS2RC6000B0	HD (HEAVY DUTY) CABLE
Operating temp. range	-30 to 80 °C
Weight	14 kg with reel and 60 m cable
Cable lengths	30, 60, 100, 150 m
Conductors	6x0.50 mm ²
Depth tactile marks	copper, every 500 mm
OS2RD6000B0	LIGHT CABLE
Operating temp. range	-30 to 80 °C
Weight	6 kg with reel and 60 m cable
Cable lengths	30, 60, 100, 150, 200 m 100, 200, 300 ft
Conductors	2x0.50 + 2x0.22 mm ²
Depth tactile marks	aluminum, every 500 mm (Metric) 2 ft (USCS units)

SISGEO.COM



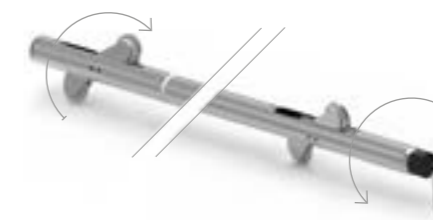
DIGITAL SPIRAL METER

The digital spiral meter is used to define the azimuth of the installed inclinometer casing in order to verify that the casing has been installed correctly. Spiral is a function of the manufacturing process, couplings and installation technique. Spiral correction improves accuracy and more reliable interpretation of data.

OS30PRI2D00 DIGITAL SPIRAL PROBE

Measuring range	±5° over wheels base (1000 mm)
Sensor type	rotary contactless potentiometer (magneto-resistive)
Resolution	0.001 FS
Repeatability	±0.01% FS
Stability	± 0.025% FS
Accuracy	< ±0.5% FS
Power supply	± 2.5 V DC
Diameter	28 mm
Length	1250 mm (without connector)
Wheel base	1000 mm
Connector	watertight, 6 pins

Digital spiral probe is fully compatible with B.R.A.IN bluetooth reel and APP. With KLION software, spiral probe data shall be inserted into the calculation in order to compensate inclinometer data with tube twisting data. Sisgeo suggests to take spiral data with the inclinometer zero reading for the data correction considering the casing twisting due to installation procedures.



Spiral probe: twisting on the probe axis for measuring the inclinometer casing torsion



KLION ANALYSIS SOFTWARE

KLION is a specially designed software to process inclinometer and T-Rex extensometer data from vertical and horizontal boreholes, providing graphs and reports. Data files may be created by manual data entry or directly from Archimede or B.R.A.IN readouts. Advanced data analysis using Mikkelsen suggestions (FMGM 2003) are available.

SOFTWARE MAIN FEATURES

- User - oriented interface for managing most operations with "point and click"
- Set-up and manage both vertical and horizontal readings
- Automatic compensation of the inclinometer data with spiral meter survey
- Customizable report file with advanced Word Processor
- Charts zoom-in or zoom-out with a simple mouse scroll
- For inclinometers, customisable charts of deformation over time are available
- With KLION you can view the inclinometer data elaborations in a 3D graph
- Geolocation with Google Map tool and main displacement vectors
- On-line automatic software updates if connected to the internet
- Multilanguage software now available in English and Italian. More languages in the next revision.

OPERATIVE SYSTEM REQUIREMENTS

KLION works on Microsoft © Vista, 7, 8, 8.1 and 10 (32 and 64 bit)
HW minimum requirement: RAM 512 MB, HD 100 MB



- _LANDSLIDES
- _DAMS
- _UNSTABLE SLOPES
- _PILES
- _DIAPHRAGM WALLS
- _TUNNELING
- _DEEP EXCAVATIONS
- _BRIDGES AND VIADUCTS
- _EMBANKMENTS

Project:
Salman Farsi
Iran



STANDARD INCLINOMETER CASINGS

Aluminium or ABS inclinometer casings are special grooved tubes, generally installed into a borehole, and used in conjunction with an inclinometer system to determine sub-surface ground or horizontal soil movements. The ABS inclinometer casings are available with standard or quick lock (QL) couplings; QL model allow faster and easier installation.

ALUMINIUM INCLINOMETERS

Models	S1110075	S1110054
Material	Aluminium	Aluminium
Outer diameter	86.4 mm	58.0 mm
Inner diameter	76.1 mm	49.0 mm
Groove inner diameter	82.0 mm	54.0 mm
Casing length	3 meter	3 meter
Weight	1.4 kg/m	0.92 kg/m
Spiral	<1.0°/3 m	<1.0°/3 m
Coupling O.D.	92.0 mm	62.6 mm

STANDARD ABS INCLINOMETERS

Model	S13100603M	S13100610F
Material	ABS plastic	ABS plastic
Tube outer diameter	71.0 mm	71.0 mm
Tube inner diameter	60.0 mm	60.0 mm
Tube groove inner diameter	64.0 mm	64.0 mm
Casing length	3 m	10 ft
Weight	0.7 kg/m	0.21 kg/ft
Spiral	<0.6°/3 m	<0.6°/10 ft
Coupling outer diameter	77.0 mm	77.0 mm
Coupling length	200 mm	200 mm

QUICK LOCK ABS INCLINOMETERS (AVAILABLE ONLY ON REQUEST)

Model	S1310L603M	S1310L610F
Material	ABS plastic	ABS plastic
Tube outer diameter	71.0 mm	71.0 mm
Tube inner diameter	60.0 mm	60.0 mm
Tube groove inner diameter	64.0 mm	64.0 mm
Casing length	3 m	10 ft
Weight	0.7 kg/m	0.21 kg/ft
Spiral	<0.6°/3 m	<0.6°/10 ft
Coupling outer diameter	77.0 mm	77.0 mm
Coupling length	200 mm	200 mm

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EASY LOCK AND QUICK-JOINT ABS CASINGS

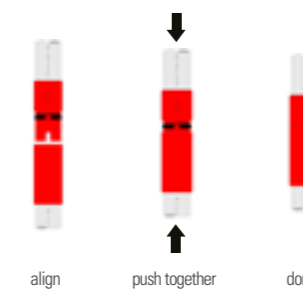
The Easy Lock inclinometer casing is a grooved tube machined at the end to have a self-aligning and fast junction. The QJ Quick-Joint casing consists of sections with built-in couplings that snap together. Both models are produced from high-quality virgin ABS and have O-rings ensure that the joint is grout proof.

OS143107000 EASY LOCK INCLIN. CASING

Material	ABS plastic
Outer diameter	70 mm
Inner diameter	58 mm
Groove inner diam.	63.5 mm
Overall casing length	3055 mm (casing + coupling)
Overall casing weight	3.6 kg (casing + coupling)
Spiral (1)	< 0.2° / m
Collapse test (2)	15 bar
HDT test ISO 75	+83°C

OS151107000 QJ INCLINOMETER CASING

Material	ABS plastic
Tube outer diameter	70 mm
Tube inner diameter	59 mm
Overall section length	3100 mm
Overall diameter	84 mm
Colour	white / red
Spiral (1)	<0.6°/3 m
Collapse test (2)	15 bar
Temperature range	-20°C +80°C



(1) During manufacturing a particular attention is paid to minimise the spiral of the casing grooves and to machine the aligning key for casing junction with self-aligning couplings.

(2) Test was performed in a water pressure chamber with empty casing sealed at the two ends.



COMBINED INCLINOMETER AND SETTLEMENT MEASUREMENT

Inclinometer and settlement measurements may be combined in the same borehole or in an embankment. The system consists of an ABS inclinometer casing equipped with telescopic couplings and settlement rings with permanent magnets. Settlement rings are available with spring spiders for installation in borehole or with round plates for embankments.

ACCESSORIES FOR EASY LOCK CASING

OS143ST0000	TELESCOPIC SECTION 3 meter section with 70 or 150 mm gap
OS131AF6000	SPIDER MAGNET RING Used in borehole with spring legs
OS131AR6000	EMBANKMENT MAGNET RING Used in fill with plate, OD 300 mm

ACCESSORIES FOR QJ CASING

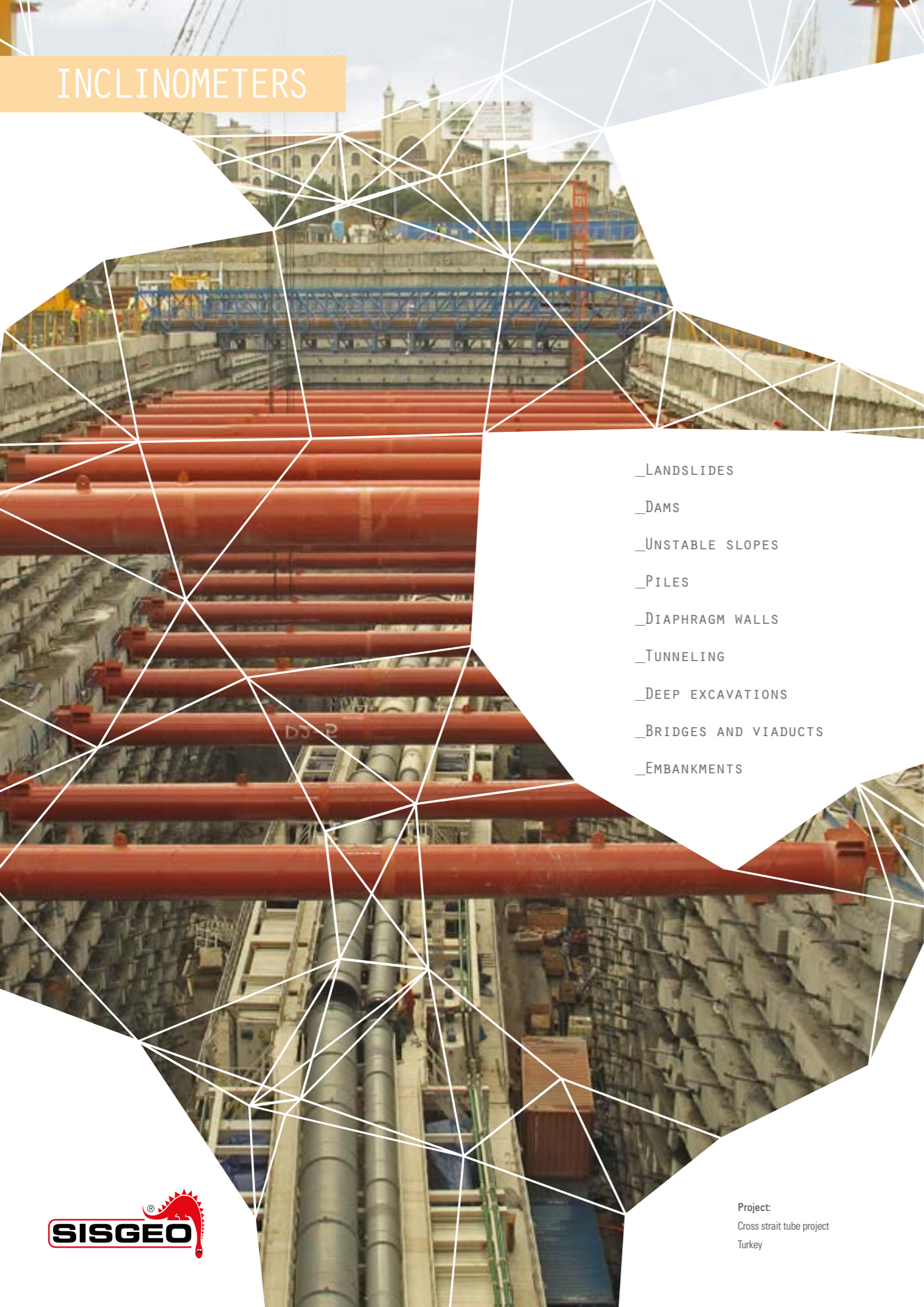
OS151MT0700	QJ TELESCOPIC COUPLING 500 mm long with 75 mm gap
OS151DR7000	QJ DATUM REFERENCE SECTION Bottom section with datum magnet
OS151AF8000	SPIDER MAGNET RING, ID 83 MM Used in borehole with spring legs
OS151AR8000	EMBANKMENT MAGNET RING Used in fill with plate, OD 300 mm

MEASUREMENTS

Manual readings are carried out lowering inside the casing:

- the inclinometer probe for monitoring the horizontal movements;
- the portable magnet extensometer readout model C121 with millimetre tape for detecting settlements.

INCLINOMETERS



- _LANDSLIDES
- _DAMS
- _UNSTABLE SLOPES
- _PILES
- _DIAPHRAGM WALLS
- _TUNNELING
- _DEEP EXCAVATIONS
- _BRIDGES AND VIADUCTS
- _EMBANKMENTS

Project:
Cross strait tube project
Turkey



MEMS IN-PLACE INCLINOMETERS

In-Place Inclinerometers (IPI sensors) are designed for the automatic monitoring of critical locations. Jointed together by lengths of steel wire and suspended inside a vertical casing where deformation may occur, IPI sensors will follow the deformation of the inclinometer casing due to the horizontal soil movements.

AVAILABLE MODELS CE

MODEL S411HA	uniaxial
MODEL S412HA	biaxial
Sensor type	self compensated MEMS
Available ranges	$\pm 10^\circ, \pm 15^\circ, \pm 20^\circ, \pm 30^\circ$
Sensor resolution @ 2 Hz	0.00056° (0.01 mm/m)
Accuracy (MPE*)	$< \pm 0.05\%$ FS
Temperature dependency	$< \pm 0.005\%$ FS /°C
Signal output	4-20 mA current loop
Power supply	18 - 30 V DC
Temp. operating range	-30°C to +70°C
Temperature sensor	Built-in thermistor
Protection	IP68 up to 1.0 MPa

PROBE FEATURES

Outer diameter	28 mm
Wheel base	1000 mm
Total length	1230 mm
Material	s/steel and thermoplastic resin
Protection	IP68 up to 1.0 MPa

ACCESSORIES

OS4TS101000	In-place inclinometer support head
OS4IPIT00L0	In-place inclinom. clamping tool
OWRAC200000	Stainless steel support wire, 2 mm
OWE106IPOZH	6 wires IPI cable, LSZH

(*) 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 (\leq Lin. MPE) and polynomial correction (\leq Pol. MPE).

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DIGITAL MEMS IN-PLACE INCLINOMETERS

This model of digital In-Place Inclinerometers (IPI) has a double carriage that permits to install probes not in continuous string at the desired depth. IPIs are suspended in the casing by means of steel wire and linked together with single digital cable. Readings can be taken manually with portable readout or automatically with OMNIAlog datalogger.

AVAILABLE MODELS CE

MODEL S411HD	vertical uniaxial
MODEL S412HD	vertical biaxial
Sensor type	self compensated MEMS
Available ranges	$\pm 10^\circ, \pm 15^\circ, \pm 30^\circ$
Sensor resolution @ 2 Hz	0.00056° (0.01mm/m)
Accuracy (MPE*)	$< \pm 0.01\%$ FS with $\pm 10^\circ, \pm 15^\circ$ FS $< \pm 0.015\%$ FS with $\pm 30^\circ$ FS
Temperature dependency	$< \pm 0.005\%$ FS /°C
Power supply	12 - 24 V DC
Signal output	RS485, MODBUS RTU protocol
Temp. operating range	-30°C to +70°C
Protection	IP68 up to 1.0 MPa

PROBE FEATURES

Outer diameter	28 mm
Wheel base	1000 mm
Total length	1230 mm
Material	s/steel and thermoplastic resin
Protection	IP68 up to 1 MPa

ACCESSORIES

OS4TS101000	In-place inclinometer support head
OWRAC250000	S/steel support wire 2.5 mm OD
OS400HD001C	Interprobe cable (digital cable with two IP68 connectors and s/steel wire) available different lengths (2 m, 5 m, 10 m and 15 m)
OECON04MV00	digital IPI connector
OWE606IPDZH	digital IPI cable



TILT BEAM SENSORS

The tilt beam sensor consists of a MEMS tiltmeter mounted on a rigid aluminum beam with a defined gauge length. Both ends of the beam are fixed to the structure. This arrangement converts tilt changes to millimeters of movement in order to monitor settlement and heave.

Special support tiltmeter plate allow to use tilt beam horizontal, vertical or inclined.

TILT BEAM SENSORS CE

MODEL S541MA	uniaxial tilt sensor
MODEL S542MA	biaxial tilt sensor
Application	horizontal, vertical or inclined
Sensor type	MEMS
Range	$\pm 2.5^\circ, \pm 5^\circ, \pm 10^\circ$
Sensor resolution	0.01%FS
Accuracy: Pol. MPE*	$\pm 0.004^\circ$ for $\pm 2.5^\circ$ range, $\pm 0.006^\circ$ for $\pm 5^\circ$ range, $\pm 0.010^\circ$ FS for $\pm 10^\circ$ range
Signal output	4-20 mA current loop (inclination), Ohm (temperature)
Power supply	18 - 30 V DC
Temp. operating range	-30°C to +70°C
Protection	IP67

DIGITAL TILT BEAM SENSOR CE

MODEL S541HD	uniaxial digital tilt sensor
MODEL S542HD	biaxial digital tilt sensor
Application	horizontal, vertical or inclined
Sensor type	MEMS
Range	$\pm 2.5^\circ, \pm 5^\circ, \pm 10^\circ$
Resolution (reading frequency 2 Hz)	0.00056°
Sensor accuracy:	
Pol. MPE**	$\pm 0.002^\circ$
Lin. MPE**	$\pm 0.004^\circ$
Signal output	RS485, MODBUS RTU protocol
Power supply	from 8 to 28 Vdc
Temp. operating range	-30°C to +70°C
IP class	IP67

BEAMS

OS7BM100002	1 meter beam
OS7BM200002	2 meter beam
OS7BM300002	3 meter beam
Material	Aluminium
Beam section	40 x 60 mm (WxH)

- _LANDSLIDES
- _DAMS
- _UNSTABLE SLOPES
- _PILES
- _DIAPHRAGM WALLS
- _TUNNELING
- _DEEP EXCAVATIONS
- _BRIDGES AND VIADUCTS
- _EMBANKMENTS

Project:
Astana National Library
Kazakhstan



SURFACE TILTMETERS

MEMS tiltmeters monitor tilt changes in either one or two axial planes perpendicular to the surface of the base plate. MEMS tiltmeters that are permanently installed either horizontally or vertically on the structure, provide a long term monitoring and are designed to be read manually or by an automatic remote data logging system.

AVAILABLE MODELS CE

MODEL S541MA	uniaxial
MODEL S542MA	biaxial
Sensor type	self compensated MEMS
Available ranges	±2.5°, ±5°, ±10°
Sensor resolution	0.01% FS
Accuracy: Lin. MPE ^(*)	±0.008° for ±2.5° range, ±0.012° for ±5° range, ±0.020° FS for ±10° range
Signal output	4-20 mA current loop (inclination), Ohm (temperature)
Power supply	18 - 30 V DC
Offset temperature dependency	±0.003° / °C (from -20°C to +70°C)
Temp. operating range	-30°C to +70°C
Overall dimensions (LxHxW)	99 x 115 x 49 mm (including connectors)
Material and IP class	anodized aluminum, IP67

ACCESSORIES

OS540AP3D02	Fine adjustment base plate especially recommended for small ranges (±2.5° and ±5°)
OEPM010IP10	Junction box for digital sensor chains Measuring box for digital sensors chain.

SERVO-ACCELEROMETER TILTMETERS CE

MODEL S530SV	uniaxial or biaxial
Sensor type	gravity referenced servo inclinometer
Available ranges	±5°, ±14.5°
Non-linearity	±0.02% FS (least squares method)
Thermal drift	±0.002% FS / °C
Temp. operating range	-20°C to +80°C
Overall dimensions	128 x 130 x 195 mm (LxWxH)
Protection	IP67

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TILLI PORTABLE TILTMETER

TILLI is a rugged portable tiltmeter. It consists of a durable stainless steel frame with an aluminium housing containing a self compensated MEMS tilt sensor. The surfaces of the frame are machined to allow the accurate positioning of the tiltmeter during successive measurements. A single TILLI can be used to measure any number of pre-installed tilt plates.

OSCLIN150H0 TILTMETER CE

TILLI sensor	uniaxial self compensated MEMS
Measuring range	±15° from the vertical
Sensor resolution @ 2 Hz	0.00056° (0.01 mm/m)
Repeatability	< ±0.003°
Temperature dependency	< ±0.005% FS / °C
Temp. operating range	-30°C to +70°C
Material stainless	Stainless steel frame anodised AL sensor housing
Weight	3 Kg (TILLI only)
Carrying case	IP68 shock-resistant plastic



Measuring activity with TILLI

OSCLTP14B00 TILT PLATE

Material	Brass
Dimensions (OD x thickness)	135 x 23 mm



SUBMERSIBLE MEMS TILTMETERS

Submersible tiltmeters are designed for in-place applications on surfaces below the water level or where flooding may occur. Submersible tiltmeters are equipped with MEMS sensors and mounted on a base plate in order to monitor tilt changes in either one or two axial planes perpendicular to the surface of the base plate.

AVAILABLE MODELS CE

MODEL S521MA	uniaxial
MODEL S522MA	biaxial
Sensor type	self compensated MEMS
Available ranges	±5°, ±10°
Sensor resolution @ 2 Hz	0.00056° (0.01 mm/m)
Accuracy (MPE ^(*))	< ±0.07% FS with ±5° FS < ±0.05% FS with ±10° FS
Temperature dependency	< ±0.005% FS / °C
Signal output	4-20 mA current loop
Power supply	18 - 30 V DC
Temp. operating range	-30°C to +70°C
Overall dimensions	36 x 68 x 245 mm (LxWxH)
Material and protection	stainless steel, IP68 until 1.0 MPa

ACCESSORIES

OS500PF1000
Stainless steel base plate with three anchors for wall mounting.
Overall diam: 100 mm



OS500AP3600
"L" shaped base plate for installation of submersible tilt meters on sloped surface.



(*) 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).

- _LANDSLIDES
- _DAMS
- _UNSTABLE SLOPES
- _PILES
- _DIAPHRAGM WALLS
- _TUNNELING
- _DEEP EXCAVATIONS
- _BRIDGES AND VIADUCTS
- _EMBANKMENTS

Project:
Metro Line C
Colosseum monitoring
Rome, Italy



D-TILTMETERS

The D-Tiltmeters use digital MEMS tilt sensors. They are designed to be permanently installed either horizontally or vertically to provide long term measurements. The D-Tiltmeters monitor tilt changes in either one or two axial planes perpendicular to the surface of the base plate. Waterproof connectors offer simple and easy connection in series.

AVAILABLE MODELS CE

MODEL S541HD	uniaxial
MODEL S542HD	biaxial
Sensor type	self compensated MEMS
Available ranges	±2.5°, ±5°, ±10°
Sensor resolution @ 2 Hz	0.00056°
Accuracy:	
Pol. MPE*	±0.002°
Lin. MPE*	±0.004°
Offset temperature dependency	±0.002° / °C
Power supply	from 8 to 28 Vdc
Signal output	RS485, Modbus RTU protocol
Temp. operating range	-30°C to +70°C
Overall dimensions (LxWxH)	151 x 106 x 49 mm (including connectors)
Material and IP class	anodized aluminum, IP67

ACCESSORIES

OS540AP3D02	Fine adjustment base plate especially recommended for small ranges (±2.5° and ±5°)
0ECAV04V200	Flying cable for New Leonardo readout for D-Tiltmeter direct reading
0EPD023IPID	Junction box for digital sensor chains
0EPM010IPI0	Measuring box for digital sensors chain

(*) 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).



BH PROFILE (DIGITAL IPI)

Digital borehole profile in-place inclinometers offer the continuous remote monitoring of casings deformed by active soil movements. BH profile chain consists of a number of digital IPIs with carbon fiber extension rods and a terminal wheel assembly to close the chain. A single digital cable connects the system to OMNIalog for remote data management, real time monitoring and alarms.

AVAILABLE MODELS CE

MODEL S431HD	vertical uniaxial
MODEL S432HD	vertical biaxial
MODEL S441HD	horizontal uniaxial
Sensor type	self compensated MEMS
Available ranges	±10°, ±15°, ±20°, ±30°
Sensor resolution @ 2 Hz	0.00056° (0.01 mm/m)
Accuracy:	
Pol. MPE ^(*)	±0.010% FS with ±10°, ±15° FS ±0.015% FS with ±20°, ±30° FS
Offset temperature dependency	±0.002° / °C
Power supply	from 8 to 28 Vdc
Signal output	RS-485 with Modbus RTU protocol
Temp. operating range	-30°C to +70°C
IP class	IP68 up to 1.0 MPa

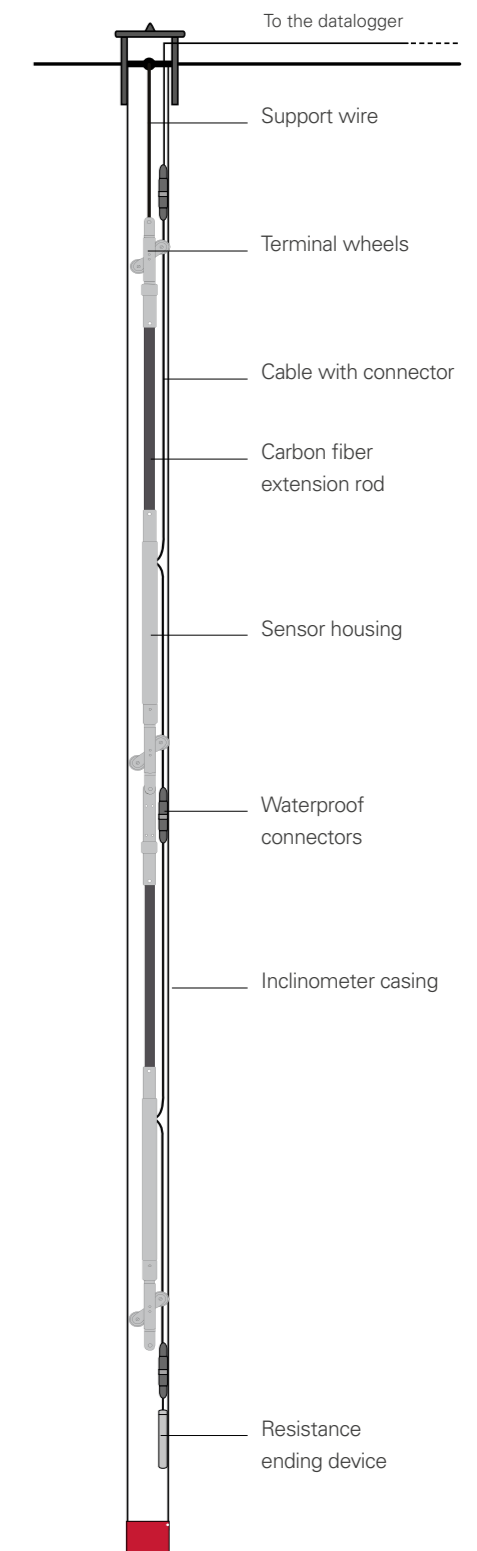
PROBE FEATURES

Sensed probe diameter	30 mm
Sensed probe material	s/steel and thermoplastic resin
Protection	IP68 up to 1 MPa
Extension rod	Carbon fiber, 20 mm OD

ACCESSORIES

OS430EX10RD	1 m carbon-fibre elongation rod
OS430EX20RD	2 m carbon-fibre elongation rod
OS430EX30RD	3 m carbon-fibre elongation rod
OS43WHE2SS0	Terminal wheels assembly
OS4TS101000	Vertical IPI support head
ODEX0TS2350	Horizontal IPI protective cap
OWRAC250000	s/steel support wire, 2.5 mm

EXAMPLE OF BH PROFILE CHAIN



RAILWAY DEFORMATION SYSTEM

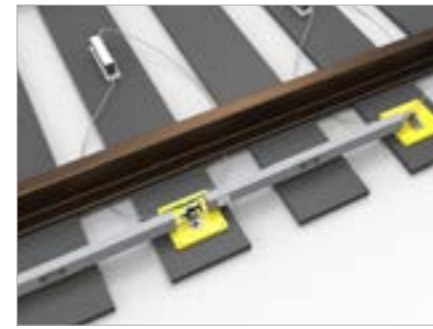


_HIGH SPEED RAILWAYS

_METRO RAILWAYS

_INTERFERENCES WITH EXCAVATION NEAR RAILWAYS

Project:
Milan - Bologna
High Speed Railway
Italy



RDS SYSTEM

RDS, Railway Deformation System, is a unique monitoring system designed by Sisgeo for the automatic surveying of the longitudinal deformation of the rail tracks and the rotation of sleepers. The rail track geometry is monitored in terms of longitudinal level and torsion of the track. RDS can be managed by a single operator on the web with WMS* (Web Monitoring System).

ADDITIONAL INFORMATION

Compared to the traditional systems, including topographic surveys, RDS offers to the Customers either high performances and significant reduction of the operating costs. In fact when the system is correctly installed there is no field activity required by technicians at site. RDS components, connected through digital cable to OMNIAlog with GPRS modem or 3G router, will be read automatically by WMS* (Web Monitoring System). FieldStat* software running directly on WMS platform, allows to determine the correlations that may have influence on collected data, for example temperature, and to filter the measures from the effects of external factors. With WMS it will be possible to have alarm thresholds and alerting.

(*) Trademarks of Field Srl



WMS graphs with railway twisting data and alert/alarm levels

SISGEO.COM



LONGITUDINAL RDS DIGITAL GAUGES

Track longitudinal deformation shall be measured in "mm" as the difference of level between two points located at preset intervals. For longitudinal deformation, the system consists of instrumented aluminum beams with digital MEMS tilt sensors and optical target. Special joint between beams is designed in order to reduce the thermal deformation which may influence the readings.

OS7RDSHDLOO LONGITUDINAL GAUGE

Sensor type	digital uniaxial MEMS
Measuring range	±10° (±5° on request)
Sensor resolution @ 2 Hz	0.00056° (0.01mm/m)
Accuracy (MPE*)	< ±0.05% FS (±0.08 mm/m with ±10° range)
Sensor temp. dependency	< ±0.005% FS /°C
Power supply	12 - 24 V DC
Signal output	RS485, MODBUS RTU protocol
Temp. operating range	-30°C to +70°C
Bar section	60 x 40 mm
Available lengths	1 m, 2 m, 3 m
Material	Aluminum bar and steel plate
Protection	IP67

RDS ACCESSORIES AND SPARE PARTS

OS7RDS00LE0 Terminal fixing plate, mandatory to finish the RDS longitudinal chain.



OS7RDS00LSP Spare mounting plate for longitudinal RDS beam. Required when RDS beam is removed from previous installation.



OS7RDS00LWP Mounting plate for longitudinal RDS in case of wooden sleepers.



TRANSVERSE RDS DIGITAL GAUGES

Trak torsion is measured in "‰" as the change in inclination of two sleepers located at the same preset intervals along the track. For the measurement of torsion the system consists of a 200 mm aluminum box equipped with digital MEMS tilt sensor and steel mounting supports.

OS7RDSHDT02 TRANSVERSE GAUGE

Sensor type	digital uniaxial MEMS
Measuring ranges	±10° (±5° on request)
Sensor resolution @ 2 Hz	0.00056° (0.01mm/m)
Accuracy (MPE*)	< ±0.05% FS (±0.025 mm, ±10°FS)
Sensor temp. dependency	< ±0.005% FS /°C
Power supply	12 - 24 V DC
Signal output	RS485, MODBUS RTU protocol
Temp. operating range	-30°C to +70°C
Overall dimensions (LxHxT)	295 x 77 x 64 mm
Material	Aluminum body and steel plate
Protection	IP67

RDS ACCESSORIES AND SPARE PARTS

OS7RDS00TSP Galvanized steel spare mounting plate for transverse RDS.



OS7RDSTER5M Terminal junction box kit to be supplied for each RDS longitudinal chain. It is composed by a junction box with 5m electric cable.

OWE606IPD2H Signal cable to link terminal junction box to OMNIAlog.

(*) 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).

SETTLEMENT GAUGES

- _ BUILDINGS
- _ EMBANKMENTS
- _ FOUNDATIONS
- _ CIVIL STRUCTURES
- _ TUNNELING
- _ CONCRETE AND EARTHFILL DAMS

Project:
Boguchanskaya HPP
Russia



H-LEVEL LIQUID LEVEL SYSTEM

The H-Level gauge consists of a low visual impact enclosure containing a high sensitivity relative pressure transducer and a small reservoir designed to avoid any air bubble creation. The LLS system consists of a series of H-Level gauges interconnected by a liquid filled tube to a reference tank; barometric air compensation tube guarantees barometric compensation on the whole system avoiding data errors caused by the air pressure variations near the gauge.

DIGITAL H-LEVEL GAUGES

OHLEV050D00	DIGITAL H-LEVEL GAUGE, 500 mm FS
OHLEV100D00	DIGITAL H-LEVEL GAUGE, 1000 mm FS
Sensor type	capacitive pressure sensor
Measuring range	500 or 1000 mm H ₂ O (2000 mm on request)
Sensitivity	0.03 mm H ₂ O with 500 mm FS 0.06 mm H ₂ O with 1000 mm FS
Gauge accuracy (*)	±0.15% FS with 500 mm range (thermal effects not included) ±0.10% FS with 1000 mm range
Operating temperature	-20°C to +80°C
Non-destructive overpressure	120 kPa
Gauge dimensions (WxHxD)	118 x 140 x 70 mm



Digital H-Level gauge is composed by the yellow pressure sensor housing and the digitalizing box (D-BOX), connected with 500 mm cable.
D-BOX dimensions (WxHxD):
120 x 60 x 52 mm

(*) MPE is the Maximum Permitted Error on the measuring range (FSR)

ANALOGUE H-LEVEL GAUGES

OHLEV050000	H-LEVEL GAUGE, 500 mm FS
OHLEV100000	H-LEVEL GAUGE, 1000 mm FS
Sensor type	capacitive pressure module
Measuring range	500 or 1000 mm H ₂ O (2000 mm on request)
Sensitivity	0.03 mm with 500 mm FS 0.06 mm with 1000 mm FS
Gauge accuracy (*)	±0.15% FS with 500 mm range (thermal effects not included) ±0.10% FS with 1000 mm range
Operating temperature	-20°C to +80°C
Non-destructive overpressure	120 kPa
Gauge dimensions (WxHxD)	118 x 140 x 70 mm



MULTIPOINT SETTLEMENT SYSTEMS

The multipoint settlement system consists of a number of hydraulic settlement gauges connected by tubing to a reference tank located on a higher, stable ground. The settlement gauge is a pressure transducer with vibrating wire or capacitive technology, mounted on a plate with a protective cover. Depending on the requirement, the settlement system can be installed with just a single gauge or with multiple gauges.

OD422R000MA ELECTRICAL GAUGE CE

Sensor type	capacitive vented pressure transducer with built-in thermistor
Measuring range	20 kPa, 50 kPa, 100 kPa 1.75 m, 4.4 m, 8.8 m (with Sisgeo liquid mix)
Sensor sensitivity	<0.006% FS
Sensor total accuracy ⁽¹⁾	<±0.1% FS
Output signal	4-20 mA (pressure), Ohm (thermistor)

OD422R000VW VIBRATING WIRE GAUGE CE

Sensor type	vibrating wire non-vented pressure transducer with built-in thermistor
Measuring range	170 kPa, 350 kPa, 700 kPa 15.0 m, 30.9 m, 61.8 m (with Sisgeo liquid mix)
Sensor sensitivity	0.025% FS
Sensor accuracy	<±0.25% FS
Output signal	frequency (pressure), Ohm (thermistor)

The operating principle is based on the pressure variation caused by the change in height of a column of liquid. Subsequent height variations occurring between the datum point and the measuring points cause proportional variations of the hydraulic level of each settlement gauge.

COMPONENTS AND ACCESSORIES

OD422SERB00	SIMPLE REFERENCE VESSEL
OD422S08000	REFERENCE TANK
0MEPR0106000	BAROMETER
0TUNY060800	6 MM PA TUBE, ID/OD 6/8 MM
1000LIGL100	SISGEO LIQUID MIX
1000COPE300	HYDRAULIC CIRCUIT INSULATION
OD422SAT200	SATURATION DEVICE



PRISMS AND TARGETS

Mini prisms are supplied with aluminum "L" shaped support offering high accuracy and small dimensions. Optical targets are available with various supports, single or double-faced, so as to suit a large number of applications. Simple bolt and benchmark can be supplied to complete the topographic accessories for structural and convergence surveying.

OGMP1040000 MINIPRISM

Max I.R. range	2000 m (7000 ft)
Prism diameter	24 mm
Prism body dimensions	Ø 60 mm, thickness 27 mm
Diameter	34 mm
L-support	aluminum, 12 x 15 mm section
Overall dimensions	76 x 90 x 27 mm

OPTICAL TARGETS

OGCTR005000	REMOVABLE TARGET with rotary plate
OGCTR38ADP0	3/8" G PLASTIC STUD ADAPTOR for OGCTR0050000
OGCTR0050TS	TARGET 50 x 50 MM with rotary plate and M6 anchor
OGCTR0050L0	TARGET 50 x 50 MM with aluminium "L" support
OGCSH165000	SHEET OF N.16 ADHES. REFLECTOR reflector dimensions 50 x 50 mm

TOPOGRAPHIC BOLTS

	0GBM025SS00 Head dimensions: Ø 25 mm, height 5 mm Body diameter: Ø 10 mm Total length: 55 mm Material: stainless steel
	0GBM000SS00 Head: removable, Ø 20 or Ø 40 mm Body dimension: 8 x 15 mm Total length: 177 mm Material: galvanized and stainless steel



SETTLEMENT GAUGES

- _ BUILDINGS
- _ EMBANKMENTS
- _ FOUNDATIONS
- _ CIVIL STRUCTURES
- _ TUNNELING
- _ CONCRETE AND EARTHFILL DAMS

Project:
Chuquicamata Mine
Chile



T-REX INCREMENTAL EXTENSOMETER

T-REX is a removable extensometer which has been designed for incremental measurements along the axis of an inclinometer casing equipped with ring magnets. Thanks to the positioning device, T-REX digital probe gives accurate measurements. KLION analyzer software includes a smoothing technique that allows the "best fit" in order to evaluate the real behaviour of the soil movements.

OEX45100DS DIGITAL T-REX SYSTEM **CE**

T-REX digital extensometer offers several advantages:

- wide measuring range (± 40 mm displacement per meter) which allows applications either in soil or rock
- fully compatible with Sisgeo BRAIN inclinometer system (cable, connector and BRAIN APP)
- no mechanical contact between probe and targets
- combined with inclinometer permits 3-D deformation borehole profile

Measuring base	1.000 mm
Measuring range	± 40 mm
Probe repeatability	0.01 mm/m
Signal output	RS485 Modbus RTU protocol
Operating temperature	$-30^{\circ}\text{C} +75^{\circ}\text{C}$
IP class	IP68 up to 2.0 MPa
Dimensions	$\varnothing 40$ mm, length 1664 mm
Material	aluminum body and steel parts

BRAIN REEL AND APP

Measurements are performed with B.R.A.IN bluetooth reel (product code OS2RC6000B0), available in different length from 30m up to 250m. APP available for both Android and Apple devices.

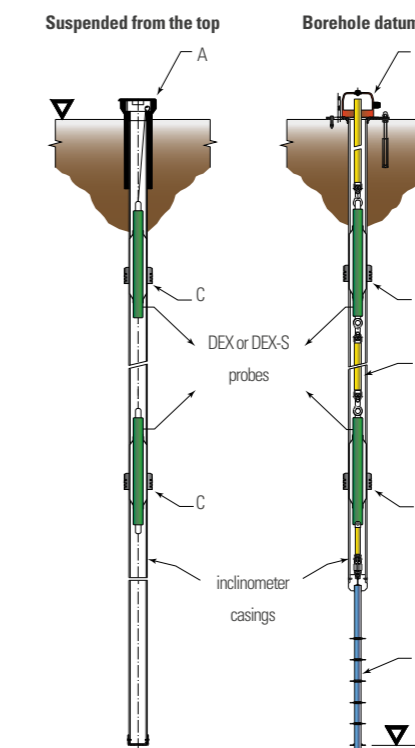


DEX IN-PLACE EXTENSOMETERS

DEX extensometers are used in conjunction with inclinometer casings for the automatic monitoring of settlement or heave. Strings of DEX extensometer are joined together with stainless steel wire or rods. DEX probes are placed at different depths where the settlement is likely to occur with reference points at the top or bottom of the casing.

TECHNICAL SPECIFICATIONS **CE**

ODEX35010000	Range 100 mm, length 1230 mm
ODEX35050000	Range 500 mm, length 1230 mm
ODEX35100000	Range 1000 mm, length 1730 mm
Sensor resolution	0.005 mm
Sensor accuracy	$< \pm 0.25\%$ FS for ODEX35010 $< \pm 0.08\%$ FS for ODEX35050 and ODEX35100
Signal output	0-10 V DC
Operating temperature	$-30^{\circ}\text{C} +70^{\circ}\text{C}$
Environmental	IP68 (up to 1.0 MPa)
Outer diameter	35 mm



DEX-S IN-PLACE EXTENSOMETERS

DEX-S are in-place extensometers equipped with biaxial MEMS tilt sensor for 3-D borehole displacement monitoring. Mixed chains of DEX, DEX-S and IPI give a cost effective solution for comprehensive borehole monitoring. DEX-S probes connected to OMNIAlog datalogger provides automatic monitoring of unattended locations and alerting.

TECHNICAL SPECIFICATIONS **CE**

ODEX35S102B0	Axial range 100 mm, Tilt range $\pm 10^{\circ}$
ODEX35S202B0	Axial range 100 mm, Tilt range $\pm 20^{\circ}$

SETTLEMENT SENSOR

Measuring range	± 50 mm (100 mm)
Linearity	$< \pm 0.30\%$ FS
Sensor accuracy	$< \pm 0.25\%$ FS
Signal output	0-10 V DC (4-20 mA on request)

TILT SENSOR

Technology	self compensated MEMS
Type	Biaxial
Sensor resolution @ 2 Hz	0.00056° (0.01 mm/m)
Sensor accuracy	$\pm 0.07\%$ FS
Temperature dependency	$< \pm 0.005\%$ FS

THERMISTOR

Type of sensor	NTC thermistor
Measuring range	$-50^{\circ}\text{C} +80^{\circ}\text{C}$
Resolution	0.1 $^{\circ}\text{C}$
Accuracy	$\pm 0.5^{\circ}\text{C}$

DEX AND DEX-S ACCESSORIES

OWE104SG0ZH	DEX signal cable, 4 wire
OWE110DX0ZH	DEX-S signal cable, 10 wire
OS4TS101000 (A)	Support head, suspended installation
OWRAC200000	Stainless steel support wire, 2 mm
OS4IPIT00L0	Wire clamping tool
ODEX0TT6000 (E)	Borehole bottom anchor
OS4RODOAC00 (D)	Stainless steel placement rods
ODEX0TS2350 (B)	Support head, rod installation
OEXORING93 (C)	DEX ring magnet, ID 71 mm OD 95 mm
OEXORING83 (C)	DEX ring magnet, ID 60 mm OD 83 mm



SETTLEMENT GAUGES

- _ BUILDINGS
- _ EMBANKMENTS
- _ FOUNDATIONS
- _ CIVIL STRUCTURES
- _ TUNNELING
- _ CONCRETE AND EARTHFILL DAMS

Project:
Afshar Dam
Turkey



MAGNET EXTENSOMETER (BRS)

Magnet extensometer is a system for measuring either settlement or heave at various depths in soil and embankments. The system consists of an access tube with external corrugated pipe and ring magnets. Readings are obtained lowering in the access tube a portable readout equipped with a reed switch probe.

COMPONENTS

OD111P30000	3 M SECTION ACCESS TUBE
OD111PV5500	CORRUGATED PIPE, OD 55 MM
OD111TF6000	TELESCOPIC END AND DATUM SUSPENSION HEAD
OD111TS1000	SPRING MAGNET RING
OD111AF6000	ID 60 mm, max span 300 mm
OD111AR6000	MAGNET SETTLEMENT PLATE
	iD 60 mm, plate OD 300 mm

C121 PORTABLE READOUT

OC121005000	READOUT, 50 M FLAT CABLE
OC121010000	READOUT, 100 M FLAT CABLE
OC121015000	READOUT, 150 M FLAT CABLE
OC121KITR00	DIPPING PROBE SPARE KIT
Probe dimensions	OD 16 mm, length 250 mm
Cable division	millimetre, class II ECC
Cable sheath	nylon
System accuracy	±1 mm
Temp. operating range	-40°C +80°C

HORIZONTAL DISPLACEMENT MAGNET SYSTEM

Magnet system can be installed horizontally to measure horizontal ground movements.

OTUHDPE5000	HDPE ACCESS TUBE, OD 50 MM
OD111PV7000	CORRUGATED PIPE, OD 70 MM
OD1RINV4000	DEAD END PULLEY ASSEMBLY
OD111AH6500	MAGNET RING ID 70 MM



PROFILE GAUGE (PROFILER)

Profiler is a hydrostatic profile gauge designed for settlement or heave monitoring beneath embankments or foundations. The Profiler probe is pulled through a HDPE pipe buried into the soil. The transducer measures the profile of the pipe relative to a reservoir fixed on a tripod located on stable ground.

OD5HPG33100 PROFILER PROBE

Range	8.5 m
Resolution	1 mm
Total accuracy	±20 mm
Time lag	3-10 sec
Diameter	34 mm
Length	280 mm
Material	stainless steel

READOUT AND REEL

Digital display	4.5 digits LCD
A/D converter	14 bits + sign
Reading linearity	±1 digit
Zero off-set	external adjustable
Power supply	12V DC rechargeable battery
Operating time	> 15 hours
Temp. operating range	-10°C +50°C
Reel diameter	695 mm
Reel cable capacity	< 150 meter
Total weight	25 Kg with 50 m cable

OWE206M1200 PROFILER CABLE

Profiler cable includes electrical cable and liquid tube encapsulated in a polyurethane external jacket.

Maximum length	150 m
Hydraulic tube	nylon 8 x 6 mm
Hydraulic fluid	de-aired water-glycerine mix
Marks	every meter
Electrical cable layout	6 x 0.22 mm
External jacket	polyurethane LSZH, OD 13.7 mm



FIXED EXTENSOMETERS

Fixed extensometer is usually defined as a device placed in an embankment fill or inside a borehole for monitoring settlement or heave between two points. Optical surveying of the top of the riser rod provides precise monitoring. Electrical transducers can be used for automatic readings in remote inaccessible locations.

SETTLEMENT PLATFORM

The primary advantage of the settlement platform is its simplicity. The settlement platform consists of a galvanized square plate to which a riser settlement rod is attached. An anti-friction corrugate pipe is placed around the riser rod. Optical levelling measurements, on the survey point mounted on the top cap, provide records of plate elevation.

OD100A20000	2 M SECTION RISER ROD
OD111PV5500	CORRUGATE PIPE, OD 55 mm
OD100B05000	SQUARE PLATE 500 x 500 mm
OD100T15000	TOP CAP AND SURVEY POINT

TELL-TALE EXTENSOMETER

The tell-tale extensometer is a single-point extensometer which is typically used for precise monitoring of ground surface settlement or heave. It consists of a stainless steel bottom anchor to which a string of riser measuring rods is attached. An anti-friction corrugate pipe is placed around the riser rods. Optical levelling measurements of the top head of the riser rod provide a measure of ground settlement. Sliding rings are placed at both ends in order to prevent down drag forces on the rod.

OD100A20000	2 M SECTION RISER ROD
OD111PV5500	CORRUGATE PIPE, OD 55 mm
OD100TT6000	BOTTOM ANCHOR
OD100TT0100	TOP CAP AND SURVEY POINT
OD100TTEL10	DTM MEASURING HEAD

ODTM0000000 DTM ELECTRICAL TRANSDUCERS

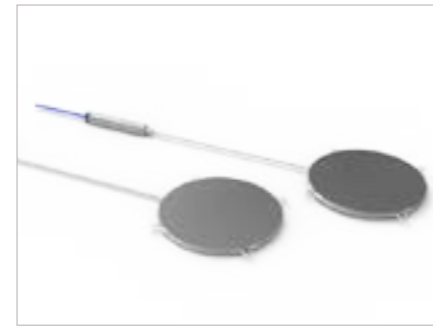
DTM electrical transducers can be mounted on either settlement platforms or the tell-tale extensometers.

Range	250 mm, 500 mm, 1000 mm
Sensor accuracy	±0.25% FS
Output signal	4-20 mA current loop

PRESSURE & LOAD CELLS



- _ EMBANKMENTS
- _ TUNNELING
- _ CONCRETE MASS
- _ EARTH FILL DAMS
- _ PILES
- _ DIAPHRAGM WALLS
- _ DEEP EXCAVATIONS
- _ BRIDGES AND VIADUCTS



EARTH PRESSURE CELLS

Earth pressure cells are utilized to monitor total pressure in earthfill dams and embankments or in the interface between the structure and the excavation wall.

The stress applied to the pad is converted into an electrical signal via the pressure transducer and can be remotely read with a variety of portable readout units or dataloggers.

AVAILABLE MODELS CE

MODEL L143D	vibrating wire technology
Full scales	350, 500, 700 kPa 1, 1.7, 2, 5, 7, 10 MPa
Sensitivity	0.03% FS
Accuracy (MPE*)	< ±0.25% FS
Signal output	frequency (VW), resistance (T)
Pressure pad size	diameter 230 mm thickness 12 mm
Transducer size	OD 28 mm, 180 mm long
Material	Stainless steel
Operating temp. Range	-20°C +80°C
Weight	0.6 kg

MODEL L141D	piezo resistive technology
Full scales	200, 500 kPa 1, 2, 5, 10 MPa
Sensitivity	0.002% FS
Accuracy (MPE*)	< ±0.25% FS
Signal output	4-20 mA current loop
Pressure pad size	diameter 230 mm thickness 13 mm
Transducer size	OD 28 mm, 180 mm long
Material	Stainless steel
Operating temp. Range	-20°C +80°C
Weight	0.6 kg

(*) 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).



NATM STRESS CELLS

Sisgeo flexible diaphragm NATM stress cells have been designed to optimize measurements of radial and tangential stresses in shotcrete and concrete tunnel linings.

The stress cell consists of a pressure pad connected to the transducer by a hydraulic tube. Readings are taken by the C6002MV portable readout directly connected to the stress cell terminal.

AVAILABLE MODELS CE

MODEL L112R	radial stress cell
Measuring range	0-5 MPa (50 Bar)
Accuracy	< ±0.3% FS
Pressure pad size	square 150 x 150 mm
Pad thickness	5 mm
Transducer size	OD 25 mm, 130 mm long
MODEL L112T	tangential stress cell
Measuring range	0-20 MPa (200 Bar)
Accuracy	< ±0.3% FS
Pressure pad size	rectangular 100 x 200 mm
Pad thickness	5 mm
Transducer	size OD 25 mm, 130 mm long

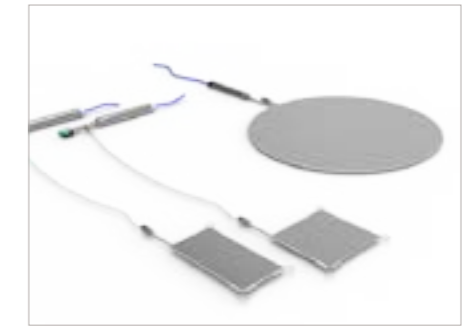
OC6002MV000 DIGITAL INDICATOR CE

Digital display	3.5 LCD
Resolution	10 kPa (0.01 MPa)
Environmental	-5°C +50°C, dust-proof case



OL111PUMPOO REPRESSURIZING DEVICE

This device permits to increase the volume of the hydraulic oil inside the cavity of the pressure pad, expanding it, in order to maintain a close contact between the pad and the surrounding material after the concrete has cured.



HYDRAULIC PRESSURE CELLS

Hydraulic pressure cells are designed to measure stress in mass concrete or in the interface between the structure and the excavation wall. They are filled under vacuum with de-aired oil that guarantees the maximum rigidity.

A re-pressurizing device is used in order to maintain close contact when the concrete has cured.

AVAILABLE PRESSURE PADS

OL111151500	for radial stress in concrete
Pad size	150 x 150 mm
Working pressure	up to 5 MPa
OL111102000	for tangential stress in concrete
Pad size	100 x 200 mm
Working pressure	up to 20 MPa
OL111204000	for contact soil/rock-structure
Pad size	200 x 400 mm
Working pressure	up to 5 MPa
OL111D05000	for contact soil-concrete
Pad size	circular 500 mm OD
Working pressure	up to 1 MPa

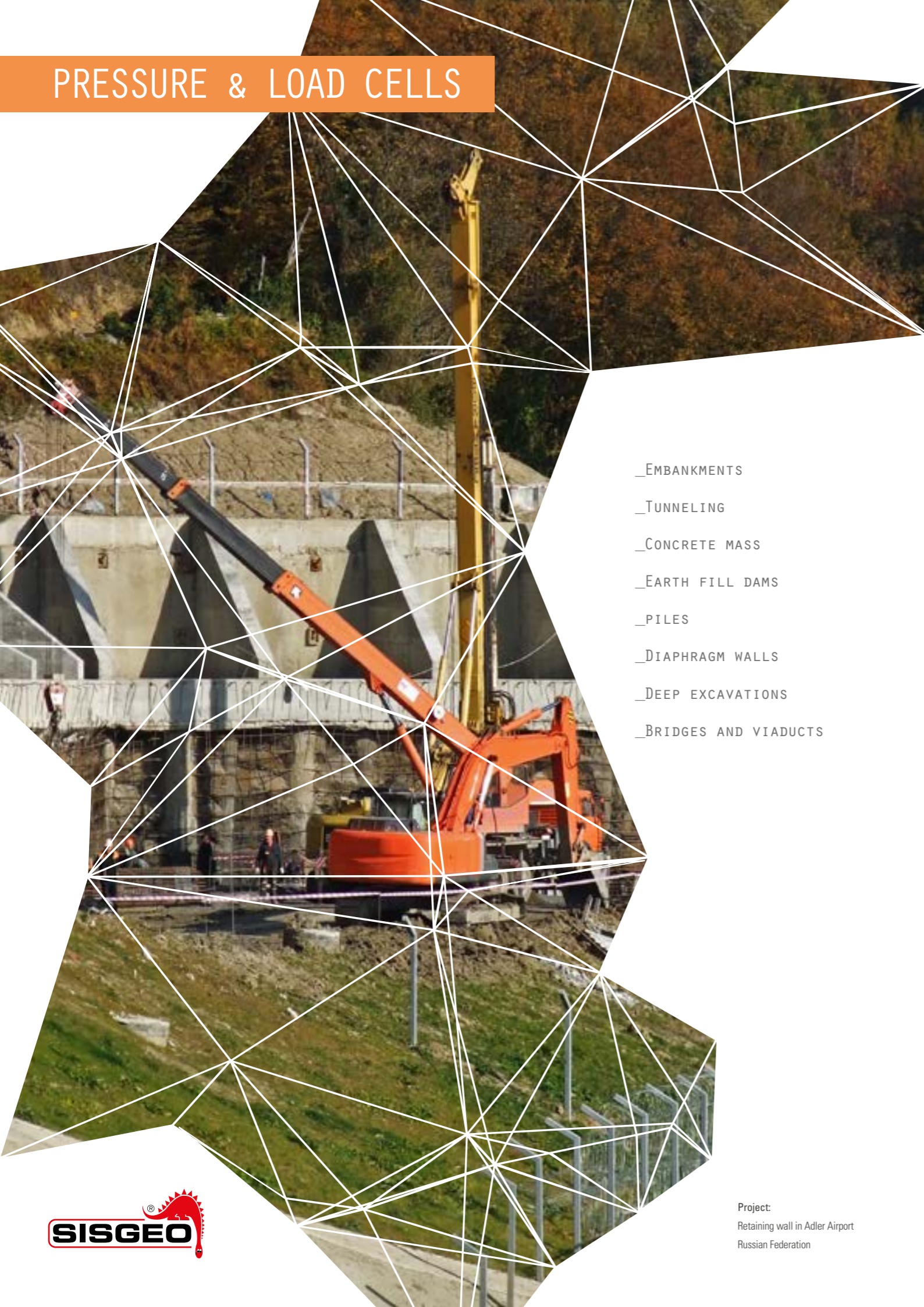
AVAILABLE TRANSDUCERS CE

MODEL PK45H	VW pressure transducers
Full scales	350, 500, 700 kPa, 1, 1.7, 2, 5, 7, 10, 20 MPa
Sensitivity	0.03% FS
Accuracy (MPE*)	< ±0.25% FS
Output signal	frequency (VW), resistance (T)
Operating temp. range	-20°C +80°C
Transducer size	OD 27 mm, 180 mm long
MODEL P252A	electrical pressure transducers
Full scales	200, 500 kPa, 1, 2, 5, 10, 20 MPa
Sensitivity	0.002% FS
Accuracy (MPE*)	< ±0.20% FS
Output signal	4-20 mA current loop
Operating temp. range	-20°C +80°C
Transducer size	OD 27 mm, 180 mm long



Project:
MRT Blue Line extension
Bangkok - Thailand

PRESSURE & LOAD CELLS



- _ EMBANKMENTS
- _ TUNNELING
- _ CONCRETE MASS
- _ EARTH FILL DAMS
- _ PILES
- _ DIAPHRAGM WALLS
- _ DEEP EXCAVATIONS
- _ BRIDGES AND VIADUCTS



Project:
Retaining wall in Adler Airport
Russian Federation



HYDRAULIC ANCHOR LOAD CELLS

Hydraulic anchor load cells are utilized to monitor loads in tiebacks, rock bolts and cables. The pressure pad between the plates is filled, under high vacuum, with deaired oil. The load is directly measured in KN through a Bourdon manometer. Electrical conversion by using pressure transducer is also available for remote readings.

GAUGE MANOMETER MODEL

OL2M04030H0	300 KN, ID 40 MM, OD 140 MM
OL2M07050H0	500 KN, ID 71 MM, OD 163 MM
OL2M09075H0	750 KN, ID 92 MM, OD 196 MM
OL2M11100H0	1000 KN, ID 110 MM, OD 231MM
OL2M13100H0	1000 KN, ID 138 MM, OD 244 MM
OL2M16150H0	1500 KN, ID 165 MM, OD 293 MM

Overload	120% with less than 2% FS zershift
Manometer accuracy	class $\pm 1.5\%$ FS
Material	AISI 304 stainless steel
Comp. temp. range	-35°C +60°C

ELECTRICAL MODEL

OL2E0705000	500 KN, ID 71 MM, OD 163 MM
OL2E0907500	750 KN, ID 92 MM, OD 196 MM
OL2E1110000	1000 KN, ID 110 MM, OD 231 MM
OL2E1310000	1000 KN, ID 138 MM, OD 244 MM
OL2E1615000	1500 KN, ID 165 MM, OD 293 MM

Overload	120% with less than 2% FS zershift
Accuracy	$\pm 1\%$ FS
Signal output	4-20 mA current loop
Temperature drift	0.05 % FS / °C
Material	AISI 304 stainless steel
Comp. temp. range	-35°C + 60°C



OL2E Electro-hydraulic anchor load cell

SISGEO.COM



ELECTRIC ANCHOR LOAD CELLS

Electrical resistance anchor load cells consist of a ring shaped stainless steel body which incorporates from 8 to 16 electrical resistance strain gauges in a full bridge configuration. The cell design minimizes the sensitivity to the eccentric load. A very stiff distribution plate is required, in order to ensure that the load is applied equally on the anular loading surface of the cell.

AVAILABLE MODELS

OL204V0300T	300 KN, ID 40 MM, OD 155 MM
OL205V0500T	500 KN, ID 50 MM, OD 155 MM
OL207V0500T	500 KN, ID 71 MM, OD 155 MM
OL207V0750T	750 KN, ID 71 MM, OD 155 MM
OL211V0750T	750 KN, ID 110 MM, OD 200 MM
OL212V1000T	1000 KN, ID 120 MM, OD 220 MM
OL216V1500T	1500 KN, ID 165 MM, OD 260 MM
OL219V1800T	1800 KN, ID 190 MM, OD 300 MM
OL222V2500T	2500 KN, ID 225 MM, OD 340 MM

Overload	150%
Sensitivity	0.06% FS
Accuracy	$< \pm 0.5\%$ FS
Thermal zero shift	$< 0.005\%$ FS / °C
Signal output	1.5mV/V at FS or 2 mV/V at FS
Power supply	from 2V DC to 10V DC
Operating temp. range	-30°C +70°C
Comp. temp. range	-30°C +70°C
Material	stainless steel 17-4 PH

DISTRIBUTION PLATES

OL20040PD00	centre hole 40 mm, OD 110 mm
OL20050PD00	centre hole 50 mm, OD 110 mm
OL20071PD00	centre hole 71 mm, OD 110 mm
OL20110PD00	centre hole 110 mm, OD 155 mm
OL20120PD00	centre hole 120 mm, OD 180 mm
OL20165PD00	centre hole 165 mm, OD 210 mm
OL20190PD00	centre hole 190 mm, OD 250 mm
OL20225PD00	centre hole 231 mm, OD 290 mm

ACCESSORIES

OECON07MV00	MIL male connector with cap
OELC420MA00	4-20 mA transmitter (2 wires)



ELECTRIC LOAD CELLS

This model of load cells is used to monitor stresses in steel linings, piles and support beams. They consist of a pressure pad connected to a pressure transducer. The pressure pad consists of two stiff stainless steel plates saturated by de-aired oil. Special distribution plates are also available for a better load distribution.

L2CE ELECTRO-HYDAULIC LC

OL2CE019000	1900 KN, OD 209 MM
OL2CE030000	3000 KN, OD 264.5 MM
Accuracy(*)	$< \pm 1\%$ FS
Signal output	4-20 mA current loop
Temp. operating range	from -20° to +80°C
Protection Class	IP 68 up to 100 KPa
Material	stainless steel
Power supply	from 9 to 30 V DC
Overall size (ODxLxH)	295 x 365 x 36,5 mm OL2CE019 355 x 421 x 36,5 mm OL2CE030

(*) linearity, hysteresis and repeatability

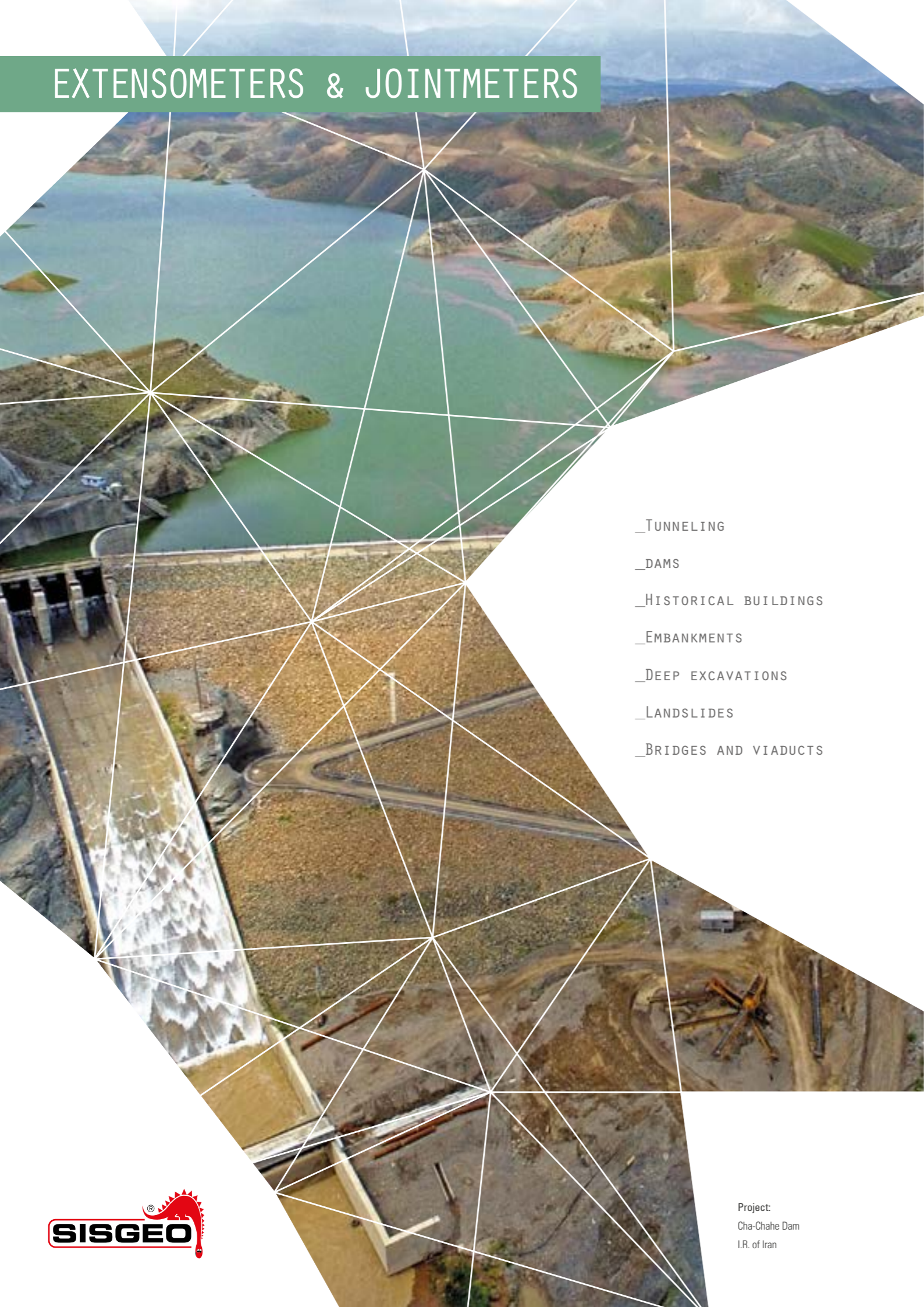
L2CT-L2CX SOLID LOAD CELLS

Specially designed for pile testing, L2CT model have higher accuracy but a large encumbrance; L2CX model have a good accuracy and smaller dimensions.

MODEL	L2CT
Full scales	5000 KN, 8000 KN, 10000 KN
Accuracy	200 mm, 250 mm, 300 mm
Height	$< \pm 0.1\%$ FS
Output signal	2 mV/V at FS
Temp. operating range	-20°C +70°C
Protection Class	IP 65

MODEL	L2CX
Full scales	3000 KN, 4000 KN, 5000 KN
Height	110 mm (for all full scales)
Accuracy	$< \pm 0.5\%$ FS
Output signal	2 mV/V at FS
Temp. operating range	-20°C +70°C
Protection Class	IP 67

EXTENSOMETERS & JOINTMETERS



- _ TUNNELING
- _ DAMS
- _ HISTORICAL BUILDINGS
- _ EMBANKMENTS
- _ DEEP EXCAVATIONS
- _ LANDSLIDES
- _ BRIDGES AND VIADUCTS



DIGITAL TAPE EXTENSOMETER

Tape extensometer is used to take accurate measurements between pairs of target points that have been permanently installed. It is available with either a hook or a 3/8" threaded termination. Typical applications include convergence monitoring of tunnel linings, according to NATM practice, shafts, underground openings and caverns.

AVAILABLE MODELS

ODN0030D000	30 M TAPE, HOOK TERMINALS
ODN0030D380	30 M TAPE, THREAD TERMINALS

Gauge resolution	0.01 mm
Gauge repeatability	0.1 mm
Gauge accuracy	±0.01 mm
Operating temperature	-10°C +60°C
Tape tension	11 kg
Tape material	stainless steel
Tension indicator	optical
Power on and power off	automatic
Weight	1.6 kg

REFERENCE BOLTS

A wide range of measuring bolts are available: to be grouted, welded or anchored to the structure.

ODN0CH20000	200 mm groutable 3/8" stud bolt
ODN0CH50000	500 mm groutable 3/8" stud bolt
ODN0CHE1000	1000 mm groutable 3/8" stud bolt
ODN0CH05000	50 mm weldable 3/8" stud bolt



EMBEDMENT JOINTMETERS

Embedment jointmeters are usually installed across the joints in concrete dams in order to measure relative movement between two concrete blocks. Their design allows them to be installed directly onto the formwork. The internal VW displacement transducer is assembled at middle range allowing movements in both directions.

AVAILABLE MODELS

OD314C025VW	VW EMBEDMENT JOINTMETER, 25 MM RANGE
OD314C050VW	VW EMBEDMENT JOINTMETER, 50 MM RANGE
OD314C100VW	VW EMBEDMENT JOINTMETER, 100 MM RANGE
OD314C150VW	VW EMBEDMENT JOINTMETER, 150 MM RANGE

TECHNICAL CHARACTERISTICS

Type of sensor	vibrating wire transducer
Measuring range	25, 50, 100, 150 mm
Sensitivity	<0.025% FS
Total accuracy	< ±0.5% FS
Signal output	frequency (VW), resistance (T)
Operating temperature	-20°C +80°C
Material	stainless steel



Embedment jointmeter installation scheme



EMBANKMENT EXTENSOMETERS

Embankment (soil) extensometers are used to measure soil strains in large earth structures. The system consists of a number of anchor plates connected through extension rods to a VW displacement transducer. Connected to a data acquisition system, they provide an automatic real time monitoring and alerting.

SYSTEM COMPONENTS

OD2320BM100	EXTENSION ROD, 1 M
OD2320BM200	EXTENSION ROD, 2 M
OD2320BM300	EXTENSION ROD, 3 M
OD111PV5500	PVC CORRUGATE
	ANTIFRICTION SLEEVE
OD232AN5000	ANCHOR PLATE, DIAM 500 MM
OD232AN5500	ANCHOR PLATE, 500 x 500 MM

MEASURING ELEMENTS

OD232T050VW	50 mm (±25 mm) range
OD232T100VW	100 mm (±50 mm) range
OD232T150VW	150 mm (±75 mm) range
Type of sensor	vibrating wire transducer
Measuring range	50, 100, 150 mm
Sensitivity	<0.025% FS
Accuracy (MPE*)	< ±0.30% FS
Signal output	frequency (VW), resistance (T)
Typical frequency range	2250 - 3000 Hz
Operating temperature	-20°C +80°C
Material	stainless steel
Protection	IP68 up to 1.0 MPa
Signal cable	OWE104X20ZH

(* 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).

EXTENSOMETERS & JOINTMETERS

- _ TUNNELING
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MULTIPOINT ROD EXTENSOMETERS (MPBX)

Multipoint rod extensometers (MPBX) are installed in boreholes in order to monitor displacements at various depths using rods of different materials and lengths. A pre-set length of measuring rod is inserted into a nylon tube to avoid soil friction and its end is fixed to a steel groutable anchor. Displacements are read with linear transducers (DTE) or with a digital gauge.

AVAILABLE MODELS

OD222AC00A0	s/steel or invar rods, DTE ≤ 100 mm
OD222AC00B0	s/steel or invar rods, DTE > 100 mm
OD222F600A0	fiberglass rods, DTE ≤ 100 mm
OD222F600B0	fiberglass rods, DTE > 100 mm
Number of bases	1 (single), from 2 to 7 (multiple)
Multiple head top tube	OD 120 mm
Extensometer rods	fiberglass pre-assembled stainless steel, 2 m sections
Protective sleeve	nylon 11 (nilsan), OD 12 mm

GROUTABLE ANCHORS

Groutable anchors are supplied with all MPBX where packer anchors are not requested.

material	galvanized steel rebar
Diameter / length	Ø 16 mm / 400 mm (MPBX with fiberglass rods) Ø 22 mm / 400 mm (MPBX with stainless steel rods)

PACKER ANCHORS

Two models of packer anchors are available, following different drilling diameter: 101 mm (4") and 127 mm (5"). If packer anchors are needed, the following products codes shall be added (max 4 packers for each extensometers):

OD222PKR127	PACKER ANCHOR for Ø 127 mm drillings (one for each measuring base)
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DISPLACEMENT TRANSDUCERS FOR MPBX

MPBX measurements can be taken manually with a depth micrometer or remotely through vibrating wire or 4-20mA displacement transducers and a readout or datalogger. Both vibrating wire and 4-20mA transducers are waterproof up to 1.0 MPa and output signals are suitable for long distance transmission.

VIBRATING WIRE TRANSDUCERS

ODTE000VW00	VIBRATING WIRE DTE
Range	10, 25, 50, 100, 150, 200 mm
Signal output	frequency (VW), resistance (T)
Accuracy (MPE*)	< ±0.50% FS for 10 and 25 mm range < ±0.30% FS for 50 mm, 100, 150 and 200 mm range
Typical frequency range	2250 - 3000 Hz
Operating temperature	-20°C +80°C
Protection	IP68 up to 1.0 MPa

POTENTIOMETRIC TRANSDUCERS

ODTE1A00000	LINEAR POTENTIOMETER DTE
Range	25, 50, 100, 150, 200 mm
Signal output	4-20 mA current loop
Accuracy (MPE*)	< ±0.30% FS for 25 mm range < ±0.20% FS for 50 and 100 mm range < ±0.15% FS for 150 and 200 mm range
Operating temperature	-20°C +80°C
Protection	IP68 up to 1.0 MPa

ODIGD020000 DIGITAL GAUGE

The digital gauge kit consists of a depth caliper with LCD (readings in metric and imperial units), a set of extension rods and carrying case.

Range	from 0 to 200 mm
Resolution	0.01 mm
Temperature rating	0° C - 40° C
Humidity rating	≤ 80%

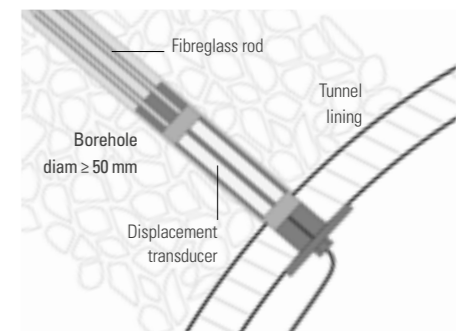


MEXID EXTENSOMETERS

MEXID are miniaturized MPBX extensometers that allow installation into a 50 mm diameter borehole. Displacement transducers are incorporated into the instrument head so, after positioning and grouting, the external encumbrance is that of the cable gland only (20 mm). Dedicated tubes allow grouting to fix the anchors to rock or soil.

AVAILABLE MODELS

OD2MX00A000	fiberglass rods, 4-20mA output available with 50 and 150 mm range
OD2MX00W000	fiberglass rods, vibrating wire sensors available with 50 and 150 mm range
Number of bases	from 2 to 4
Signal output	4-20 mA current loop frequency (VW), resistance (T)
Accuracy	< ±0.20% FS (4-20mA output) < ±0.30% FS (Vibrating wire)
Head diameter	48.3 mm
Head length	476 mm for 50 mm range 816 mm for 150 mm range
Extensometer rods	fiberglass, OD 7 mm
Protective sleeve	nylon 11 (nilsan), OD 12 mm
Groutable anchor	rebar 16 mm OD, 400 mm long
Transducers protection	IP68 (watertight up to 1.0 MPa)



RODS AND CABLE

OD221BMFG00	FIBREGLASS ROD, 7 MM OD with antifriction protective sleeve
OWE1160LSZH	LSZH MULTICORE CABLE, 8 PAIRS 8 x 2 (24 AWG) conductors



Project:
Letlhakane Mine
Botswana

EXTENSOMETERS & JOINTMETERS



_TUNNELING

_DAMS

_HISTORICAL BUILDINGS

_EMBANKMENTS

_DEEP EXCAVATIONS

_LANDSLIDES

_BRIDGES AND VIADUCTS



Project:
Cerro del Águila Dam
Perú



WIRE CRACKMETER AND DEFORMETER

Wire crackmeter is designed to monitor changes in distance between two anchor points located at up to 30 m apart. The wire deformer is used to monitor the displacement between two opposite surfaces (convergence in tunnels, rock masses, etc...). USB deformer incorporates a small logger for automatic monitoring.

OD241A20000 WIRE CRACKMETER

Mechanical range	2000 mm
Electrical range	240 mm
Accuracy	±1 mm (depends mainly from the thermal effects on the wire)
Signal output	4-20 mA current loop
Operating temperature	-20°C +80°C
Wire diameter	2 mm, stainless steel
Max. wire tension	8 Kg
Transducer housing	300 x 200 x 185 mm
Target assembly	eyebolt expansion anchor

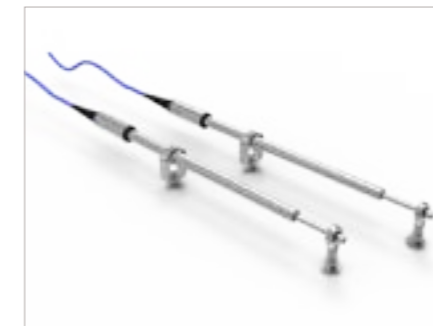
OD313F00000 WIRE DEFORMERS

Type of sensor	linear potentiometer or vibrating wire
Signal output	4-20 mA current loop frequency (VW), resistance (T)
Measuring range	25 mm (±12.5), 50 mm (±25)
Total accuracy	< ±0.3% FS (4-20mA) < ±0.5% FS (vibrating wire)
Operating temperature	-20°C +80°C
Body diameter	16 mm
Wire	stainless steel, up to 10 meter
Protection	IP68 (watertight up to 1.0 MPa)

OD314FV8000 USB DEFORMETER

Type of sensor	rotating potentiometer
Displacement range	80 mm
Resolution	0.003 mm
Accuracy	< ±0.1% FS
Operating temperature	-10°C +60°C
A/D converter	15 bits
Storage capacity	>51.000 measurements
Battery life	4 years with 1 saving per hour
Protection	IP65

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ELECTRICAL AND VW CRACKMETERS

Crackmeters and jointmeters are utilized to monitor movements of surface cracks and joints in concrete structures or rock. The displacement transducer housed in the sensor body is positioned across the joint/crack which enables the measurement changes in distance between the anchors.

ELECTRICAL CRACKMETERS

Technology	Linear potentiometer
Full scales (*)	10, 25, 50, 100, 150 mm
Accuracy (MPE**)	< ±0.3% FS
Signal output	4-20 mA current loop
Power supply	12-24V DC
Operating temperature	-20°C +60°C
Sensor diameter	16 mm
Material	stainless steel
Protection	IP68 (watertight up to 100 kPa)

(*) Available up to 260 mm upon request

(**) MPE is the Maximum Permitted Error on the measuring range (FSR)

VIBRATING WIRE CRACKMETERS

Technology	Vibrating wire
Full scales (*)	10, 25, 50, 100, 150 mm
Accuracy (MPE**)	< ±0.5% FS
Signal output	frequency (VW), resistance (T)
Operating temperature	-20°C +80°C
Body diameter	16 mm
Material	stainless steel
Protection	IP68 (watertight up to 1.0 MPa)

(*) Available up to 300 mm upon request

(**) MPE is the Maximum Permitted Error on the measuring range (FSR)

ACCESSORIES

OD31Y1DTE00	Y-AXIS STAINLESS STEEL FIXING KIT
OD31Z1DTE00	Z-AXIS STAINLESS STEEL FIXING KIT



3-D MECHANICAL CRACKMETERS

3-D (triaxial) mechanical jointmeters are aimed to monitor joints and cracks. The movements between the two anchors are obtained by mechanical dial gauges. Simple and inexpensive, the TT-1 tell-tale crack monitor, installed across a fissure, allows the crack survey in two directions.

AVAILABLE MODELS

OD3103D3000	3-D CRACKMETER ASSEMBLY
Mechanical range	0-30 mm
Base lengths	200 mm (3-D)
Anchors	2 groutable rebar Ø 16 mm, length 80 mm
Material	Stainless steel and aluminium

OD1630KIT00 DIAL GAUGE KIT

Compatible with	OD3101D3000 OD3103D3000
Measuring range	0-30 mm
Gauge resolution	0.01 mm
Gauge accuracy	±0.05 mm

OD300LINE00 TT-1 CRACK MONITOR

Model	2-D biaxial
Mechanical range	±20 mm (X-axis), ±10 mm (Y-axis)
Resolution	1 mm
Material	polycarbonate



STRAIN-GAUGES & THERMOMETERS

_PILES AND MASS CONCRETE

_CONCRETE STRUCTURES,
BEAMS AND COLUMNS

_CONCRETE FOUNDATIONS
AND DIAPHRAGM WALLS

_TUNNEL SEGMENTS

_STEEL STRUCTURES, PIPES
AND ARCH SUPPORTS

_GRAVITY AND ARCH DAMS

_BRIDGES AND VIADUCTS



VIBRATING WIRE STRAIN-GAUGES

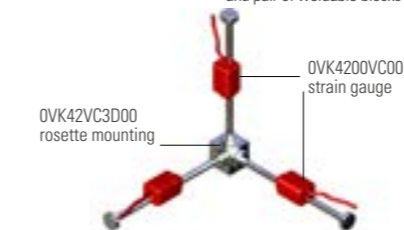
Vibrating wire strain-gauges are used to monitor variation in strain, which allows stress evaluation in steel or concrete structures. A thermistor incorporated into the gauge gives the temperature at the point of measurement allowing temperature compensation. No-stress gauge and 3-D rosette mounting are also available.

AVAILABLE MODELS CE

OVK4000VS00	WELDABLE SG
OVK4000VSCO	CONCRETE SURFACE SG
OVK4200VC00	EMBEDMENT SG
OVK4200VCHP	EMBEDMENT SG FOR DEEP APPLICATION
OVK4000SM00	SHOTCRETE SG WITH ADJUSTABLE TENSIONING
Range (nominal)	3000 $\mu\epsilon$ (shotcrete 10000 $\mu\epsilon$)
Signal output	Frequency (strain), Ohm (temperature)
Accuracy	$\pm 0.5\%$ FS ($\pm 3\%$ FS for OVK4000SM00)
Repeatability	$\leq \pm 1 \mu\epsilon$, $\leq \pm 3 \mu\epsilon$ for OVK4000SM00
Coil resistance (nominal)	150 ohm
Embedded thermistor type	NTC 3 k Ω
Temperature range	-20°C + 80°C

ACCESSORIES

OVK42VC3D00	3D rosette mounting block for embedment strain gauges.
OVK400JIG00	Spacing jig for mounting the arc-weldable strain gauges end blocks.
OVK400MB200	Pair of arc-weldable surface mounting blocks.
OVK400COVER	S/steel protective cover with lugs and pair of weldable blocks



VW strain gauges in 3D configuration



VIBRATING WIRE REBARS

Rebar strain meters are "rebars" which incorporate a vibrating wire strain gauge element with plucking coil. A thermistor is included in each strain meter. Vibrating wire rebar strain meters are available in different units in order to match the sizes of the concrete reinforcing bars.

AVAILABLE MODELS CE

OVKBAR01800	VW REBAR 18 MM
OVKBAR02200	VW REBAR 22 MM
OVKBAR02600	VW REBAR 26 MM
OVKBAR03000	VW REBAR 30 MM
Active gauge length	47.5 mm
Range (nominal)	$\pm 1500 \mu\epsilon$
Signal output	frequency (VW), resistance (T)
Sensitivity	1.0 $\mu\epsilon$
Accuracy	$\pm 0.5\%$ FS
Stability	0.1% FS / year
Typical frequency	from 800 to 2500 Hz
Coil resistance	150 Ohm
Temperature sensor	NTC thermistor
Thermal coeff. of expansion	5 ppm / °C
Temperature range	-20°C a +80°C



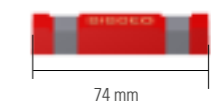
SPOT WELDABLE STRAIN GAUGES

Vibrating wire spot-weldable strain gauges are mainly designed to measure strain on steel surfaces. They consist of a weldable SG and a cover which contains the plucking coil. SG is pre-tensioned during manufacturing at mid range. SG installation is preferred using the spot welder recommended by the manufacturer.

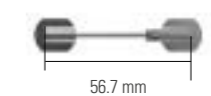
OVK4100VS00 SPOT WELDABLE SG CE

Active gauge length	47.5 mm
Range (nominal)	$\pm 1500 \mu\epsilon$
Signal output	frequency (VW), resistance (T)
Sensitivity	1.0 $\mu\epsilon$
Accuracy	$\pm 0.5\%$ FS
Stability	0.1% FS/year
Typical frequency	from 600 to 2500 Hz
Coil resistance	150 Ohm
Temperature sensor	NTC thermistor
Thermal coeff. of expansion	5 ppm / °C
Temperature range	-20°C a +80°C

OVK4100VSP0 PLUCKING COIL



OVK4100VSG0 STRAIN GAUGE ONLY



ACCESSORIES AND COMPONENTS

OVK410PSW00	Portable spot-welder for VW spot-weldable strain gauges
OWE104SG0ZH	LSZH signal cable
OVK4100VSG0	Strain-gauge only
OVK4100VSP0	Plucking coil only

STRAIN GAUGES & THERMOMETERS

_PILES AND MASS CONCRETE

_CONCRETE STRUCTURES, BEAMS AND COLUMNS

_CONCRETE FOUNDATIONS AND DIAPHRAGM WALLS

_TUNNEL SEGMENTS

_STEEL STRUCTURES, PIPES AND ARCH SUPPORTS

_GRAVITY AND ARCH DAMS

_BRIDGES AND VIADUCTS



RESISTIVE STRAIN GAUGES

This model of SG incorporates resistive strain gauges in full bridge configuration bonded to a steel bar.

This arrangement allows the compensation for both temperature and bending effects. Resistive strain-gauges offer a valid alternative to the vibrating wire type when continuous dynamic measurements are required.

AVAILABLE MODELS CE

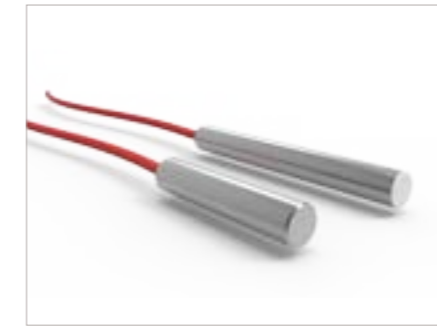
OL3400VS000	STRAIN-GAUGE BAR, mV/V output
OL3400VSC00	STRAIN-GAUGE BAR, V output
OL3400AS000	STRAIN-GAUGE BAR, 4-20 mA output
Bar section / length	8 x 8 mm / 400 mm
Measuring range	±1500 µε (nominal)
Sensitivity	0.0015 mV/µε
Total accuracy	< ±1% FS
Signal output	±2 mV/V at FS (OL3400VS000) ±10 mV at FS (OL3400VSC00) 4-20 mA current loop (OL3400AS000)

Temp. operating range -20°C +70°C



CABLES AND ACCESSORIES

OWE1060LSZH	Electric cable 6 wires (24 AWG) for strain gauges mV/V or V output
OWE102KEOZH	Electric cable 2 wires (20 AWG) for strain gauges 4-20 mA output
OL3400MB200	Pair of welding blocks for resistance strain gauges



EMBEDMENT THERMOMETERS

Temperature is a very important parameter to measure, so as the evaluation of the influence of thermal effects on the recorded data associated with the structure being monitored. Sisgeo uses three types of technologies to monitor temperature: thermistors, RTDs (Resistance Thermal Detectors) and vibrating wire sensors.

OT111PT1000 PT100 THERMOMETERS CE

Type of sensor	PT100 platinum resistance
Measuring range	-50°C +80 °C
Resolution	0.1°C
Accuracy	±0.2°C
Diameter	20 mm
Length	100 mm
Body material	stainless steel

OT3800GKA00 THERMISTORS CE

Type of sensor	NTC thermistor (YSI 44005)
Measuring range	-50°C +80 °C
Resolution	0.1 °C
Accuracy	±0.5 °C
Diameter	12 mm
Length	55 mm
Body material	stainless steel

OT2200VW000 VW THERMOMETER (AVAILABLE ONLY ON REQUEST) CE

Type of sensor	vibrating wire
Measuring range	-20°C +80 °C
Resolution	0.1 °C
Accuracy	±0.5 °C
Diameter	20 mm
Length	166 mm



TEMPERATURE STRINGS

Temperature strings are often used to monitor the thermal profile in boreholes or mass concrete temperature during curing. They consist of a RTD or thermistor sensors mounted on a length of multicore cable. The spacing between two sensors is customized according to Client requests.

OTS00RTD000 RTD STRINGS CE

Type of sensor	PT100 platinum resistance
Number of sensor	until N.4 with OWE1160LSZH cable until N.8 with OWE1320LSZH cable
Measuring range	-50°C +80 °C
Resolution	0.1°C
Accuracy	±0.2°C
Sensed section	Ø20 mm, length 180 mm

OTS00NTC000 THERMISTOR STRINGS CE

Type of sensor	NTC thermistor (YSI 44005)
Number of sensor	until N.8 with OWE1160LSZH cable until N.16 with OWE1320LSZH cable
Measuring range	-50°C +80 °C
Resolution	0.1 °C
Accuracy	±0.5 °C
Sensed section	Ø20 mm, length 180 mm

CABLES FOR TEMPERATURE STRINGS

OWE1160LSZH	LSZH MULTICORE CABLE, 8 PAIRS
OWE1320LSZH	LSZH MULTICORE CABLE, 16 PAIRS
single conductor	tinned copper, CU ETP 5649/88
Inner jacket	flame retardant polyolefin
Outer jacket	technopolymer M1, LSZH
Diameter	9.2 mm for OWE1160LSZH 12.2 mm for OWE1320LSZH

- _ARCH DAMS
- _CONCRETE DAMS
- _SKYSCRAPERS
- _SLENDER STRUCTURES
- _BELL TOWERS
- _MINARETS



Project:
Ermenek Dam
Turkey



DIRECT AND INVERTED PENDULUMS

Direct and inverted pendulums are simple, reliable and accurate systems used to monitor horizontal movements. Commonly utilized in concrete dams, they permit to measure the change in verticality. The inverted pendulum anchored in foundation in combination with a direct pendulum allows to obtain a complete profile of the verticality of the dam.

OS911002500 DIRECT PENDULUM

The direct pendulum is a gravity-referenced instrument. It consists of:

- stainless steel cylindrical fluid tank with cover
- wire tensioning weight and damping unit
- upper wire anchor system with rail and sliding block
- turnbuckle for trimming the damping unit position

Tank dimensions	410 mm diam, 415 mm high
Material	stainless steel
Damping fluid (mineral oil)	not supplied

OS912006000 INVERTED PENDULUM

The inverted pendulum provides a fixed datum from which structural movements can be measured. It consists of:

- stainless steel anular damping chamber with cover
- stainless steel floating unit
- adjustable tie bar with 100 mm vertical stroke
- external tube for liquid level survey
- steel ballast for borehole wire anchoring

Tank dimensions	615 mm diam, 497 mm high
Floating unit	allows ± 72 mm movement in any direction

Groutable anchor diameter	75 mm, adjustable from 80 mm to 160 mm by centralized pins, steel.
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Material	stainless steel
Damping fluid (mineral oil)	not supplied

OWRAC200000 PENDULUM WIRE

Material	stainless steel
Diameter	2 mm

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OPTICAL PENDULUM READOUT

The pendulum readout (coordinometer) is a reliable and simple instrument for manual readings of pendulum systems. It allows calculation of the horizontal movements of the pendulum wire and a digital LCD displays the X and Y coordinates in millimetres. It can be utilized for either in-place installation or removable measurements in different locations.

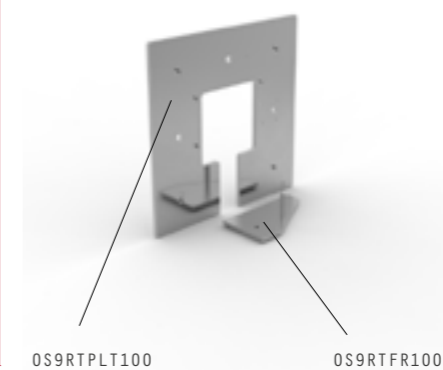
OS9RTB15000 MANUAL READOUT

Measurement area	X-axis: 0-150 mm (± 50 mm) Y-axis: 0-150 mm (± 50 mm)
Gauge resolution	0.01 mm
Gauge accuracy	$< \pm 0.1$ mm
Gauge protection	IP67
Temp. operating range	-20°C $+60^{\circ}\text{C}$
Material	aluminium
Dimensions	340 x 340 x 115 mm
Weight	3.5 kg

ACCESSORIES

OS9RTP1100	SUPPORT BASE PLATE
Material	galvanized steel
Dimensions	415 x 415 x 10 mm (LxWxH)

OS9RTR1000	CALIBRATION FRAME
Material	stainless steel /aluminium
Overall dimensions	204 x 120 x 98 mm (LxWxH)



OS9RTP1100

OS9RTR1000



TEL-310S TELECOORDINOMETER

The Sisgeo TEL-310 (Telependulum) is a contactless automatic pendulum readout which uses infrared diode (emitters/receivers) in order to determine the position of the pendulum wire. The measurements are automatically compensated. TEL-310 consist of three separate units: SUS (sensor unit), CUS (control unit with web server on board) and PWS (power supply unit).

OTEL31036S0 TELECOORDINOMETER

Measuring system	contactless
Measurement area	X-axis: 0-150 mm (145 mm real) Y-axis: 0-60 mm
Resolution	0.005 mm
Repeatability	X-axis: ± 0.007 mm / ± 0.005 mA Y-axis: ± 0.012 mm / ± 0.007 mA
Total accuracy	X-axis: ± 0.010 mA (repeatability+accuracy+hysteresis) Y-axis: ± 0.015 mA
Power supply	85/230V AC, 50-60Hz
Communication	
- Local readings	Ethernet, USB 2.0
- Remote monitoring	RS485, 4-20mA (to OMNIAlog)
Memory	2 GB
Temp. operating range	-10°C $+60^{\circ}\text{C}$
Overall dimensions and weight	
- SUS optical unit	630 x 280 x 165 mm, 11.2 kg
- CUS control unit	330 x 345 x 111 mm, 4.8 kg
- PWR power supply unit	330 x 250 x 111 mm, 5.8 kg
Detectable wire	minimum 1 mm diam.
Protection	IP68 until 50 kPa

ACCESSORIES

OTEL310ANS0	ADJUSTABLE MOUNTING BRACKET Material: stainless steel and aluminium Dimensions: 240 x 310 x 170 mm (LxWxH)
OTEL310AND0	BRACKET MOUNTING JIG
OTEL310CAL0	CALIBRATION FRAME
OTEL310XC53	IP68 CABLE FOR RS485 NETWORK
OTEL310X485	RS485 TO USB INTERFACE
OTEL310XC83	IP68 CABLE FOR 4-20 mA NETWORK



- _ TUNNELLING
- _ DAM SURVEILLANCE
- _ STRUCTURAL MONITORING
- _ MINING EXPLORATION
- _ DEEP EXCAVATION
- _ LANDSLIDE SAFETY IMPLEMENTATION
- _ RETAINING WALLS
- _ GEOTECHNICAL INVESTIGATION CAMPAIGN



MINI OMNIALOG FIELD LOGGER

Mini OMNIAlog is a 4 channels, battery powered logger designed for field use with a low power consumption. It permits to read and store data from both analogue (VW, mA, V, etc...) and digital instruments. Mini OMNIAlog can be equipped with a 3G/WiFi module, so that readings can be automatically transmitted to the user FTP server or email.

OMNIAMINIO MINI OMNIALOG

Processor	ARM Cortex - M3, 20 MHz CPU
A/D converter	24 bit with autocalibration
Type of measurement	mA, mV, mV/V, V, °C (NTC), Hz (VW)
Mass storage	2 GB for data and WEB pages
Resolution	1 µA at FS 20 mA 1 µV at FS ±10 mV 0.001mV/V at FS ±10 mV/V 0.1 Hz at FS 400-6000 Hz 0.1 °C for NTC
Accuracy	±0.05% FS (0.1% FS for NTC)
Analog differential inputs	4 channels, configured at factory
Digital input	RS485 digital sensors
Digital output	one relay for alarm, 30V, 1A
Temperature drift	<10 ppm/°C (-30°C +70°C)
Internal battery	6 x 1.5V AA not rechargeable
Environmental	-30°C +70°C, IP67
COMM port	USB 2.0, RS232 for 3G modem
Dimensions and weight	151 x 125 x 90 mm, 780 g

ACCESSORIES

00MX24V030W	Digital sensor kit to allow miniOMNIAlog to manage up to 64 digital instruments.
0AXBC022010	90/230 V power supply kit consisting of a 10W 12V AC/DC converter and a plastic box housing the 2.3 Ah battery.
0AX10W003AH	Solar power kit composed by a 10W solar panel with 10 m cable and a plastic box housing the 2.3 Ah battery and charge controller.



CRD-400 MULTIPURPOSE READOUT

CRD-400 is an hand-held readout designed to take readings from any Sisgeo instruments. Easy to use, comes in a splash proof plastic case with color graphic display (good in sunlight), Ni-MH rechargeable battery, battery charger and clips jumper cable. CRD-400 displays readings in both electrical and engineering units.

CRD-400 READOUT

Type of measurements	mA, mV, mV/V, V, °C, Hz, µsec
A/D converter	24 bit Sigma-Delta (22 true-bit)
Display	TFT LCD panel, LED backlighting 320 x 240 pixel, sunlight reliable
Resolution	1 µA at FS 20 mA 1 µV at FS ±10 mV 0.001mV/V at FS 10 mV/V 0.1 Hz at FS 400-6000 Hz 0.1 °C for PT100 and NTC
Accuracy	±0.01% FS (0.1% for NTC and PT100)
Rechargeable battery	4 x AA NiMH, 2450 mAh
Environmental	-20°C +60°C, IP67
Dimensions and weight	100 x 230 x 45 mm, 0.5 Kg

SPARE PARTS AND ACCESSORIES

0ECABCRD400	Battery charger 100-240 V AC input 12 V DC output
0ECAV8P6A00	Clips jumper cable with 6 alligator clips for instrument reading
0ECAV08V2S0	Jumper cable with 2 connectors for reading connectorized instruments
0ECAV08V2S0	Switch jumper cable with 2 connectors for switch panels and measuring boxes



PORTABLE DATALOGGERS

Galileo and New Leonardo are durable, water resistant and easy-to-use portable dataloggers. They are equipped with high performance microprocessor, Ni-MH batteries and large color graphic display. SMART MANAGER SUITE software allows to manage the dataloggers directly from PC and automatic FW up-dating.

NEW LEONARDO DATALOGGER

Number of channels	two (2)
A/D converter	2 x 24 bit with autocalibration
Display	TFT graphic backlight LCD, 5.7" 320 x 240 pixel, sunlight reliable
Type of measurement	mA, mV, mV/V, V, °C (PT100/NTC), Hz, µsec
Storage memory	2 GB
Resolution	1 µA at FS 20 mA 1 µV at FS ±10 mV 0.001mV/V at FS 10 mV/V 0.1 Hz at FS 400-6000 Hz 0.1 °C for PT100 and NTC
Accuracy	±0.01% FS (0.1% for NTC and PT100)
Battery	12 V DC, 4500 mAh Ni-MH
Dimensions and weight	200 x 280 x 65 mm, 2 kg
Environmental	-20°C +60°C, IP67
COMM port	USB 2.0 (pen drive style)

GALILEO VW DATALOGGER

Number of channels	two (2)
A/D converter	2 x 24 bit with autocalibration
Display	TFT graphic backlight LCD, 5.7" 320 x 240 pixel, sunlight reliable
Type of measurement	vibrating wire (Hz, µsec), °C (NTC)
Storage memory	2 GB
Resolution	0.1 Hz at FS 400-6000 Hz, 0.1 °C
Accuracy	±0.01% FS (0.1% for NTC)
Battery	12 V DC, 4500 mAh Ni-MH
Dimensions and weight	200 x 280 x 65 mm, 2 kg
Environmental	-20°C +60°C, IP67
COMM port	USB 2.0 (pen drive style)

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Project:
San Leo Rockfall
Italy



OMNIALOG DATALOGGERS

OMNIALog is a web-based datalogger designed for geotechnical and structural monitoring applications. OMNIALog offers extensive measurements and control functionality; it is supported by a selection of communication options. On-board keyboard/display and external storage using USB flash drive are also included. OMNIALog doesn't require any proprietary software and stored data can be sent to the user FTP server or email address.

OOMNIALOG00 AND OOMNIALOG24 MODULES

Processor	ARM Cortex M3, 120 MHz, 1MB RAM
A/D converter	24 bit with autocalibration
Memory	2 GB SD card for data and web pages
Analog inputs	N.8 diff. (OOMNIALOG00) N.24 diff. (OOMNIALOG24) expandable by multiplexer (MUX) up to 384 channels
Digital inputs	N.2 opto-isolated
Resolution	1 μ A at FS 20 mA 1 μ V at FS \pm 10 mV 0.001mV/V at FS 10 mV/V 0.1 Hz at FS 6000 Hz 0.1 $^{\circ}$ C for PT100 and NTC
Measurement accuracy	\pm 0.01% FS (0.1% FS for NTC and PT100)
Temperature drift	< 10 ppm/ $^{\circ}$ C over all temp. range
Comm. ports	LAN 10/100, USB 2.0, RS232
Protections	electro-mechanical relays on every channel and gas discharge tubes on circuit
External battery	12V DC nominal
Operating temp. range	-30 $^{\circ}$ C +70 $^{\circ}$ C (display -20 $^{\circ}$ C +70 $^{\circ}$ C)

OOMNIALOG00 DIGITAL MODULE

Processor	ARM Cortex M3, 120 MHz, 1MB RAM
A/D converter	24 bit with autocalibration
Memory	2GB SD card for data and web pages
Digital inputs	N.1 opto-isolated
Comm. ports	LAN 10/100, USB 2.0, RS232
Protections	electro-mechanical relays
External battery	12V DC nominal
Operating temp. range	-30 $^{\circ}$ C +70 $^{\circ}$ C (display -20 $^{\circ}$ C +70 $^{\circ}$ C)



OMNIALOG CABINETS

The versatility and the flexibility of OMNIALog allow customized systems to meet the Client needs and the project requirements. A variety of "cabinet" with internal relay multiplexers are offered in order to expand the number of channels (sensors) managed by one datalogger. Each channel can be independently configured minimizing the number of multiplexer.

COMPONENTS AND ACCESSORIES

00MNCAB2000	IP65 cabinet, polycarbonate, 500x400x200mm, ready for max No.2 MUX digital power supply kit and comm interface
00MNCAB3000	IP65 cabinet, stainless steel, 600x400x250mm, ready for max No.3 MUX, digital power supply kit and comm interface
00MNCAB8000	IP65 cabinet, stainless steel, 600x600x250mm, ready for max No.8 MUX, digital power supply kit and comm interface
00MN24MUX00	MUX board, 24 channels, overvoltage protections on every channel
00MN24V100W	Additional kit for digital instruments including DC/DC 12/24V 100W power supply and No.4 input wiring board

MAIN COMMUNICATION INTERFACES

00MXMODEM3G	3G Quad band modem Suggested when only data shall be pushed on user FTP server or e-mail.
00MXROUTVPN	HSPA 3G router with VPN service Is the fastest and easy way for remote OMNIALog managing and data download.
00MXFOMMSWT	Optical fiber interface Switch ethernet with multimode optical fiber ports for in/out (Available only on request).



REMOTE MULTIPLEXERS

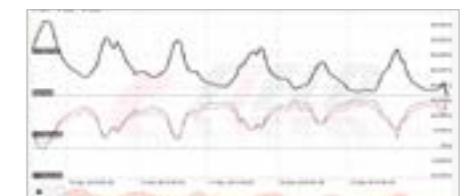
Multiplexer boxes offer a valid alternative to OMNIALog cabinets when a distributed sensor network is preferred. The relay multiplexer boards, mounted inside an IP67 box, operate as peripheral units; they are connected through a RS485 bus to a remote OMNIALog datalogger which controls, collects and stores data as the brain of the networking system.

COMPONENTS AND ACCESSORIES

00MNIABOX00	IP65 box, OOMNIALOG00 module polycarbonate enclosure, 400x300x180mm ready for external MUX box connection and communication interface
00MN24MUXB0	MUX box, 24 channels inputs polycarbonate enclosure, 300x300x180mm overvoltage protections on every channel
00MN48MUXB0	MUX box, 48 channels inputs polycarbonate, 300x300x180mm overvoltage protections on every channel
0WE610MUXZH	Connecting cable from MUX to MUX or from MUX to OMNIALog datalogger
00MX4MUXEXT	External MUX connection board for maximum No.4 external MUX.
0AXB022000	IP67 power supply kit AC/DC charger, Vin 85-265 Vac 50-60Hz, Vout 13.2V / 0.9A.
0AX00W000AH	Solar power supply package available in different model, including panel, battery and charge controller.

WMS WEB MONITORING SYSTEM

WMS runs inside a dedicated WEB portal and allows authenticated users to access customized pages where many advanced services can be displayed such as raw data automated conversion, manual and automatic data validation, real-time data analysis and graphical display, SMS/e-mail advanced alarms setup, synoptic chart with instruments status alarm, etc...



READOUTS, DATALOGGERS & ACCESSORIES

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Project:
Karahnjukar HPP
Iceland



WR LOG WIRELESS MONITORING SYSTEM

WR LOG is composed by a number of nodes to which instruments are connected, and a gateway communicating with nodes through radio. Nodes are configured through an Android APP while the gateway have a web server on-board for the set-up. Distance between node and gateway can arrive up to 15 km. The gateway can push data on a FTP server; remote connection to gateway is allowed for data download and set-up.

GATEWAYS

The gateway receive readings from the nodes and push data through the internet to a server for management and visualization.

OLSWR868GW0	868 MHz ISM BAND GATEWAY 10/100 Ethernet, 3G quad band modem
OLSWR915GW0	915 MHz FCC ISM BAND GATEWAY 10/100 Ethernet, 3G quad band modem
OLSWR923GW0	915-928 MHz ISM BAND GATEWAY 10/100 Ethernet, 3G quad band modem

NODES

OLSWR1CHVNS	1 CH VIBRATING WIRE NODE Enclosure 100 x 100 x 61 mm, IP67
OLSWR5CHVW0	5 CH VIBRATING WIRE NODE Enclosure 100 x 200 x 61 mm, IP67
OLSWR4CHANL	4 CH ANALOGUE NODE Enclosure 100 x 200 x 61 mm, IP67
OLSWRDIG000	DIGITAL NODE Enclosure 100 x 200 x 61 mm, IP67
OLSWR02INC15	WIRELESS TILT METER Enclosure 100 x 100 x 61 mm, IP67

SOFTWARE SUITE



SISGEO.COM



READOUT ACCESSORIES AND SPARE PARTS

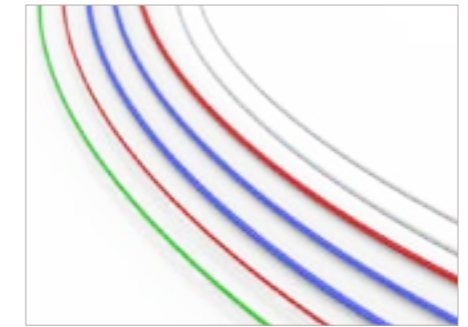
In order to simplify installation and reading procedures, Sisgeo offers a variety of accessories to meet all the Client requirements such as cable splicing kits, connectors, cable end protections, etc... Cable splicing kits permit to make cable joints at site by means of bi-component epoxy resin.

ACCESSORIES

0EGSM0K0200	CABLE SPLICING KIT (2 TUBES) with caps and epoxy resin
0EGSM0K1000	CABLE SPLICING KIT (10 TUBES) with caps and epoxy resin
1000RES2C0R	BI-COMPONENT EPOXY RESIN 0,5 Kg pack
0ECON07MV00	FLYING MIL CONNECTOR AND CAP 7 PIN male MIL connector
0ETPOP60700	CABLE END PROTECTION for cable with OD 2.3 to 6.7 mm
0ETPOP60900	CABLE END PROTECTION for cable with OD 4.8 to 8.0 mm
0ETPOP61300	CABLE END PROTECTION for cable with OD 7.0 to 12.0 mm

CDL READOUTS SPARE PARTS

0ECAV7P2A00	JUMPER SHIELDED CABLE, 2 ALL CLIP MIL connector and no. 2 clips + GND
0ECAV7P4A00	JUMPER SHIELDED CABLE, 4 ALL CLIP MIL connector and no. 4 clips + GND
0ECAV7P6A00	JUMPER SHIELDED CABLE, 6 ALL CLIP MIL connector and no. 6 clips + GND
0ECAV07V200	FLYING SHIELDED CABLE, 2 CONN. MIL connector M/F 7 pins
0ECAB12VNMB	BATTERY CHARGER 220V / 12V for Archimede, Galileo and New Leonardo



SIGNAL AND MULTICORE CABLES

Sisgeo cables are designed for a variety of geotechnical and hydro-geological applications and can be embedded in concrete or buried in the soil. All Sisgeo signal and multicore cables have LSZH (Low Smoke Zero Halogen) jackets according to the latest required standards.

INSTRUMENT CABLES

0WE102KE0ZH	2-LEADS 20-AWG CABLE, KEVLAR Polyolefin + M1 technopolymer jackets
0WE104K00ZH	2-TWISTED PAIRS 22-AWG CABLE Polyolefin + M1 technopolymer jackets
0WE104SG0ZH	2-TWISTED PAIRS 22-AWG CABLE M1 technopolymer red jacket
0WE104X20ZH	ELECTRIC ARMoured CABLE Polyolefin + M1 technopolymer jackets
0WE1060LSZH	ELECTRIC CABLE 6 COND. Polyolefin + M1 technopolymer jackets
0WE106IPOZH	ELECTRIC CABLE 6 COND. Polyurethane external jacket
0WE110DX0ZH	ELECTRIC CABLE 10 COND-24 Polyolefin + M1 technopolymer jackets
0WE606IPDZH	EL. CABLE 6 COND FOR DIGITAL IPI Polyurethane external jacket

VENTED CABLES

0WE203KE0ZH	2-LEADS VENTED CABLE, KEVLAR Polyolefin + M1 technopolymer jackets
0WE205KE0ZH	4-LEADS VENTED CABLE, KEVLAR Polyolefin + M1 technopolymer jackets

MULTICORE CABLES

0WE1160LSZH	8-TWISTED PAIRS 24-AWG CABLE Polyolefin + M1 technopolymer jackets
0WE1320LSZH	16-TWISTED PAIRS 24-AWG CABLE Polyolefin + M1 technopolymer jackets

OMNIALOG-MUX CONNECTING CABLE

0WE610MUXZH	OMNIA-MUX CONNECTING CABLE 4+2 twisted pairs, M1 technopol. jacket
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In construction underground, where the engineer deals with materials having properties that vary not only in space but also in time, details of construction often have significant or even overwhelming influence on the behavior of the structure and of the surrounding soil.

For an understanding of the behavior, these details must be observed and recorded.

Ralph B. Peck (1972)

Courtesy of CENTENO RODRIGUEZ & ASOCIADOS S.C.



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

WWW.SISGEO.COM



SUCURSAL LATINOAMÉRICA

C.RA 16A # 80-06/16
EDIF ONTARIO OF.506, BOGOTÁ-COLOMBIA
CALLE 12 SUR # 22-121
PORTÓN DE LA COLINA, MEDELLÍN-COLOMBIA

INFO@LATINOAMERICA.SISGEO.COM
WWW.LATINOAMERICA.SISGEO.COM

