



— 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



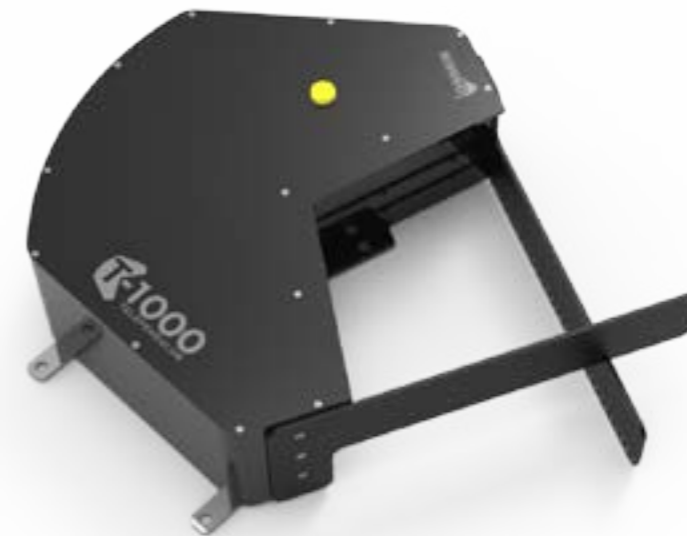
WE DELIVER THE FUTURE

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 **T-1000** telependulum



— OUR GROUP OF COMPANIES

—
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 and SISGEO Latinoamerica.

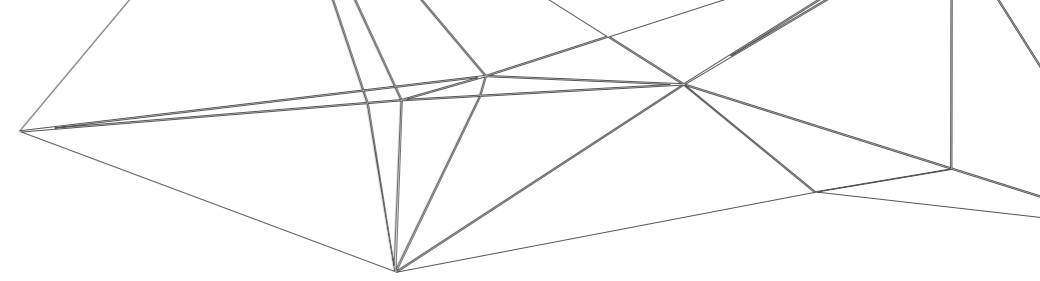
FIELD, founded in 2000, specializes in providing integrated and customized solutions from design, installation and management of geotechnical and structural monitoring systems. Its services include on-site tests and a qualified service of real time data management thanks to the innovative WMS (Web Monitoring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

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 MD-PROFILE inclinometer



3



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 system 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

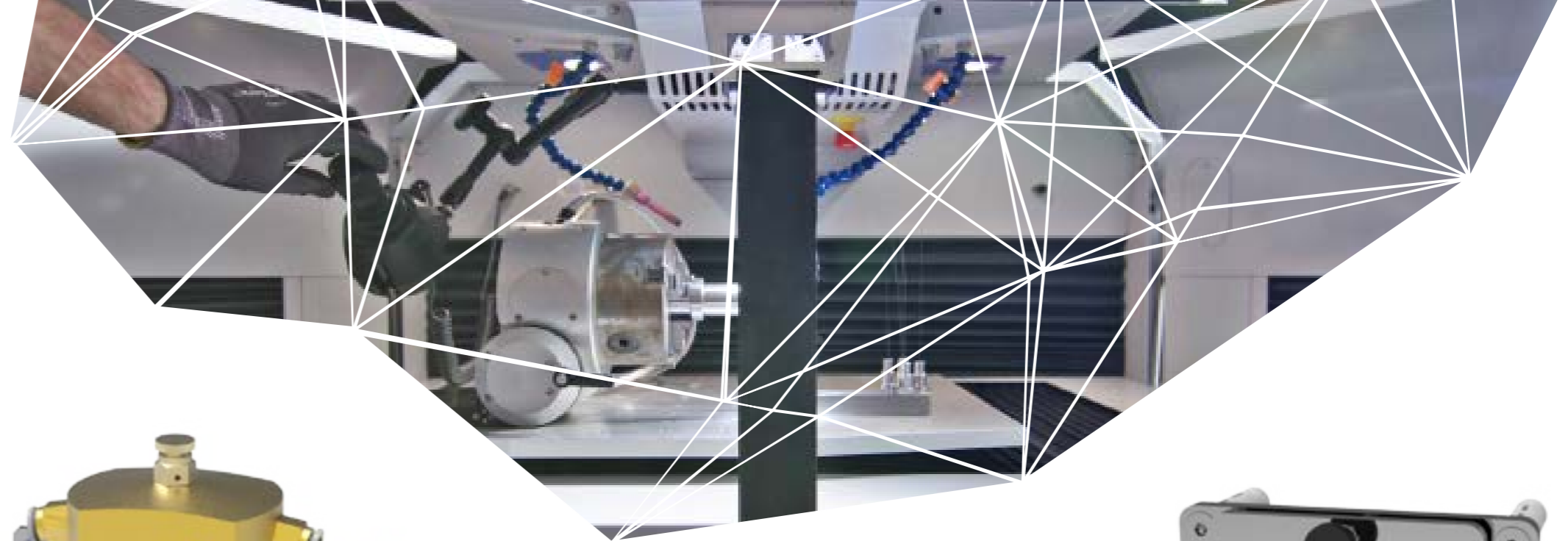
Research and development are hallmarks of SISGEO.

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).

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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 chemically inert. Titanium piezometers are recommended in landfills, brackish groundwaters 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

_ EARTH FILL 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 € €

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

| MODEL | PIEZORESISTIVE |
|-----------------------|---|
| P235I | 0 - 200 kPa, 0 - 5.0 MPa |
| Standard ranges | 4-20 mA current loop |
| Signal output | 0.01% FS |
| Sensitivity | < ±0.15% FS |
| Accuracy (MPE*) | < ±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. Lenght: 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 installed in Casagrande piezometers with the P101 porous filter unit which mates to the conical tip of the transducer housing. 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.

AVAILABLE MODELS € €

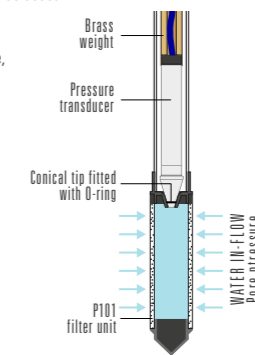
| MODEL | VW range 0-200 kPa |
|-----------------------|----------------------------------|
| PK45C2 | 0.025% FS |
| PK45C5 | frequency (VW), resistance (T) |
| Signal output | 0.025% FS |
| Sensitivity | < ±0.25% FS |
| Accuracy (MPE*) | -20°C +80°C |
| Temp. operating range | 27 mm body - 30 mm head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

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

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 installed as usual 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. The transducer 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 € €

| | |
|-----------------------|--------------------------------|
| 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.

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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

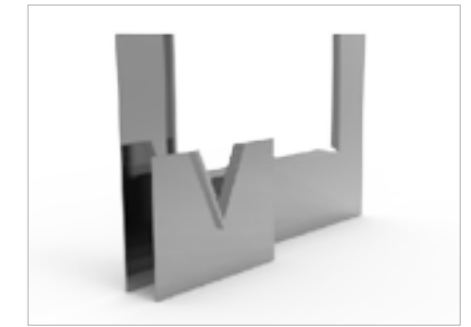
The staff gauges are used for a quick visual indication of the surface level in reservoirs, rivers, streams and open channels. These environmentally rugged iron gauges are finished with porcelain enamel to ensure easy reading and resist to rust or discoloration. Each gauge is accurately graduated and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



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.

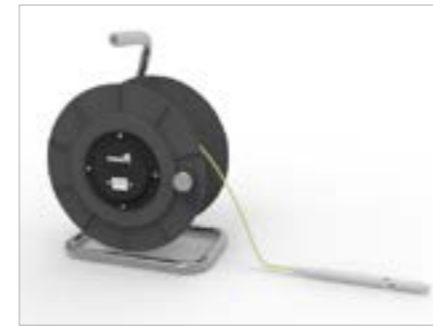
| | |
|-----------------------|----------------------------------|
| 0QVML0500EX | Level transducer, range 0-500mm |
| 0QVML1000EX | Level transducer, range 0-1000mm |
| Transducer type | relative pressure transducer |
| Measuring range | 500 or 1000 mm H ₂ O |
| Accuracy | ±0.1 mm H ₂ O |
| Output signal | 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

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- _PORE WATER PRESSURE
- _EARTHFILL DAMS AND EMBANKMENTS
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- _SEEPAGE MONITORING
- _WATER PRESSURE BEHIND TUNNEL LININGS
- _POTENTIAL LANDSLIDES
- _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.

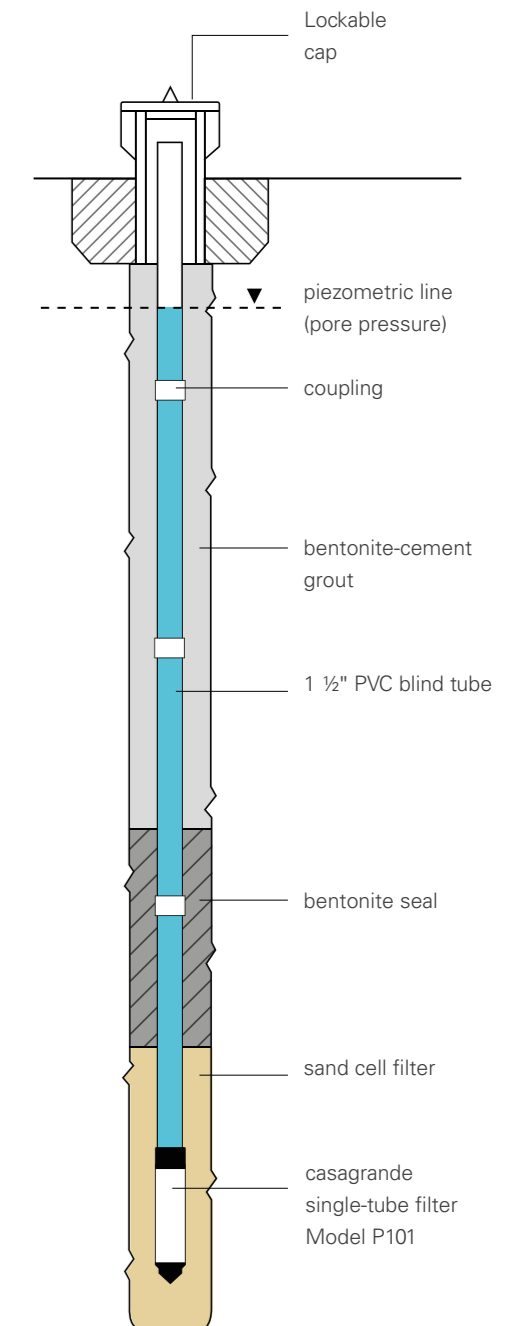
AVAILABLE MODELS

| | | |
|-------------|---|---|
| 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



Project:
Forrestfield Airport Link
Australia

- _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. Standard inclinometer casings assembly require drill, rivets, glue and tape.

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 |



EASY LOCK AND QUICK-JOINT ABS CASINGS

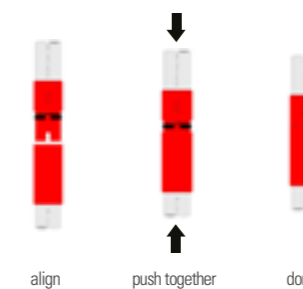
The Easy Lock inclinometer casing is a grooved tube machined at the end to have a self-aligning and fast junction. The QJ Quick-Joint casing consists of sections with built-in couplings that snap together. Both models are produced from high-quality virgin ABS and have O-rings ensure that the joint is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



B.R.A.IN INCLINOMETER SYSTEM

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

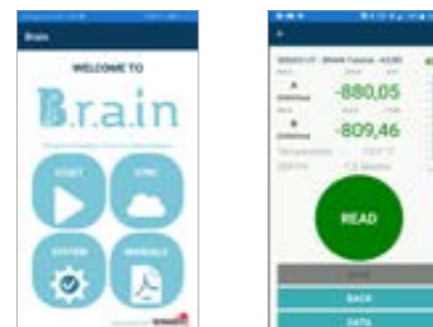
| | |
|--|--|
| Readout value | 20000 sin alpha (other values available on request) |
| System resolution: | |
| - with 500 mm gauge length | 0.011 mm / 500 mm |
| - with 1000 mm | 0.023 mm / 1000 mm |
| - with 2 ft gauge length | ±0.0005 in/2 ft |
| Repeatability (precision) ¹ | |
| - with 500 mm gauge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



MEMS INCLINOMETER AND SPIRAL PROBES

The vertical and horizontal 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 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.

OS242DV3000 VERTICAL PROBE

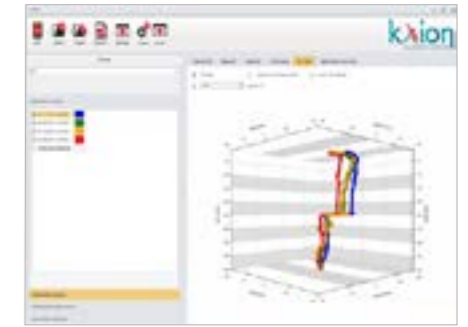
| | |
|-------------------------|--|
| Measuring range | ±30° |
| Sensor type | biaxial digital MEMS |
| Probe accuracy (MPE*) | ±0.01% FS |
| Temp. operating range | -30°C to +70°C |
| Body material and diam. | stainless steel, 28 mm |
| Gauge length | 500mm, 1000mm, 2 ft |
| Wheels | 2 spring-loaded carriages with 2 wheels each |
| IP rate | IP68 up to 2.0 MPa |

OS241DH3000 HORIZONTAL PROBE

| | |
|-------------------------|---|
| Measuring range | ±30° |
| Sensor type | uniaxial digital MEMS |
| 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 |
| Wheels | 2 fixed wheels and 2 spring-loaded wheels |
| IP rate | IP68 up to 2.0 MPa |

OS30PR12D00 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 |






KLION ANALYSIS SOFTWARE

KLION is a specially designed software to process inclinometer, spiral meter 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:
Lyon-Turin high speed railway tunnel
Border France-Italy



MEMS IN-PLACE INCLINOMETER

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 local inclination of the casing due to the horizontal soil movements.

AVAILABLE MODELS

| | |
|--------------------------|---|
| 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 |
| OWE1061POZH | 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).



MD-PROFILE SYSTEM

MD-Profile gauges are designed to be placed within internally flush pipes. The system is suitable for geotechnical and structural applications, where vertical or horizontal accurate profiling is required. Each segment is mechanically and electrically linked to one another through connectors in a RS485 Modbus daisy chain configuration.

AVAILABLE MODELS

| | |
|-------------------------|--|
| MODEL MDP30V | vertical biaxial |
| MODEL MDP30H | horizontal uniaxial |
| Sensor type | triaxial MEMS, 2-axis used |
| Available ranges | $\pm 30^\circ$ (other under request) |
| Sensor resolution | 0.0002° |
| Accuracy (MPE*) | $< \pm 0.04\%$ FS with $\pm 30^\circ$ FS |
| Sensor temp. dependency | $< \pm 0.01\%$ /°C (A axis - vertical) $< \pm 0.004\%$ /°C (B axis - vertical) $< \pm 0.004\%$ /°C (A axis - horizontal) |
| Power supply | 8 - 28 V DC |
| Signal output | RS485, MODBUS RTU protocol |
| Temp. operating range | -30°C to +70°C |

PROBE FEATURES

| | |
|------------------|--------------------------|
| Probe diameter | 28 mm |
| Probe material | s/steel and carbon fibre |
| Protection | IP68 up to 1.5 MPa |
| Available length | 0.5m, 1.0m, 1.5m, 2.0m |

ACCESSORIES

| | |
|-------------|------------------------|
| OMDHANGKIT0 | MD Profile hanging kit |
| OS4TS101000 | Support head |
| OMDP4ASC150 | 1.5" centering device |
| OMDP4ASC200 | 2.0" centering device |
| OETERMRESMD | MDP ending resistance |
| OMDP15TPV30 | MDP 1.5" flush tube |
| OMDP20TPV30 | MDP 2.0" flush tube |
| OEDSCKIT000 | DSC SW config. kit |



LT-INCLIBUS

The LT-Inclibus gauge is able to monitor local tilting along a line, assuring the alignment, distance and measuring axis orientation between the gauges. The standard segment is composed by a 2m fibre glass rod with two biaxial waterproof gauges, 1m spaced. The rods are connected through mechanical joints, while the gauges are connected in a RS485 chain.

AVAILABLE MODELS

| | |
|-------------------------|--|
| MODEL LTIBV | vertical biaxial |
| MODEL LTIBH | horizontal biaxial |
| Sensor type | triaxial MEMS, 2-axis used |
| Available ranges | standard $\pm 10^\circ$ (other under request) |
| Sensor resolution | 0.0002° |
| Accuracy (MPE*) | $< \pm 0.10\%$ FS with $\pm 10^\circ$ FS |
| Sensor temp. dependency | $< \pm 0.01\%$ /°C (A axis - vertical) $< \pm 0.004\%$ /°C (B axis - vertical) $< \pm 0.004\%$ /°C (A and B axis - horiz.) |
| Power supply | 8 - 28 V DC |
| Signal output | RS485, MODBUS RTU protocol |
| Temp. operating range | -30°C to +70°C |

GAUGE FEATURES

| | |
|--------------------------|-----------------------|
| Gauge section dimensions | 145mm x 35mm x 35mm |
| Material | polycarbonate, FG rod |
| Protection | IP68 up to 1.0 MPa |
| whole length | 2.0m |

ACCESSORIES

| | |
|--------------|--|
| OS400HD00MT | Cable with connector |
| OETERMRESIO | Eding resistance |
| OLTIIBROD020 | 2m fibre-glass elongation rod (no sensors) |



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

Project:
Metro Line C
Colosseum monitoring
Rome, Italy



BH-PROFILE IN-PLACE INCLINOMETER

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 €€

| | |
|-----------------------------------|--|
| MODEL S431HD | vertical uniaxial |
| MODEL S432HD | vertical biaxial |
| 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 |
| OS43WHE2SSO | Terminal wheels assembly |
| OS4TS101000 | Vertical IPI support head |
| OWRAC250000 | s/steel support wire, 2.5 mm |



HORIZONTAL IN-PLACE INCLINOMETER

IPI horizontal string is composed by a chain of IPI gauges with carbon fiber extension rods and a terminal wheels assembly. A string of horizontal IPIs is usually installed inside inclinometer casing buried within trenches, foundations or horizontal drill holes for automatic monitoring of settlements or heaves.

AVAILABLE MODELS €€

| | |
|-------------------------------|--|
| 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

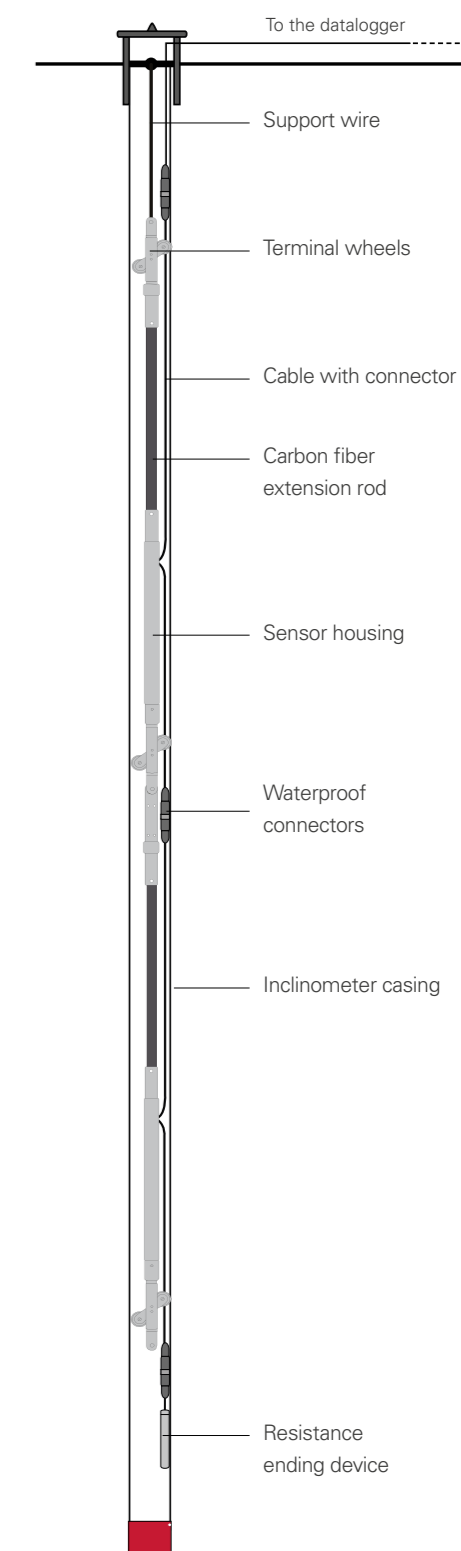
| | |
|-----------------------|---------------------------------|
| Sensed probe diameter | 30 mm |
| Sensed probe material | s/steel and thermoplastic resin |
| Protection | IP68 up to 1 MPa |
| Extension rod | Carbon fiber, 20 mm OD |

ACCESSORIES

| | |
|-------------|---------------------------------|
| OS430EX10RD | 1 m carbon-fibre elongation rod |
| OS430EX20RD | 2 m carbon-fibre elongation rod |
| OS44WHE2SSO | Horiz. terminal wheels assembly |
| ODEXOTS2350 | Horizontal IPI protective cap |

(*) 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).

EXAMPLE OF BH-PROFILE CHAIN



TILTMETERS

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

Project:
Cross strait tube project
Turkey



SURFACE TILTMETER

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 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

| | |
|-----------------------------------|---|
| 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°) |
| 0EPM010IP10 | Junction box for digital sensor chains Measuring box for digital sensors chain. |



D-TILTMETER

The D-Tiltmeters use digital MEMS tilt sensors. They are designed to be permanently installed 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

| | |
|-------------------------------|--|
| 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 |
| 0EPD023IP10 | Junction box for digital sensor chains |
| 0EPM010IP10 | 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 (\leq Lin. MPE) and polynomial correction (\leq Pol. MPE).



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

| | |
|-----------------------|---|
| MODEL S541MA | uniaxial tilt sensor |
| MODEL S542MA | biaxial tilt sensor |
| Application | horizontal, vertical or inclined |
| Sensor type | MEMS |
| Range | ±2.5°, ±5°, ±10° |
| Sensor resolution | 0.01% FS |
| Accuracy: Pol. MPE* | ±0.004° for ±2.5° range, ±0.006° for ±5° range, ±0.010° FS for ±10° 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

| | |
|-------------------------------------|----------------------------------|
| MODEL S541HD | uniaxial digital tilt sensor |
| MODEL S542HD | biaxial digital tilt sensor |
| Application | horizontal, vertical or inclined |
| Sensor type | MEMS |
| Range | ±2.5°, ±5°, ±10° |
| Resolution (reading frequency 2 Hz) | 0.00056° |
| Sensor accuracy: | |
| Pol. MPE ^(*) | ±0.002° |
| Lin. MPE ^(*) | ±0.004° |
| 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



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

| | |
|--------------------------|---|
| 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 TILTMETER

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

| | |
|--------------------------|---|
| 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).

EXAMPLE OF SUBMERSIBLE TILTMETER INSTALLATION



Submersible tilt meter installed on up-stream face of Sogamoso Dam - Colombia (190mt high)

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 compact 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

| | |
|---|---|
| OHLEV050D02 | DIGITAL H-LEVEL GAUGE, 500 mm FS |
| OHLEV100D02 | DIGITAL H-LEVEL GAUGE, 1000 mm FS |
| Sensor type | capacitive ceramic sensor |
| Measuring range | 500 or 1000 mm H ₂ O (2000 mm on request) |
| Gauge resolution | 0.002% FS |
| Gauge accuracy (MPE*) | ±0.07% FS |
| (thermal effects not included) | |
| Offset temp. dependency | < ±0.01 mm/°C with 500mm range < ±0.03 mm/°C with 1000mm range |
| Internal sensors (embedded on electronic board) | Temperature, humidity and supply voltage monitor |
| Output signal | RS-485, Modbus RTU protocol |
| Operating temperature | -20°C to +70°C |
| Housing dimensions (WxHxD) | 75 x 175 x 50 mm |
| Housing material | Anodized aluminum |

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

ANALOGUE H-LEVEL GAUGES

| | |
|--------------------------------|---|
| OHLEV050002 | H-LEVEL GAUGE, 500 mm FS |
| OHLEV100002 | H-LEVEL GAUGE, 1000 mm FS |
| Sensor type | capacitive ceramic sensor |
| Measuring range | 500 or 1000 mm H ₂ O (2000 mm on request) |
| Gauge resolution | infinite |
| Gauge accuracy (MPE*) | ±0.15% FS with 500mm range |
| (thermal effects not included) | ±0.10% FS with 1000mm range |
| Offset temp. dependency | < ±0.05 mm/°C with 500mm range < ±0.15 mm/°C with 1000mm range |
| Output signal | 4-20mA (pressure), Ohm (temperature) |
| Operating temperature | -20°C to +60°C |
| Housing dimensions (WxHxD) | 75 x 175 x 50 mm |
| Housing material | Anodized aluminum |



MULTIPOINT SETTLEMENT SYSTEM

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 €€

| | |
|--------------------------------------|---|
| 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 €€

| | |
|--------------------|---|
| 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 x15 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

OREX45100DS DIGITAL T-REX SYSTEM €€

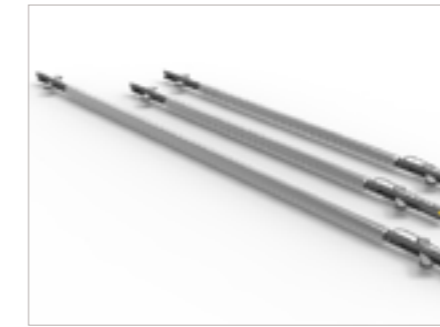
T-REX digital extensometer offers several advantages:

- 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°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 EXTENSOMETER

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.

DIGITAL DEX SPECIFICATIONS €€

| | |
|-----------------------|--|
| ODEX350100D | Range 100 mm, length 1230 mm |
| ODEX350500D | Range 500 mm, length 1230 mm |
| ODEX351000D | Range 1000 mm, length 1730 mm |
| Sensor resolution | 0.0001 mm (with OMNIAlog) |
| Sensor accuracy | $< \pm 0.25\%$ FS for 100mm range $< \pm 0.08\%$ FS for 500 and 1000mm ranges |
| Temperature sensor | accuracy $\pm 1^{\circ}\text{C}$ |
| Int. humidity sensor | accuracy $\pm 5\%$ RH |
| Signal output | RS485 with Modbus RTU Protocol |
| Operating temperature | -30°C $+70^{\circ}\text{C}$ |
| Environmental | IP68 (up to 1.0 MPa) |
| Outer diameter | 35 mm |

ANALOGUE DEX SPECIFICATIONS €€

| | |
|-----------------------|--|
| 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°C $+70^{\circ}\text{C}$ |
| Environmental | IP68 (up to 1.0 MPa) |
| Outer diameter | 35 mm |



DEX-S 3D IN-PLACE EXTENSO-INCLINOMETER

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.

DIGITAL DEX-S SPECIFICATIONS €€

| | |
|--------------------------|--|
| ODEX35S115D | Axial range 100 mm, Tilt range $\pm 15^{\circ}$ |
| ODEX35S130D | Axial range 100 mm, Tilt range $\pm 30^{\circ}$ |
| SETTLEMENT SENSOR | |
| Measuring range | ± 50 mm (100 mm) |
| Linearity | $< \pm 0.30\%$ FS |
| Sensor accuracy | $< \pm 0.25\%$ FS |
| TILT SENSOR | |
| Technology | MEMS inclinometer |
| Type | Biaxial |
| Sensor resolution @ 2 Hz | 0.00056° (0.01 mm/m) |
| Sensor accuracy | $\pm 0.015\%$ FS (for $\pm 15^{\circ}$ range) $\pm 0.020\%$ FS (for $\pm 30^{\circ}$ range) |
| Temperature dependency | $< \pm 0.002^{\circ} / ^{\circ}\text{C}$ |
| TEMPERATURE GAUGE | |
| Measuring range | -40°C to $+125^{\circ}\text{C}$ |
| Accuracy | $\pm 1^{\circ}\text{C}$ (with temperature range -10°C to $+85^{\circ}\text{C}$) |
| SIGNAL OUTPUT | RS485 with Modbus RTU Protocol |

SETTLEMENT GAUGES

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

Project:
Afshar Dam
Turkey



FIXED EXTENSOMETER

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 |

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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.

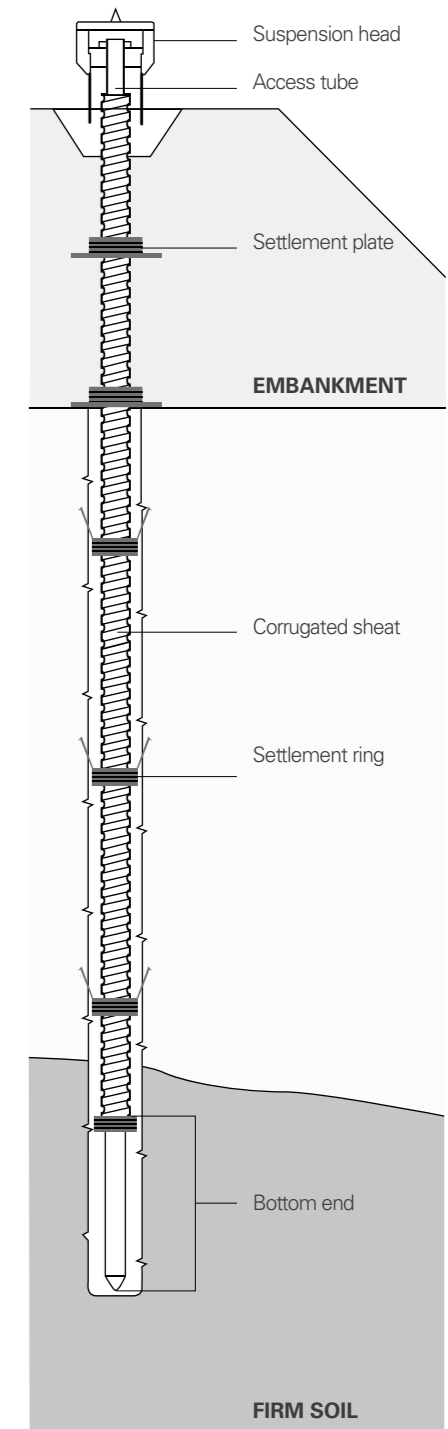
COMPONENTS

| | |
|-------------|---------------------------|
| OD111P30000 | 3 M SECTION ACCESS TUBE |
| OD111PV5500 | CORRUGATED PIPE, OD 55 MM |
| OD111TF6000 | TELESCOPIC END AND DATUM |
| OD111TS1000 | SUSPENSION HEAD |
| OD111AF6000 | SPRING MAGNET RING |
| | 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 |

EXAMPLE OF MAGNET EXTENSOMETER COLUMN



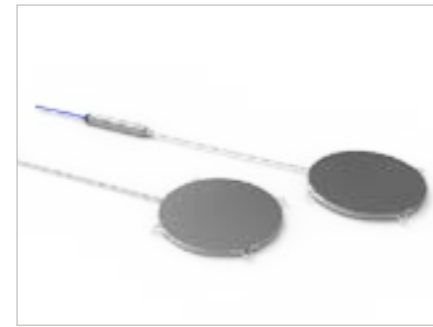
PRESSURE & LOAD CELLS



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



Project:
MRT Blue Line extension
Bangkok - Thailand



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.

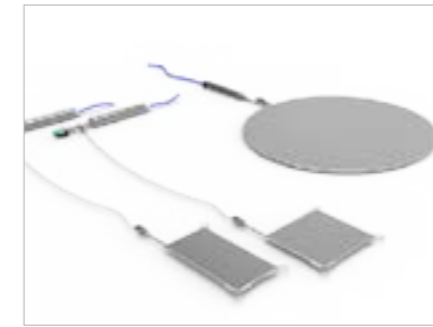
AVAILABLE MODELS CE

| | |
|-----------------------|--|
| 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).

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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

| | |
|--------------------|-----------------------------------|
| 0L111151500 | for radial stress in concrete |
| Pad size | 150 x 150 mm |
| Working pressure | up to 5 MPa |
| 0L111102000 | for tangential stress in concrete |
| Pad size | 100 x 200 mm |
| Working pressure | up to 20 MPa |
| 0L111204000 | for contact soil/rock-structure |
| Pad size | 200 x 400 mm |
| Working pressure | up to 5 MPa |
| 0L111D05000 | 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 |

EXAMPLE OF EARTH PRESSURE CELLS INSTALLATION



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 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 ±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 | ±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

| | |
|-------------|-------------------------------|
| OL204V03000 | 300 KN, ID 40 MM, OD 155 MM |
| OL205V05000 | 500 KN, ID 50 MM, OD 155 MM |
| OL207V05000 | 500 KN, ID 71 MM, OD 155 MM |
| OL207V07500 | 750 KN, ID 71 MM, OD 155 MM |
| OL211V07500 | 750 KN, ID 110 MM, OD 200 MM |
| OL212V10000 | 1000 KN, ID 120 MM, OD 220 MM |
| OL216V15000 | 1500 KN, ID 165 MM, OD 260 MM |
| OL219V18000 | 1800 KN, ID 190 MM, OD 300 MM |
| OL222V25000 | 2500 KN, ID 225 MM, OD 340 MM |

| | |
|-----------------------|-------------------------------|
| Overload | 150% |
| Sensitivity | 0.06% FS |
| Accuracy | < ±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

| | |
|-------------|-------------------------------|
| OEC0N07MV00 | MIL male connector with cap |
| OELC420MA00 | 4-20 mA transmitter (2 wires) |



ELECTRO-HYDRAULIC 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(*) | < ±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

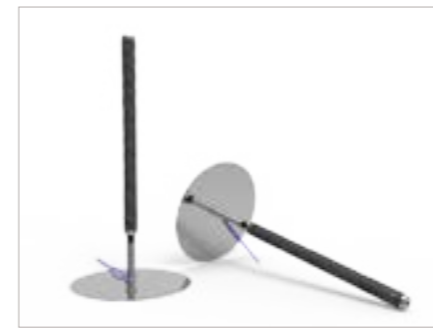
L2CT-L2CX SOLID LOAD CELLS

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 | < ±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 | < ±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



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).



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.

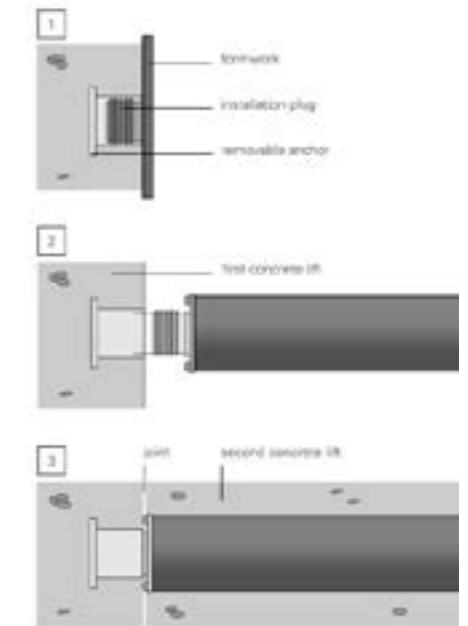
AVAILABLE MODELS

| | |
|-------------|---------------------------------------|
| 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 JOINTMETERS: INSTALLATION PROCEDURES



- 1 The removable anchor is embedded in the first pour. A plug keeps concrete out of the anchor.
- 2 After the plug is removed, the transducer body is screwed into the anchor and embedded in the second pour of concrete.
- 3 Now the instrument spans the joint between two blocks of concrete.

EXTENSOMETERS & JOINTMETERS

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



MULTIPOINT ROD EXTENSOMETER (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 (rilisan), 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) |
|-------------|--|



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% |



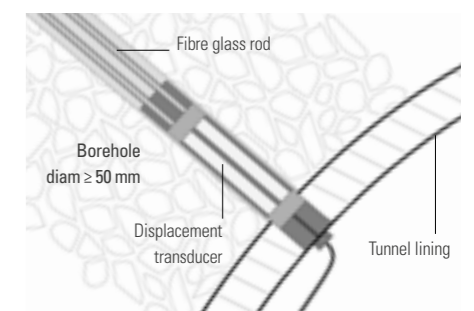
MEXID EXTENSOMETER

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

| | |
|-------------|--|
| OD2MX00D000 | fiberglass rods, Digital RS-485, available with 50 and 150 mm range |
| OD2MX00W000 | fiberglass rods, vibrating wire sensors available with 50 and 150 mm range |
| OD2MX00A000 | fiberglass rods, 4-20mA output <u>available only under request</u> |

| | |
|------------------------|--|
| Number of bases | from 1 to 4 (2 to 4 for digital) |
| Signal output | |
| OD2MX00A000 | 4-20 mA current loop |
| OD2MX00D000 | RS-485 Modbus RTU |
| OD2MX00W000 | frequency (VW), resistance (T) |
| Accuracy | < ±0.20% FS (4-20mA output) < ±0.20% FS (digital) < ±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 (rilisan), OD 12 mm |
| Groutable anchor | rebar 16 mm OD, 400 mm long |
| Transducers protection | IP68 (watertight up to 1.0 MPa) |



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 deformeter is used to monitor the displacement between two opposite surfaces (convergence in tunnels, rock masses, etc...). USB deformeter 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 |

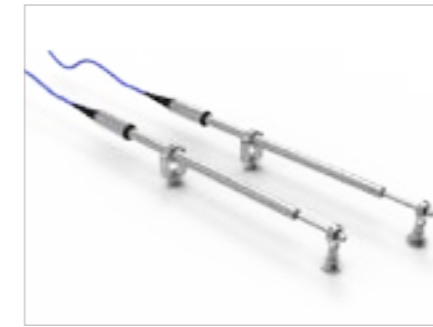
OD313F00000 WIRE DEFORMETERS €€

| | |
|-----------------------|--|
| 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 CRACKMETER

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 |

OD1G30KIT00 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

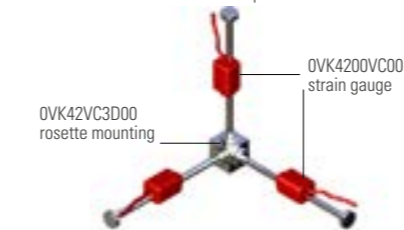
Vibrating wire strain-gauges are used to monitor variation in strain, which allows stress evaluation in steel or concrete structures. A thermistor incorporated into the gauge gives the temperature at the point of measurement allowing temperature compensation. 3-D rosette mounting is also available.

AVAILABLE MODELS

| MODEL | DESCRIPTION |
|---------------------------|---|
| OVK4000VS00 | WELDABLE SG |
| OVK4000VSC0 | CONCRETE SURFACE SG |
| OVK4200VC00 | EMBEDMENT SG |
| OVK4200VCHP | EMBEDMENT SG FOR DEEP APPLICATION |
| OVK4000SM00 | SHOTCRETE SG WITH ADJUSTABLE TENSIONING |
| Range (nominal) | 3000 µε (shotcrete 10000 µε) |
| Signal output | Frequency (strain), Ohm (temperature) |
| Accuracy | ±0.5% FS (±3% FS for OVK4000SM00) |
| Repeatability | <±1 µε, <±3 µε for OVK4000SM00 |
| Coil resistance (nominal) | 150 ohm |
| Embedded thermistor type | NTC 3 kΩ |
| 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



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.

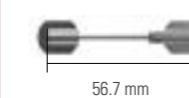
OVK4100VS00 SPOT WELDABLE SG

| | |
|-----------------------------|--------------------------------|
| Active gauge length | 47.5 mm |
| Range (nominal) | ±1500 µε |
| Signal output | frequency (VW), resistance (T) |
| Sensitivity | 1.0 µε |
| Accuracy | ±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 |

OVK4100VSPO 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 |
| OVK4100VSPO | Plucking coil only |

EXAMPLE OF EARTH PRESSURE CELLS INSTALLATION



TELT - Tunnel Euralpin Lyon Turin, installation of VW strain gauges within TBM precast concrete element.

STRAIN GAUGES & THERMOMETERS

_PILES AND MASS CONCRETE

_CONCRETE STRUCTURES,
BEAMS AND COLUMNS

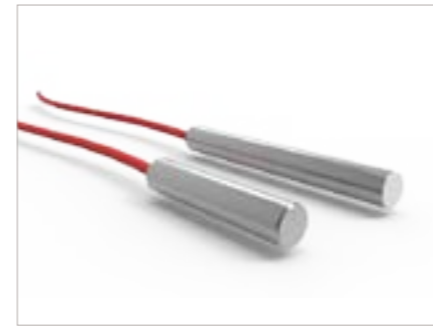
_CONCRETE FOUNDATIONS
AND DIAPHRAGM WALLS

_TUNNEL SEGMENTS

_STEEL STRUCTURES, PIPES
AND ARCH SUPPORTS

_GRAVITY AND ARCH DAMS

_BRIDGES AND VIADUCTS



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 €€

| | |
|-----------------|---------------------------|
| 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 €€

| | |
|-----------------|----------------------------|
| 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) €€

| | |
|-----------------|----------------|
| 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 €€

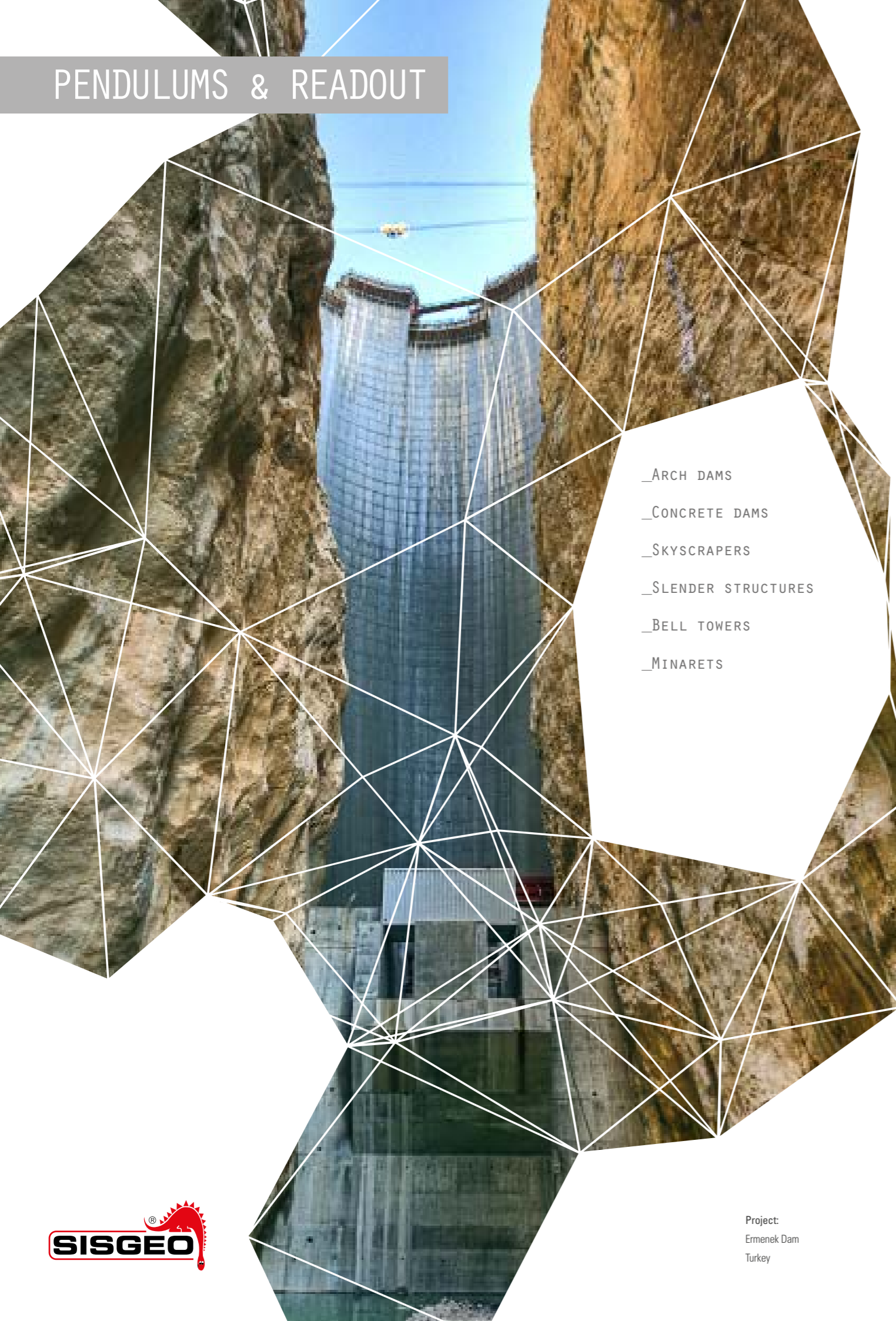
| | |
|------------------|--|
| Type of sensor | PT100 platinum resistance |
| Number of sensor | until N.4 with OWE1160LSZH cable until N.8 with OWE1320LSZH cable |
| Measuring range | -50°C +80 °C |
| Resolution | 0.1°C |
| Accuracy | ±0.2°C |
| Sensed section | Ø20 mm, length 180 mm |

OTS00NTC000 THERMISTOR STRINGS €€

| | |
|------------------|---|
| 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:
Emenek 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 the foundation combined with the direct pendulum allow to obtain a complete profile of the dam's verticality.

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. |
| Material | stainless steel |
| Damping fluid (mineral oil) | not supplied |

OWRAC200000 PENDULUM WIRE

| | |
|----------|-----------------|
| Material | stainless steel |
| Diameter | 2 mm |

SISGEO.COM



T-1000 TELEPENDULUM

T-1000 Teleependulum is designed to take automatic readings of the coordinates of pendulum's plumb lines. Thanks to the new optic sensor without any moving parts, it has very high accuracy and resolution and wide measuring range. T-1000 can be settled and read locally with dedicated mobile APP or can be integrated into automatic data acquisition system networks through RS485 or 4-20mA output.

OTELT100000 TELEPENDULUM

| | |
|-------------------------------------|--|
| Measurement principle | optical |
| Measurement range | X-axis: 0-150 mm (± 75 mm) Y-axis: 0-150 mm (± 75 mm) |
| Resolution | 0.01 mm |
| Repeatability (both axis): | |
| in core area ⁽¹⁾ | ± 0.02 mm |
| whole measuring area ⁽¹⁾ | ± 0.05 mm |
| Accuracy Pol. MPE ⁽¹⁾ | |
| in core area ⁽¹⁾ | |
| for movements < 30mm | ± 0.05 mm for both axis |
| in meas. area ⁽¹⁾ | |
| for movements < 30mm | ± 0.10 mm for both axis |
| in meas. area ⁽¹⁾ | |
| for movements ≥ 30 mm | ± 0.25 mm ($\pm 0.15\%$ FS) for both axis |
| Stability @60 hours | ± 0.05 mm |
| Detectable wire (diameter) | from 0.8 mm to 2 mm best performance with 1 mm wire |
| Output: | |
| - Local readings | Mobile APP through Bluetooth 4.2 |
| - Remote monitoring | RS-485 with Modbus RTU protocol ⁽¹⁾ 4-20mA 4-wires |

T-1000 APP



Output reading page

Diagnostic parameters output page

⁽¹⁾ Refer to T-1000 datasheet technical specifications notes



OPTICAL PENDULUM READOUT

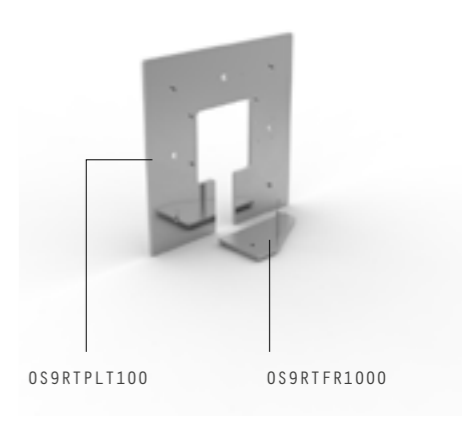
The pendulum readout (coordinometer) is a reliable and simple instrument for manual readings of pendulum systems. It allows calculation of the horizontal movements of the pendulum wire and a digital LCD displays the X and Y coordinates in millimetres. It can be utilized for either in-place installation 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°C |
| Material | aluminium |
| Dimensions | 340 x 340 x 115 mm |
| Weight | 3.5 kg |

ACCESSORIES

| | |
|--------------------|----------------------------|
| OS9RTPLT100 | SUPPORT BASE PLATE |
| Material | galvanized steel |
| Dimensions | 415 x 415 x 10 mm (LxWxH) |
| OS9RTFR1000 | CALIBRATION FRAME |
| Material | stainless steel /aluminium |
| Overall dimensions | 204 x 120 x 98 mm (LxWxH) |



OS9RTPLT100

OS9RTFR1000



MIND READOUT

MIND is an innovative readout, compatible with both digital and analogue instruments. It is designed in order to be rugged, flexible and to obtain fast and precise readings. Internal diagnostic sensors (temperature, humidity and battery voltage) help the user to control the health of the readout during the usage.

OMIND000000 MIND READOUT

| | |
|-----------------------|--|
| Type of measurements | mA, mV, mV/V, V, °C, VW, RS-485 Modbus RTU |
| A/D conversion | Resolution: 24bit, modulation method sigma-delta |
| Material | aluminum |
| IP class | IP65 |
| Overall dimensions | 205x128x45 mm |
| Weight | 1 Kg |
| Operative temperature | -30 to +70 °C (battery -20 to +60°C) |

Detailed electrical characteristics available on MIND datasheet

SPARE PARTS AND ACCESSORIES

| | |
|-------------|--|
| 0ECAV08V2J0 | Jumper cable with 2 connectors for reading connectorized instruments |
| 0ECAV08V2S0 | Switch jumper cable with 2 connectors for switch panels and measuring boxes |
| 0ECAV8P6A00 | 6-clips jumper cable with 6 alligator clips for instrument reading |
| 0ECABMIND00 | Battery charger Input volt. 90-264 Vac, 50-60 Hz IP41 Max output power 10 W |
| 0ECABMINDMU | MUX box to MIND cable Jumper cable for direct connection from MIND to multiplexer boxes. |



MIND APP MAIN FEATURES

- Automatic configuration of sensors through QRcode
- Simultaneous display of electrical and engineering measures
- Real time charts
- Quick read for immediate readings without configuration
- Geolocation of sites and sensors
- Multiplexers reading
- Digital chains reading
- Biaxial analogue sensors reading with the simultaneous reading of temperature
- Search engine for sites and sensors
- Spectrum Analyzer on board for vibrating wire sensors analysis



MIND App compatible with:



MINIOMNIALOG DATALOGGER

MiniOMNIAlog 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. Stored readings can be retrieved via USB connection with a PC or with a USB flash drive if a PC is not available.

OOMNIAMINIO 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 |
| 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. |



OMNIALOG DATALOGGER

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 µA at FS 20 mA 1 µV at FS ±10 mV 0.001mV/V at FS 10 mV/V 0.1 Hz at FS 6000 Hz 0.1 °C for PT100 and NTC |
| Measurement accuracy | ±0.01% FS (0.1% FS for NTC and PT100) |
| Temperature drift | < 10 ppm/°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°C +70°C (display -20°C +70°C) |

OOMNIALOGDO 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°C +70°C (display -20°C +70°C) |



OMNIALOG CABINETS

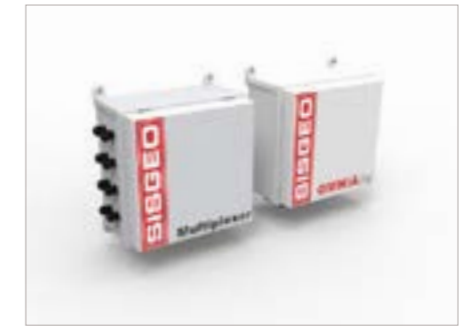
The versatility and the flexibility of OMNIALog allow customized systems to meet the Client needs and the project requirements. A variety of "cabinet" with internal relay multiplexers are offered in order to expand the number of channels (sensors) managed by one datalogger. Each channel can be independently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

| | |
|-------------|---|
| 00MXR0UTVPN | HSPA 3G router with VPN service Is the fastest and easy way for remote OMNIALog managing and data download. |
| 00MXF0MMSWT | Optical fiber interface (available only on request) Switch ethernet with multimode optical fiber ports for in/out (Available only on request). |



REMOTE MULTIPLEXERS

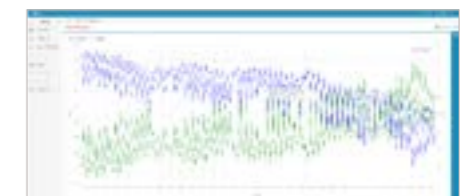
Multiplexer boxes offer a valid alternative to OMNIALog cabinets when a distributed sensor network is preferred. The relay multiplexer boards, mounted inside an IP67 box, operate as peripheral units; they are connected through a RS485 bus to a remote OMNIALog datalogger. Remote multiplexers can be used as terminal boxes, reading them with MIND readout.

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. |
| 0AXB0C22000 | 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 is a software platform for the management and visualization of data coming from monitoring systems. Through its WEB pages the data are available for the Users at any time, in graphical and tabular format. It is possible to set up to 4 types of alarm thresholds and send alarm messages via SMS/e-mail to authorized Users when an instrument reading exceeds the thresholds.



Project:
San Leo Rockfall
Italy

READOUTS, DATALOGGERS & ACCESSORIES



WR LOG WIRELESS MONITORING SYSTEM

WR LOG system 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.

| | |
|-------------|--|
| OLSWR868GW4 | 868 MHz ISM BAND GATEWAY 10/100 Ethernet, 4G modem |
| OLSWR915GW4 | 915 MHz FCC ISM BAND GATEWAY 10/100 Ethernet, 4G modem |
| OLSWR923GW4 | 915-928 MHz ISM BAND GATEWAY 10/100 Ethernet, 4G modem |

NODES

| | |
|--------------|--|
| OLSWR1CHVMS | 1 CH VIBRATING WIRE NODE Enclosure 100 x 100 x 61 mm, IP67 |
| OLSWR5CHVMO | 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

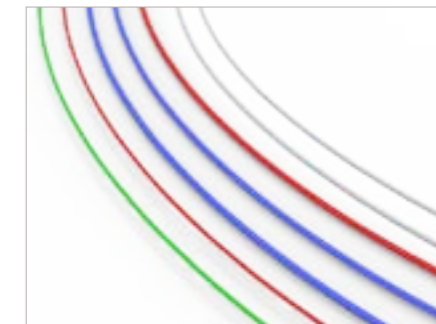


READOUT ACCESSORIES AND SPARE PARTS

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

| | |
|--------------|---|
| 0EGSMOK0200 | CABLE SPLICING KIT (2 TUBES) with caps and epoxy resin |
| 0EGSMOK1000 | CABLE SPLICING KIT (10 TUBES) with caps and epoxy resin |
| 1000RES2COR | 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 |
| 0EPD0000000 | SIMPLE JUNCTION BOXES Available up to 1, 2 or 3 signal cables |
| 0EPD023IPID0 | DIGITAL JUNCTION BOXES Joint 2 cable in one line |
| 0EPDP000W00 | JUNCTION BOXES WITH OVP Over voltage protection up to 6 wires |
| 0EPC0600S00 | TERMINAL SWITCH BOXES up to 6, 12, 18 or 24 instruments |



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

| | |
|-------------|--|
| OWE102KE0ZH | 2-LEADS 20-AWG CABLE, KEVLAR Polyolefin + M1 technopolymer jackets |
| OWE104K00ZH | 2-TWISTED PAIRS 22-AWG CABLE Polyolefin + M1 technopolymer jackets |
| OWE104SG0ZH | 2-TWISTED PAIRS 22-AWG CABLE M1 technopolymer red jacket |
| OWE104X20ZH | ELECTRIC ARMoured CABLE Polyolefin + M1 technopolymer jackets |
| OWE1060LSZH | ELECTRIC CABLE 6 COND. Polyolefin + M1 technopolymer jackets |
| OWE106IPOZH | ELECTRIC CABLE 6 COND. Polyurethane external jacket |
| OWE110DX0ZH | ELECTRIC CABLE 10 COND-24 Polyolefin + M1 technopolymer jackets |
| OWE606IPDZH | EL. CABLE 6 COND FOR DIGITAL IPI Polyurethane external jacket |

VENTED CABLE

| | |
|-------------|--|
| OWE203KE0ZH | 2-LEADS VENTED CABLE, KEVLAR Polyolefin + M1 technopolymer jackets |
|-------------|--|

MULTICORE CABLES

| | |
|-------------|---|
| OWE1160LSZH | 8-TWISTED PAIRS 24-AWG CABLE Polyolefin + M1 technopolymer jackets |
| OWE1320LSZH | 16-TWISTED PAIRS 24-AWG CABLE Polyolefin + M1 technopolymer jackets |

OMNIALOG-MUX CONNECTING CABLE

| | |
|-------------|--|
| OWE610MUXZH | OMNIA-MUX CONNECTING CABLE 4+2 twisted pairs, M1 technopol. jacket |
|-------------|--|



Project:
Karahnjukar HPP
Iceland

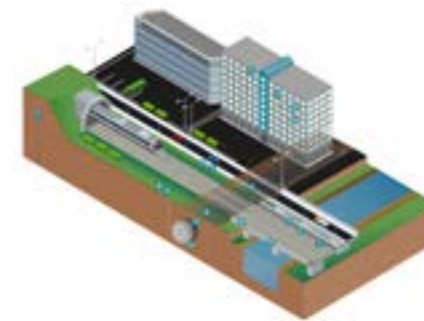


MONITORING SOLUTIONS FOR RAILWAY INFRASTRUCTURES



SISGEO RAIL®

The railway sector deserves the most advanced surveillance solutions to guarantee the highest level of safety. SISGEO RAIL® is the specialized brand of the SISGEO Group dedicated to the railway industry and rail monitoring solutions. The mission is to actively participate in the digitization of worldwide rail infrastructure providing unique value through both cabled and IoT monitoring solutions. Thanks to the recognized experience of SISGEO in the field of structural and geotechnical instrumentation, through large investments in innovation and R&D, SISGEO RAIL® is able to meet the industrial and technological challenges linked to the development of this strategic and environmentally friendly transportation mode that is the train.



Discover more at: www.sisrail.com



FLX-RAIL® RAIL SWING MONITORING

FLX-Rail®, specially developed for the railway swing monitoring, automatically and continuously measures the maximum vertical deformation of the rail at each train passage. This phenomenon is commonly known as "rail swing" or "rail dance". The instrument is installed between the track and the ballast, fixed under the rail using two powerful magnets for a quick and easy installation.

SBV® TECHNOLOGY

SBV® is a revolutionary technology specially developed for railway monitoring instrumentation which aims to activate the measuring devices only when needed.

TECHNICAL SPECIFICATIONS

| | |
|-------------|---|
| 0DFLXS700T | FLX-Rail® gauge, vertical displacement range 70 mm with rail skin temperature sensor |
| 0DFLXS7010T | FLX-Rail® gauge, vertical displacement range 70 mm with rail biaxial tiltmeter and rail skin temp. sensor |

DYNAMIC DEFLECTION SENSOR

| | |
|---|------------------------|
| Sensor type | Optic |
| FS and Measuring range | 70 mm |
| Sensor resolution | 0.01 mm |
| Reading frequency | 350 Hz |
| Offset temperature dependency | 0.03 mm/°C |
| Sensor repeatability | ±0.01 mm |
| Sensor 24 hours stability ⁽¹⁾ | ±0.1 mm |
| Sensitivity ⁽²⁾ | See Calibration Report |
| Sensor accuracy (Lin. MPE) ⁽³⁾ | <±0.1 mm |



RDS RAILWAY DEFORMATION SYSTEM

RDS, Railway Deformation System, is a unique monitoring system designed by Sisgeo for the automatic surveying of the rail tracks longitudinal deformation and the sleepers rotation. 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 INFORMATIONS

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 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)





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)



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