soil INSTRUMENTS

BERTSCHI Instrumentos

PRECISELY MEASURED
Instrumentation and Monitoring

PRODUCT CATALOGUE

MANUFACTURING EXCELLENCE

Premium quality geotechnical & structural monitoring instruments.

SINCE 1962

BRIDGE APPLICATION

Products	Page	Type of Measurement	Where is it used?	
VW Crackmeter, VW Triaxial Jointmeter Mechanical Jointmeter	6	Joint & Crack	Monitoring the opening and closing of concrete joints and cracks	
VWLOG2, VWLOG8 GPRS, ARGUS Monitoring Software	8	Datalogger	Used to read, record and display the data from sensors with the option for remote cellular transmission	
Digital Inclinometer, Inclinometer Casing Smart In-place Inclinometer"	14	Inclination	Used to monitor horizontal subsurface failure in a slope/abutments and possible slip plane movement	
Electrolevel Tiltsensor	25	Tilt	Used to monitor rotation of main structural components related to bridges	
VW Readout	31	Readouts	Handheld Readout for VW and Thermistor sensors	
VW Load Cell, Strain Gauge Load Cell	35	Load & Pressure	Used to monitor loads applied to tendons and ground anchors	
VW Piezometer, Standpipe Piezometer Water Level Meter	39	Water	Measuring pore pressures within the soil around bridges	

Soil Instruments is recognised as one of the UKs market leaders in the supply of monitoring services for the safety and stability of all bridge applications.

This table illustrates the comprehensive range of instrumentation we typically supply within bridge applications.

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One Company
The complete solution

Our Products

Soil Instruments Limited strives to continuously develop ground breaking, innovative products that are able to meet the challenge of the demanding environments in which we work. Our unique systems enable us to provide multiple solutions simultaneously across diverse industries and locations on a global scale.

These systems include:

- MEMS based digital inclinometers
- Vibrating Wire and solid state piezometers
- Pressure and load cells
- Tiltsensors
- Automatic data acquisition
- Data presentation software
- GPRS enabled dataloggers

Our equipment is trusted daily in virtually every country in the world to ensure the safety of major construction projects including civil engineering, mining, dams, railways and road infrastructures.

Our Service

Fundamental to our business strategy is the building of long-term partnerships with our customers, distributors, suppliers and employees. This requires the adoption of a customer-focused, quality-driven service and because we design and manufacture our own monitoring instrumentation, we have an unrivalled understanding of the technology and processes involved.

With the combination of our cutting edge Technology and the vast experience we have at Soil Instruments, we are Committed to providing quality products and services to our customers. To this end we have BSEN ISO 9001:2008 registration for Quality Management Systems.

Active Support

Soil Instruments is uniquely positioned in that we not only design, develop, manufacture premium quality geotechnical and structural instrumentation, we back this up with an exceptional range of support services, including:

Help desk - How can we help you?
Call our help desk to discuss your query in person with one of our experts.

Online help - Find a solution to your problem via our web-based support service, including access to a wide range of technical papers on our client Knowledgebase.

In-house manufacturing team - Our design, manufacturing and inspection teams are all situated within the same building, which enables us to have instant access to a wide resource of skills and expertise to help solve problems quickly and efficiently.

Improve your own skills - We provide a range of hands-on training sessions for those clients who wish to improve their own skills.

Product information

THE TECHNICAL RATING:

As the correct installation of any monitoring sensor or system is vital to maximise performance and accuracy, Soil Instruments makes the following recommendations, for the skill level of the installation contractor.

ADDITIONAL SUPPORT

Soil Instruments offer installation and monitoring services to support this system. For more information please email : **sales@soilinstruments.com** or call **+44 (0) 1825 765044**

ADVANCED	The installer is trained and experienced in the installation of this type of instrument or systems, and is ideally a specialist Instrumentation and Monitoring contractor.
INTERMEDIATE	The installer already has previous experience and/or training in the installation of this instrument or system.
BASIC	As a minimum the installer has read and fully comprehends the manual, and if possible has observed these instruments or systems being installed by others.

Software

MEMS:
Micro Electro Mechanical Systems, or MEMS, is a technology that uses miniaturised mechanical and electro mechanical elements.

Vibrating Wire Principle:
The physical changes measured by the sensor result in small changes to the position of the movable point which results in a change to the tension of the wire.

Contents

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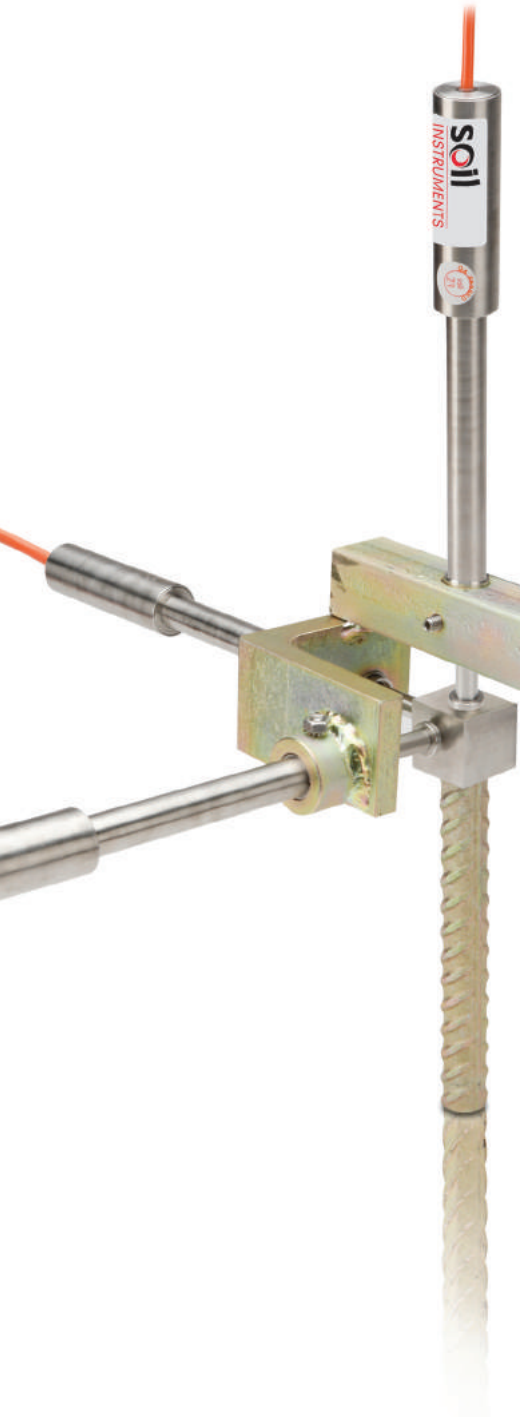
Joint & Crack



J1 Vibrating Wire Embedment Jointmeter

Description

The Vibrating Wire Embedment Jointmeter is designed to monitor movement of joints in mass concrete structures.

The jointmeter comprises two parts; a detachable socket and a protective main body which houses a Vibrating Wire displacement transducer.

Features

- **Highly accurate and robust; accuracy unaffected by cable length**
- **Connecting cable is strong, screened, flexible and can be used in lengths in excess of 1000m**
- **Option to fit a thermistor**
- **Over-voltage surge arrestor fitted to protect against electrical damage**

Benefits

- **Very good long-term stability**
- **Suitable for remote reading and datalogging**
- **Thermistor option enables examination of temperature effects**

Specifications

Sensor			
Ranges	30mm	50mm	100mm
Accuracy	±0.2% full scale		
Resolution*	0.025% full scale		
Temperature range	-20 to +80°C		
Excitation method	Pluck or sweep		
Material	PVC / 316 grade Stainless Steel		
Ingress protection	IP68 to 1700kPa		
Thermistor			
Type	NTC 3k Ω		
Accuracy	±0.5°C		
Resolution*	0.1°C		

J2 Vibrating Wire Crackmeter

Description

The Vibrating Wire Crackmeter provides accurate measurement of crack propagation for structural or geotechnical monitoring.

The sensor is made from high quality Stainless Steel, incorporates O-rings to allow for underwater use and is designed for long-term, reliable monitoring.

Features

- **Uses proven Vibrating Wire technology**
- **Suitable for long-term monitoring**
- **Suitable for manual or remote monitoring**
- **Fully waterproof**
- **Fitted with thermistor for temperature monitoring**

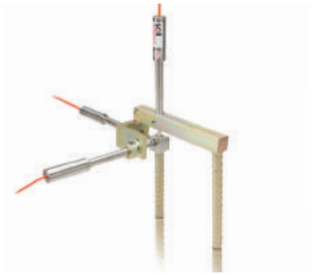
Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Connecting cable is strong, screened and flexible**

Specifications

Sensor			
Ranges	30mm	50mm	100mm
Accuracy	±0.2% full scale		
Resolution*	0.025% full scale		
Temperature range	-20 to +80°C		
Weight less cable	190g	212g	254g
Dimensions*	290mm x 19mmØ	340mm x 19mmØ	450mm x 19mmØ
Excitation method	Pluck or sweep		
Material	316 grade Stainless Steel		
Ingress protection	IP68 to 1700 kPa		

J3 Vibrating Wire Triaxial Jointmeters



Description

The Vibrating Wire Triaxial Jointmeter is designed to monitor three way displacement (X, Y and Z) at joints and cracks.

The reference anvil design allows the VW transducers to show independent movement in all directions, irrespective of each other.

Features

- **Reads in X, Y and Z axes**
- **Uses proven Vibrating Wire technology**
- **Proven in long-term monitoring**
- **Suitable for manual or remote monitoring**
- **Fully waterproof**
- **Integral thermistor**
- **Accurate and robust**

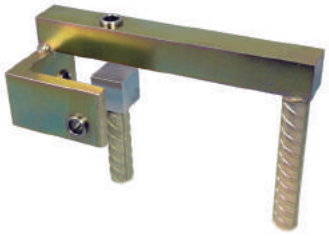
Benefits

- **Three way independent movement monitoring in one easy installation**
- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Over-voltage surge arrestor fitted to protect against electrical damage**
- **Connecting cable is strong, screened and flexible**

Specifications

Vibrating Wire Transducer	
Range	30mm
Accuracy	±0.2% full scale
Resolution*	0.025% full scale
Temperature range	-20 to +80°C
Weight less cable	190g
Material	316 grade Stainless Steel
Excitation method	Pluck or sweep
Dimensions[2]	290mm x Ø19mm
Ingress protection	IP68 to 1700kPa
3D Mounting	
Dimensions	260mm x 112mm x 112mm

J5 Mechanical Triaxial Jointmeter



Description

The Mechanical Triaxial Jointmeter is designed to monitor three way displacement (X, Y and Z) across joints or cracks between adjoining concrete and rock structures.

The jointmeter comprises two elements; a measurement arm and a reference head, both attached to embedment anchor stems.

Features

- **Reads in X, Y and Z axes**
- **Accurate and precise**
- **Proven in long-term monitoring**
- **Simple in principle and operation**
- **Accepts digital or dial depth gauge**

Benefits

- **Three way independent movement monitoring in one easy installation**
- **Low and easy maintenance**
- **Long working life, long-term stability and reliability**

Specifications

Jointmeter			
Ranges	±12mm	±35mm	±75mm
Dimensions*	248 x 242 x 94mm	275 x 345 x 125mm	345 x 385 x 208mm
Material	Mild steel, zinc coated frame | Stainless Steel reference surface		
Reference Anvil			
Material	Stainless Steel		
Dimensions	31mm[2]	170 x 165 x Ø10mm	170 x 165 x Ø10mm
Anchors			
Type	Groutable		

J6 Linear Potentiometer Crackmeter

Description

The Linear Potentiometer Crackmeter is a highly accurate and robust instrument used to measure displacements across cracks and joints of a structure.

The potentiometer is installed across a crack or joint of the structure to be monitored, using groutable or expanding shell anchors.

Features

- **High resolution and accuracy**
- **Robust design**
- **Suitable for long-term monitoring**
- **Suitable for manual or remote monitoring**
- **Two versions available; Standard (IP67) and Submergible (IP68 to 1700 kPa)**

Benefits

- **Accurate, repeatable readings**
- **Long working life**
- **Long-term stability and reliability**
- **Connecting cable is strong, screened and flexible**

Specifications

Linear Potentiometer			
Ranges*	25mm	50mm	100mm
Accuracy	±0.25% full scale		
Repeatability	< ± 0.01 mm		
Temperature range	-30 to +150°C		
Weight less cable	26g	29g	37g
Dimensions*	95L x Ø9.5mm	120L x Ø9.5mm	178L x Ø9.5mm
Ingress protection	IP67		
Anchors			
Type	Groutable	Expanding Shell	
Materials	Zinc plated steel		
Diameter	12mm	16mm	

Qualifiers apply to the product specifications marked with a ***** symbol. Please refer to the product datasheet for the complete specifications and full product information.

Dataloggers & Software

D1-VW-LOG2

VWLOG2

Description

The VWlog2 is a simple, rugged, low-power, Stand alone, 2 channel Datalogger which reads most commercially available geotechnical and structural Vibrating Wire (VW) sensors and optional thermistor temperature sensors.

Features

- **Reads two Vibrating Wire sensors and combined thermistor temperature sensors**
- **4MB internal memory; reads up to 50,000 readings per channel, equating to 5 years of data sampling at hourly intervals**
- **IP66 rated, rugged, die-cast aluminium enclosure**
- **True USB interface; data downloaded via drag-and-drop**

Benefits

- **Optional 15V excitation ensures quality readings from sensors with long cables**
- **Ideal for long-term monitoring in harsh environments**
- **Fast setup and download time**
- **All electronics sealed to protect from static and water damage**
- **Versatile and economical**
- **Standard D-Cell powered**

Specifications

Vibrating Wire Inputs	
Sweeping frequency range	1700 - 6000 Hz
Accuracy	±0.02 % of full scale
Resolution	0.1 Hz
Output (excitation) voltage	5V and15V square wave (user selectable)
Power	
Supply	3 V DC using two D Cell alkaline batteries

D1-VW-LOG8

VWLOG8 GPRS

Description

VWlog8 GPRS is an eight channel datalogger which reads most commercially available geotechnical and structural Vibrating Wire (VW) sensors and optional thermistor temperature sensors, communicating via GPRS.

Features

- **Wireless data retrieval via the mobile internet network to users own FTP site**
- **Data can be downloaded directly from SD card**
- **Reads with the user selected sweep frequency range (450 - 6000Hz)**
- **Fully configurable data logging schedule**

Benefits

- **Readings are accurate and repeatable**
- **Optional 15V excitation ensures quality readings from sensors with long cables**
- **Internet enabled; data uploaded directly to users own FTP site**
- **Quick and easy to set up in the field**
- **Various power supply options**

Specifications

Vibrating Wire Inputs	
Sweeping frequency range	450 - 6000 Hz
Accuracy	±0.2 Hz
Resolution	0.1 Hz
Output (excitation) voltage	5V and15V square wave (user selectable)
Power	
Input voltage	11 to 20V DC
GSM/GPRS	
Frequency band	Quad band 850, 900, 1800, 1900

D1 Dataloggers

Description

The Datalogger is a bespoke, site specific logger with various additional module and communication options combined with a power supply, contained within a steel or reinforced GRP IP65 enclosure.

Features

- **Configured to customer requirements according to sensor, power supply and communication requirements**
- **Can be configured to read almost any geotechnical or structural monitoring sensor**
- **Data kept in simple ASCII file for use with web based interfaces such as 'ARGUS', or a spreadsheet**

Benefits

- **Proven track record on major projects**
- **Rugged construction**
- **Low power consumption; ideal for remote applications**
- **Various communication options available (ADSL, short haul modem, GPRS modem)**

Specifications

Datalogger - 100Hz scan rate
Analogue Inputs
Multiple differential (DF) and single-ended (SE) individually configured Channels expansion provided by AM16/32 and AM25T multiplexers
Analogue Outputs
Expandable with vast range of accessories to meet project needs
Voltage outputs programmable between ±2.5 V with 0.67 mV resolution
4Mb, SRAM for data and program storage and CPU usage

Please refer to Datasheet D1 for full specifications

D4 'ARGUS' Data Monitoring Software

Description

'ARGUS' is an easy-to-use software suite with a graphical user interface (GUI) that allows quick and easy interpretation of large amounts of instrumentation data from a variety of sources.

Features

- **Handles all data processing requirements**
- **Fully configurable, to suit specific project requirements**
- **Run from a server**
- **Multiple language support**
- **Accessible from anywhere that has an internet connection**

Benefits

- **No software installation required**
- **Provides a reliable and cost-efficient method for processing and monitoring ASCII files with numerical data**
- **Imports from almost any data acquisition system**
- **No limit to the number of sensors that can be processed**

Specifications

Password protected access with three main levels of privileges
Multiple projects with company logos and start-up logos
Multiple users per project available; no licences to pay for additional users
Unlimited amount of plots (pre-defined) per project
Multiple views of the project
Automated and manual import of ASCII files
Watchdog function to generate an email and/or text message alarm
Complex formula builds with references to any sensor in the project

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

D8 Modem Logger

Description

The Modem Logger is a highly advanced, rugged, low-power, single channel datalogger, with one channel reading an external 0-10V , pulse or 4-20mA sensor.

Features

- **On-board GSM/GPRS modem**
- **Data delivered in engineering units**
- **Intelligent alarming with 6 user defined thresholds and alarm notification via SMS and FTP**
- **Low power; requires one D-Cell battery**
- **Micro SD card**

Benefits

- **Data delivered direct to 'ARGUS' Software via FTP**
- **No post-processing of data required**
- **Swift notification of changes in site conditions, alerting multiple users**
- **Reduces the likelihood of false alarms**
- **Atmospheric pressure compensation**
- **Internal logging of millions of data points**
- **Pulse type rain gauge channel**

Specifications

Sensor Input		
Sensor type	0-10V/Pulse	4-20mA
Power		
Power supply	1 Lithium D-Cell battery	
Current consumption	Typically 5mA	Maximum 25mA
Sensor transmission	Typically 200mA during GSM/GPRS use	
Battery life[1]	up to 2 years	

Please refer to Datasheet D1 for full specifications

[1] Battery life dependent on frequency of readings and data transmission rates

RO TB-JB-TJ

Terminal and Junction Boxes

Description

Terminal Boxes are used for projects that require the integration of cables from multiple instruments into one convenient location. A Terminal Box consists of a fibreglass or die cast aluminium enclosure with a variety of size and switching options.

Features

- **Terminates Vibrating Wire, thermistors and two or four-wire type instruments**
- **Standard Junction/Terminal Boxes (switching and non-switching) cater for 12, 24 or 48 instruments**
- **Small Terminal Box (non-switching) connects up to 5 separate instruments**

Benefits

- **Ideal solution for terminating multiple cables**
- **Allows joining of several individual cables into a single multicore cable**
- **Provides convenient access for readings**
- **Provides protection from water ingress and corrosion resistance**

Specifications

Small Terminal Box - non switching

For terminating Vibrating Wire, thermistors and 2 wire type instruments; to cater for 1 to 6 instruments

Switched Terminal Unit

For Vibrating Wire, thermistors and other 2 wire type instruments; composed from epoxy fibreglass with lockable hinged door, sealed with a neoprene gasket. Equipped with a rotary switch to select the correct transducer. Standard units cater for 12, 24 or 48 instruments

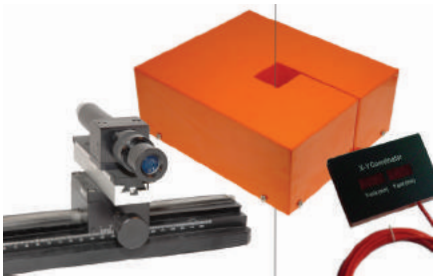
Junction Box

For projects that require cables from multiple instruments to be integrated into a multi core cable; Standard units cater for 12, 24 or 48 instruments

Other options available, surge protection available on request

Inclination

C1 Hanging and Inverted Pendulum System



Description

Hanging and Inverted Pendulums are used for accurate and long-term monitoring of horizontal movements in large structures such as dams, bridges, nuclear power stations, towers and tall buildings.

Features

- **Greater measuring accuracy than precise geodetic surveying**
- **Manual or automatic readouts available**
- **Simple to use**
- **Long-term reliability**

Benefits

- **Movements can be observed at frequent intervals without repeated and costly surveys**
- **Ideal for long-term use**
- **Can read X, Y and Z movement**

Specifications

Portable Pendulum Readout	
Range	X = ±75mm, Y = ±75mm
Accuracy	±0.1mm
Resolution	0.1mm
Repeatability*	±0.1mm
Eyepiece	0º | 45º | 90º
Weight	4kg
Automatic Pendulum Readout (CCD)	
Ranges	X= ± 25mm, Y = ±25mm
	X = ±25mm, Y = ±50mm
	X = ±25mm , Y = ±50mm, Z = ±25mm
Accuracy	+/- 0.1mm
Resolution	0.01mm
Repeatability*	±0.01mm
Temperature range	-15ºC to +60ºC
Output	RS485 / 4-20mA

C9 Easy Connect Inclinometer Casing

Description

EC (Easy Connect) Casing is an ABS inclinometer casing that pushes together, requiring no rivets, tape or glue.
The casing is manufactured using advanced extrusion techniques which results in a highly accurate groove profile, allowing accurate orientation of inclinometer probes and In-Place Inclinometers (IPIs).

Features

- **Push fit, faster and easier to install than standard inclinometer casing**
- **Reliable joints; a machined slot ensures consistent keyway alignment**
- **Watertight; an O-ring on each seal prevents ingress of water or grout**
- **Deep, tight groove profile ensures accurate data**

Benefits

- **Requires no rivets, tape or glue**
- **Saving in installation time; significantly reduces labour cost and drill rig standby charges**
- **Can be used in conjunction with magnetic extensometers to form a combined inclinometer/extensometer**

Specifications

Material	ABS (Acrylonitrile Butadiene Styrene)
Groove spiral	< 0.5° / 3m
Collapse rating	1960kPa
Bend rating	252N
Maximum temperature	80°C
Tensile strength	585kgF
Torque	25Nm
Casing length	3m
Outside diameter	70mm
Inside diameter	59mm

C9-4 Quick Drive Inclinometer Casing

Description

QD (Quick Drive) Casing has all of the advantages of EC (Easy Connect) Casing, combined with a mild steel nose cone for driving into pre-formed window sampling holes and shallow installations in soft soils. The casing can be extended or joined at any point along its length using standard or telescoping couplings.

Features

- **Fitted with mild steel nose cone**
- **Push fit, faster and easier to install than standard inclinometer casing**
- **Reliable joints; a machined slot ensures consistent keyway alignment**
- **Watertight; an O-ring on each seal prevents ingress of water or grout**

Benefits

- **Extremely simple, driven installation technique**
- **Requires no rivets, tape or glue**
- **Saving in installation time; significantly reduces labour and drill rig standby charges**
- **End cone ensures that the casing fixes well, thereby providing an accurate datum**

Specifications

Material	ABS (Acrylonitrile Butadiene Styrene)
Groove spiral	< 0.5° / 3m
Collapse rating	1960kPA
Bend rating	252N
Maximum temperature	80°C
Tensile strength	585kgF
Torque	25Nm
Cone diameter	76mm
Outside diameter	70mm
Inside diameter	59mm

C18 Standard Inclinometer Casing

Description

Standard Inclinometer Casing is manufactured using advanced extrusion techniques which results in a deep and highly accurate groove profile, ensuring accurate and repeatable data. The casing is joined together using standard or telescoping couplings with rivets, glue and tape to seal against water or grout ingress.

Features

- **Deep, tight groove profile ensures accurate data**
- **Available in 70mm and 85mm outer diameters**
- **Manufactured from virgin ABS**

Benefits

- **Cost effective**
- **Reduced wastage; casing can be cut and joined at any point along its length**
- **Can be used in conjunction with magnetic extensometers to form a combined inclinometer/extensometer**

Specifications

	70mm OD	85mm OD
Material	ABS (Acrylonitrile Butadiene Styrene)	
Groove spiral	< 0.3° / 3m	
Collapse rating	1960kPa	1770kPa
Bend rating	3.07kN	2.65kN
Maximum temperature	80°C	
Tensile strength	705kgF	700kgF
Torque	520Nm	481Nm
Length	3m	
Outside diameter	70mm	85mm
Inside diameter	62mm	77mm

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

C12 In-Place Inclinometer (IPI)

Description

The In-Place Inclinometer (IPI) is used to measure lateral displacement within a borehole. Most commonly, the IPI is used in a system where multiple IPIs are installed at varying depths. In this manner the profile of the displacement can be monitored. Horizontal versions measure vertical displacements such as bases of large storage tanks.

Features

- **Sensor strings give a readily automated profile of vertical or horizontal displacements**
- **Accurate and precise measurements using MEMS sensors**
- **Available in Uniaxial and Biaxial versions**
- **Inbuilt temperature compensation**

Benefits

- **Easy to automate using data acquisition systems and 'ARGUS' software**
- **Removes the need for manual monitoring**
- **Recoverable and reusable**
- **Suitable for safety critical applications**

Specifications

Calibrated range	±3°	±5°	±10°	±15°
Sensor accuracy	±0.05% full scale			
Resolution*	0.008% full scale			
Repeatability	±0.01% full scale			
Operating temperature	-20 to +80°C			
Minimum casing internal diameter	56mm			
Maximum casing internal diameter	72mm			
Weight (without cable)	540g			
Dimensions	192mm x 32mmØ			
Input voltage	10 -16V DC			
Signal output at full range	±2.5V DC differential			
Current consumption	9mA (uniaxial) / 17mA (biaxial)			
Ingress protection	IP68 to 200mH_2O (2000kPa)			
Housing material	Stainless Steel			

C12-SIPI

Smart In-Place Inclinometer (IPI)

Description

The single cable Smart IPI system is used to remotely monitor lateral displacement within a vertical borehole. The Smart IPI system comprises a data acquisition system, a Sensor Interface Module, one top connector, up to 40 Smart IPI nodes and 1 termination node.

Features

- **Single cable system**
- **Onsite allocation of node IDs**
- **Mechanical and electrical connection rated to 20 bar**
- **Easy connect connector between each node**
- **Unique design**

Benefits

- **Fast onsite installation with minimal cable management**
- **Plug and play Sensor Interface Module**
- **Up to 41 Smart IPIs per borehole**
- **Ability to add to the network as and when required**

Specifications

Calibrated range	±10°
Sensor accuracy	±0.01% full scale
Resolution*	0.001% full scale
Repeatability	±0.006% full scale
Operating temperature	-10 to +50°C
Input voltage	11-16 V DC
Housing material	Stainless Steel
Ingress protection	IP68 to 200mH_2O (2000kPa)
Minimum casing internal diameter	56mm
Maximum casing internal diameter	72mm

C13 In-Profile Inclinometer Data Presentation Software

Description

'In-Profile' software has been developed for the purpose of importing and analysing inclinometer data. 'In-Profile' has been designed to be user friendly and simple to use.

Features

- **Easy exportation of trend graphs**
- **Simple icons and menus**
- **Strata can be easily applied with fill patterns and colours to define**
- **Report function**
- **Handles data from all popular types of inclinometers**

Benefits

- **Downloaded data can be viewed in various formats**
- **Exported graphs can be viewed without the use of 'In-Profile' software**
- **Easy handling and presentation of data**

Specifications

Data entry	Direct retrieval | File import | Manual entry	
Graph export formats	HTML	Print to PDF
Units supported	Metric	Imperial
Gauge length	No length restrictions	
Inclinometer systems	Most commercially available systems supported	
Interpretation views	Cumulative Displacement | Plan View | Incremental Displacement | Absolute Position	

C17 Vertical Digital Inclinometer System

Description

The Vertical Digital Inclinometer System is used to take highly accurate readings of lateral deflections. The system comprises a biaxial probe, cable reel and a rugged Field PC supplied with 'In-Port' data logging software.

Features

- **No connectors between probe, cable reel and Field PC**
- **Probe is manufactured from 316 Stainless Steel**
- **Bluetooth connection between cable reel and Field PC**
- **Accurate and precise measurements using MEMS sensors**

Benefits

- **Moulded cable connection eliminates water ingress and connection problems**
- **Digital signal allows interference-free data transmission**
- **Advanced electronics ensure long, trouble free use in a site environment**
- **Can take a day's worth of readings on a single battery charge**

Specifications

Calibrated ranges	±30° (±250mm)	[±12"]
	±60° (±433mm)	[±20.78"]
	±90° (±500mm)	[±24"]
Sensor accuracy	±0.02% full scale (±0.1mm)	
	±0.02% full scale (±0.17mm)	
	±0.02% full scale (±0.2mm)	
Resolution	0.01mm	[0.001"]
Repeatability	±0.008% full scale	
Operating temperature	-10 to +50°C	14 to +122°F
Probe gauge length	500mm (metric)	24" [imperial]
Probe diameter	28.5mm	1.12"
System accuracy* (over 25m)	±30° = ±2mm	
	±60° = ±3mm	
	±90° = ±4mm	
Minimum casing internal diameter	48mm	1.88"
Maximum casing internal diameter	83mm	3.26"

C17-PRO

Vertical Digital Inclinometer Pro System

Description

The Vertical Digital Inclinometer PRO System is used to measure lateral deflections within a borehole. The system comprises a biaxial probe, cable reel and ultra-rugged Field Tablet supplied with 'In-Port PRO' data capture software.

Features

- **Large 7" display robust Field Tablet**
- **Borehole recognition system**
- **Auto run feature for rapid borehole runs**
- **Review datasets graphically upon completion of borehole run**
- **Small diameter probe for traversing tighter bend radius in inclinometer casing**

Benefits

- **Moulded cable connection eliminates water ingress and connection problems**
- **Digital signal allows interference-free data transmission**
- **Easy data transfer via Bluetooth, direct connection or internet using Wi-Fi or GSM network**
- **Long battery life**

Specifications

Calibrated range	±30°(±250mm [±12"]
Sensor accuracy	±0.02% full scale (±0.1mm)
Resolution	0.005mm [0.0002"]
Repeatability	±0.005% full scale
Operating temperature	-20 to +70°C
Probe gauge length	500mm (metric system) or 24" [imperial system]
Probe diameter	25.4mm
System accuracy* (over 25m)	±2mm
Minimum casing internal diameter	38mm
Maximum casing internal diameter	83mm

C19-1 Horizontal Digital Inclinometer System

Description

The Horizontal Digital Inclinometer System is used to take highly accurate readings of horizontal profiles. The system comprises a biaxial probe, cable reel and a rugged Field PC supplied with 'In-Port' data logging software.

Features

- **Field PC with custom 'In-Port' software**
- **Metal marker/cable gate system**
- **Kevlar reinforced cable**
- **Bluetooth connection between cable reel and Field PC**
- **Accurate and precise measurements using MEMS sensors**

Benefits

- **Elimination of cable resistance and noise issues**
- **Repeatable depth control using metal markers and cable gate system**
- **High degree of repeatability**
- **No water ingress or connection failures**
- **Light and easily portable**

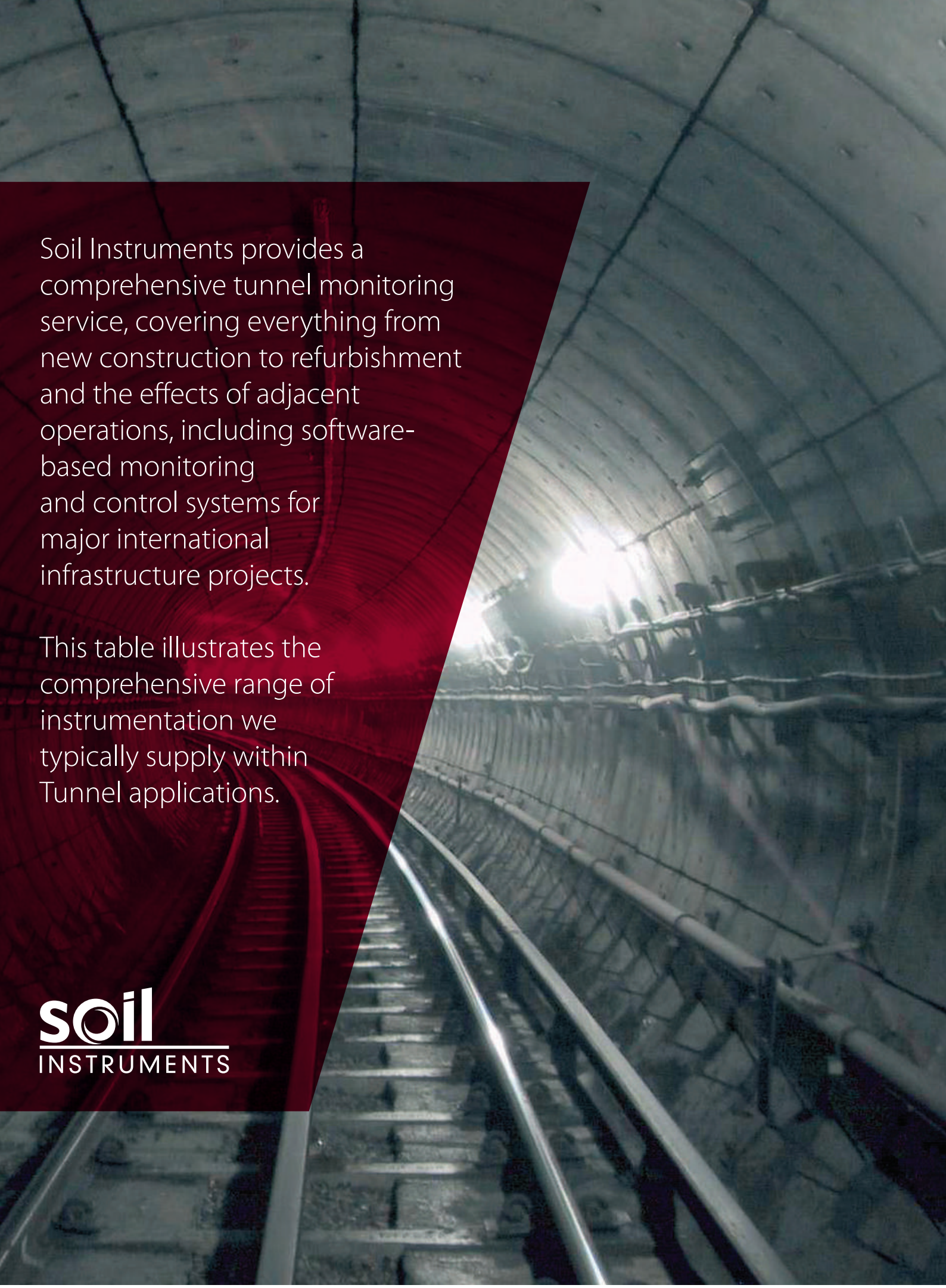
Specifications

Calibrated range	±86.8mm/500mm (±10° arc)
Sensor accuracy	±0.028% FS (±0.05mm)
Resolution	0.01mm
Repeatability	±0.006% full scale
Operating temperature	-10 to +50°C
Probe gauge length	500mm (metric system) or 24" [imperial system]
Probe diameter	44mm
System accuracy* (over 25m)	±2mm
Minimum casing internal diameter	57mm
Maximum casing internal diameter	73mm

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

TUNNEL APPLICATION

Products	Page	Type of Measurement	Where is it used?	
VW Crackmeter, VW Triaxial Jointmeter Mechanical Jointmeter	6	Joint & Crack	Monitoring the opening and closing of fissures in a tunnel wall	
VWLOG2, VWLOG8 GPRS, ARGUS Monitoring Software	8	Datalogger	Used to read, record and display the data from sensors with the option for remote cellular transmission	
Digital Inclinometer, Inclinometer Casing Smart In-place Inclinometer"	14	Inclination	Used to monitor horizontal subsurface failure in a slope and possible slip plane movement	
Tape Extensometer, Continuous Rod Extensometer	20	Extension	Manual monitoring of convergence of the tunnel cross section	
Electrolevel Tiltsensor	25	Tilt	Monitoring the differential displacement profile of a tunnel wall	
VW Concrete Stress Cell, VW Pressure Cell	35	Load & Pressure	Used to measure load or pressure in a tunnel wall	
VW Piezometer	39	Water	Used to measure pore pressure build up due to consolidation of soils	
VW Strain Gauges	44	Strain	Measuring strain in steel members or mass concrete	
Bassett Convergence System	25	Convergence	Automated monitoring of convergence of the tunnel cross section	



Soil Instruments provides a comprehensive tunnel monitoring service, covering everything from new construction to refurbishment and the effects of adjacent operations, including software-based monitoring and control systems for major international infrastructure projects.

This table illustrates the comprehensive range of instrumentation we typically supply within Tunnel applications.

soil
INSTRUMENTS

Extension

E2 Magnetic Probe Extensometer

Description

The Magnetic Extensometer system comprises a probe, a graduated tape on a reel and an access pipe along which magnetic targets are positioned.

As the probe moves along the access pipe, it detects the magnets by way of a reed switch circuit closing.

Features

- **Versatile system with a variety of magnetic targets to suit different applications**
- **Measures settlement and heave**
- **Oversized targets are available to use with inclinometer casing**
- **Magnetic Extensometer probe is available with various tape lengths**

Benefits

- **Reliable and accurate measuring system that is easy to read**
- **Any number of targets can be monitored in a single borehole**
- **One probe reads at many locations**

Specifications

Probe / Reel	
Ranges*	30m | 50m | 100m | 150m | 200m
Resolution	1mm
Repeatability*	±2mm
Operating temperature	-30 to +80°C
Graduations	mm/cm/m
Indicators	Audio & visual
Probe material	Stainless Steel
Probe diameter	16mm
Tape type	Contoured / shaped copper conductors
Tape material	Steel / polyethylene coated
Reel material	Steel frame / polypropylene hub
Battery life	12 hours continuous use
Weight	1.7kg | 2.0kg | 3.0kg | 3.8kg | 4.6kg

E3 Digital Tape Extensometer

Description

The Digital Tape Extensometer is a portable device used for measuring displacement between pairs of eyebolts.

The unit comprises a Stainless Steel measuring tape with equally spaced precision punched holes. The tape winds onto a reel, which incorporates a tape tensioning device and a digital LCD readout.

Features

- **Measuring range of up to 30m**
- **Digital LCD readout giving precise measurement**
- **Stainless Steel measuring tape**
- **Optical tension indicator**

Benefits

- **Compact, portable and lightweight**
- **Accurate and robust**
- **Simple, reliable and easy to read**
- **Repeatable measurements using the optical tape tension indicator**
- **Can be operated by one person**
- **Can read multiple arrays using a single instrument**

Specifications

Digital Tape Extensometer			
Range	20m	30m	50m
Accuracy*	±0.01mm		
Resolution	0.01mm		
Repeatability*	0.1mm		
Operating temperature	-10 to +60°C		
Tape tension	11kg		
Tension indicator	optical		
Weight excluding tape	1kg		
Tapes			
Lengths	20m	30m	50m
Weight	410g	610g	1kg

E7 Vibrating Wire Soil Extensometer

Description

The Vibrating Wire Soil Extensometer measures lateral deformation of soil and rock, particularly in embankment dams and quarry or mining excavations.

The extensometer consists of a Vibrating Wire displacement transducer contained within a heavy duty sealed housing.

Features

- **Accurate, robust and very good long-term stability**
- **Heavy duty steel housing suitable for burial in rock fill**
- **Over-voltage surge arrestor fitted to protect against electrical damage**
- **Waterproof and sealed to 1000kPa**

Benefits

- **Connecting cable is strong, flexible, armoured and can be used in lengths in excess of 1000m**
- **Very heavy duty**
- **Accuracy unaffected by cable length**

Specifications

Vibrating Wire Soil Extensometer Transducer	
Range	300mm
Accuracy	±0.2%
Resolution*	0.025%
Operating frequency	1300Hz to 2700Hz
Operating temperature	–20 to +80°C
Thermistor type	NTC 3k Ω
Thermistor accuracy	±0.5°C
Thermistor resolution*	0.1°C
Ingress protection	IP68 to 1000kPa
Extensometer Body	
Body diameter	50mm

E10 Rod Extensometer

Description

The Rod Extensometer system accurately measures settlement and/or heave between single or multiple anchor points in a borehole and at its reference head.

The system employs up to eight rods, anchored along the axis of a borehole, terminating in the reference head at the borehole entrance.

Features

- **Supplied in component form for onsite assembly**
- **Choice of Stainless Steel or fibreglass rods**
- **Various anchor types available according to soil conditions and installation method**
- **Manual or remote monitoring**

Benefits

- **Installation in drillholes or boreholes at any orientation**
- **Easily adaptable rod lengths to suit variable site conditions**
- **Depth gauges can be used for manual reading**

Specifications

Vibrating Wire Transducer			
Ranges	30mm	50mm	100mm
Accuracy	±0.2% full scale		
Resolution*	0.025% full scale		
Operating temperature	-20 to +80°C		
Thermistor type	NTC 3k Ω		
Thermistor accuracy	±0.5°C		
Thermistor resolution*	0.1°C		
Weight less cable	190g	212g	254g
Dimensions*	290 x 19mmØ	340mm x 19mmØ	450mm x 19mmØ
Excitation method	Pluck or Sweep		
Material	316 grade Stainless Steel		
Ingress protection	IP68 to 1700kPa		

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

E13 Continuous Rod Extensometer

Description

The Continuous Rod Extensometer system accurately measures settlement and/or heave at single or multiple anchor points in a borehole and at its reference head.

The Continuous Rod Extensometer is pre-assembled to specified lengths.

Features

- **Rods and anchors are delivered pre-assembled to customer specified length**
- **Various anchor types available according to soil conditions and installation method**
- **Manual or remote monitoring**
- **Up to 8 measuring points per borehole**

Benefits

- **Installation in drillholes or boreholes at any orientation**
- **Quicker installation than conventional rod extensometer systems**
- **Fibreglass less sensitive to temperature changes than steel**

Specifications

Type	Vibrating Wire Transducer	Linear Potentiometer
Ranges	30mm, 50mm, 100mm	
Accuracy	±0.2% full scale	0.5% full scale
Resolution*	0.025% fs	virtually infinite
Temperature range	-20 to +80°C	
Excitation method	Pluck or Sweep	
Type	**Digital Depth Gauge**	**Dial Depth Gauge**
Ranges	±60mm	50mm
Accuracy	±0.02mm	±0.05% FSD
Resolution*	0.01mm	0.01mm

E14 INCREX Incremental Extensometer

Description

The INCREX system is used in conjunction with inclinometer casing to acquire highly accurate measurements of ground deformation within the axis of the borehole.

The system consists of a number of brass rings that are situated at one metre intervals along the inclinometer casing.

Features

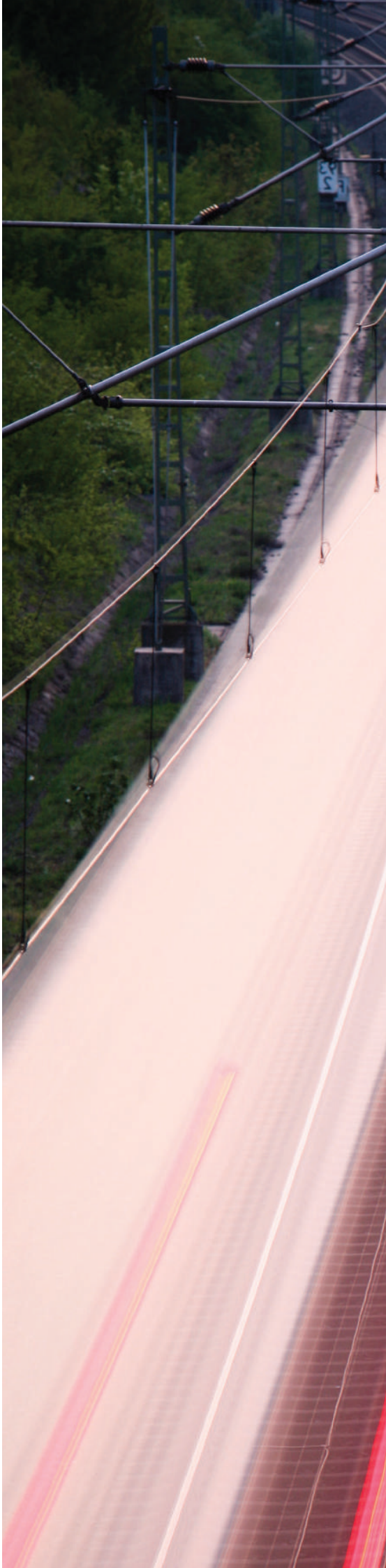
- **Robust waterproof construction to 15bar**
- **Light weight and portable**
- **Electromagnetic induction phenomenon**
- **Operates in inclinometer casing**
- **Can be used in vertical, horizontal and inclined boreholes**

Benefits

- **High accuracy and resolution measurements**
- **Multiple measuring points**
- **Lateral and vertical deformation can be measured in the same borehole**
- **Three-dimensional deformation profile plots possible**

Specifications

Increx probe	
System accuracy	±0.02mm
Sensor resolution	0.001mm
Sensor accuracy	±0.01mm
Operating temperature	-5 to 105°C
Outer diameter	46mm
Length	1550mm
Weight	5.0 kg
Measuring base	1000mm
Measurement range	±20mm/m
Water pressure	15 bar



Cables

CA-1.1 Armoured Cable

Description

Cables are most commonly used to connect instruments to their termination point. These range from terminal boxes, junction boxes, data acquisition systems and manual readouts to a variety of other sources.

All of our cables are of a very high quality, manufactured to stringent British Standards.

Features

- **Armoured cable resists high tensile loading**
- **PVC sheathing for waterproofing**
- **Cables can be run over 1000m**
- **Jointing can be done on site with epoxy jointing kits**

Benefits

- **Ideal connection on sites where cables may be exposed to weather or at risk of damage**
- **Reliable, durable and flexible**

Specifications

Number of cores	2	4
Materials	Plain annealed 1.5mm² copper conductors, XLPE insulated, PVC extruded bedding, steel wire armoured and PVC sheathed	
Maximum operating temperature	+ 90°C	
Rating	Up to 600V	
Conductor resistance	92 Ω DC/Km	
Conductors	1.5mm²	
Weight	280g/m	336g/m

CA2.2 Multicore Cable

Description

The amount of cores available varies greatly and the amount required is determined by the number of sensors to be connected to the cable, soil instruments supplies cable with up to 50 cores.

All of our cables are of a very high quality.

Features

- **Multicore cable resists high tensile loading**
- **Sheathing for waterproofing**
- **Shielded pairs protect against electrical noise**
- **Multiple cable options available from 2 to 50 cores**
- **Cables can be run over 1000m**
- **Jointing can be done on site with epoxy jointing kits**

Benefits

- **Ideal connection on sites where cables may be exposed to weather or at risk of damage**
- **Reliable, durable and flexible**

Specifications

Number of cores*	6	12
Materials	Plain annealed 1.5mm2 copper conductors, polyethylene insulated, in twisted pairs each screened with aluminium backed polyester tape, copper drain wire, overall screened and sheathed with polyethylene	
Maximum operating temperature	+70°C	
Rating	440V	
Conductor resistance	39 Ω DC/Km	
Conductors	0.22mm²	
Weight	55g/m	83g/m

The specifications above are for Multicore Cable - 7/0.20. Multicore Cable - 16/0.20 is available from 4 to 50 cores.

CA3.1 Instrument Cable

Description

There are different kinds of cables that are required according to site requirements.

Instrument packages supplied by soil instruments usually specify which cable is recommended.

All of our cables are of a very high quality.

Features

- **Sheathing for waterproofing**
- **Cables can be run over 1000m**
- **Jointing can be done on site with epoxy jointing kits**

Benefits

- **Ideal connection on sites where cables may be exposed to weather or at risk of damage**
- **Reliable, durable and flexible**

Specifications

Number of cores	4	6
Materials	Tinned copper conductors, polyethylene insulated, screened with aluminium backed polyester tape, tinned copper drain wire and sheathed with polyethylene	
Operating temperature	-30 to +80°C	
Rating	30V with polyethylene sheath	
Conductor resistance	39 Ω DC/Km	
Conductors	0.6mm²	
Weight	29 g/m	36g/m

Low smoke and vented cables are also available. Please contact soil instruments for more details on cables.

Qualifiers apply to the product specifications marked with a ***** symbol. Please refer to the product datasheet for the complete specifications and full product information.

Tilt

TLT1 Electrolevel Beam Sensor

Description

The Electrolevel Beam Sensor measures rotation of structures in the vertical plane.

When multiple beams are placed end to end, a differential displacement profile of the structure from anchor point to anchor point can be derived.

Features

- **Multiple beams in a chain give a complete displacement profile**
- **Simple, well proven device, ideal for measuring tilt in structures**
- **Accurate and precise**
- **Measures tilt along the whole length of a beam**
- **Measures vertical rotation**

Benefits

- **Easy to automate using data acquisition systems and 'ARGUS' software**
- **Removes the need for manual monitoring**
- **Recoverable and reusable**
- **Suitable for safety critical applications**
- **Low power consumption**

Specifications

Sensor Type	Horizontal	Vertical
Range	±45 Arc Minutes (±13mm/m)	
Accuracy*	±0.1mm/m	
Resolution*	0.02% full scale	
Repeatability	±0.05% full scale	
Operating temperature	-20 to +50 °C	
Excitation voltage	2.5V AC	
Current Consumption	< 1 µA	
Output Signal	Ratiometric AC	
Zero adjustment range	5°	±5° fine ±25° course
Ingress protection	IP66	
Dimensions	180 x 31 x 25	135 x 127 x 60

TLT2 Electrolevel Tiltsensor

Description

The Electrolevel Tiltsensor measures rotation of structures in the vertical plane. The sensor is housed in a sealed enclosure incorporating an adjustable mounting plate.

The measurement of vertical rotation perpendicular to the structure is obtained by using an optional 90° angle bracket.

Features

- **Simple, well proven device, ideal for measuring tilt in structures**
- **Accurate and precise**
- **Measures vertical rotation**

Benefits

- **Easy to automate using data acquisition systems and 'ARGUS' software**
- **Removes the need for manual monitoring**
- **Compact**
- **Recoverable and reusable**
- **Suitable for safety critical applications**
- **Low power consumption**

Specifications

Sensor Type	Electrolevel
Range	±45 Arc Minutes (±13mm/m)
Accuracy*	±0.1mm/m
Resolution*	0.02% full scale
Repeatability	±0.05% full scale
Operating temperature	-20 to +50°C
Excitation voltage	2.5v AC
Current consumption	< 1µA
Output signal	Ratiometric AC
Zero adjustment range	±5° fine, ±25° coarse
Ingress protection	IP66
Dimensions	135L x 127H x 60W

TLT3 Bassett Convergence System

Description

The Bassett Convergence System is designed for automated monitoring of tunnel deformation.

The system is robust, simple and proven. It is most commonly used in transportation tunnels, but can be adapted to monitor other structures.

Features

- **Very low profile system**
- **Low cost, simple, rugged MEMS sensor technology**
- **Gives a complete Δx and Δz profile**
- **Automated via data acquisition and BCS software**
- **Very well established track record on major projects across the world**

Benefits

- **Can be fitted in areas of minimum clearance such as live railway tunnels**
- **Needs very little power to read**
- **Designed specifically for monitoring tunnels**
- **Suited for harsh environments**
- **Does not interfere with tunnel traffic**
- **Unaffected by vibration, temperature or electromagnetic interference**

Specifications

Type	Long Arm	Short Arm
Calibrated range	±34.9mm (±2°)	±173.65mm (±10°)
Sensor accuracy	±0.05% full scale	
Resolution*	0.008% full scale	
Operating temperature	-20 to +80°C	
Weight (without cable)	475g	
Dimensions	100mm x Ø55mm	
Signal output full range	±2.5V DC	
Current consumption	9mA	
Ingress protection	IP67	
Housing material	Stainless Steel	
Input voltage	10 -16V DC	

TLT4 Digital Portable Tiltmeter

Description

The Digital Portable Tiltmeter is used to measure the angular difference between the sensors axis when held or placed on the X and Y planes of the tiltplate.

Housed within the unit is a MEMS accelerometer that measures the angular position of the tiltplate.

Features

- **No connectors between tiltmeter and Field PC**
- **Accurate and precise measurements using MEMS sensor**
- **Lightweight and easily portable**
- **Field PC allows easy interface with most office systems and applications**
- **Enhanced 'Tilt-Port' software included with Field PC for easy data capture**

Benefits

- **Eliminates water ingress and connection problems**
- **Digital signal allows interference-free data transmission**
- **Advanced electronics ensure long, trouble free use in a site environment**
- **Can take a days' worth of readings on a single battery charge**
- **Cost effective**

Specifications

Sensor	
Range	±10°
Accuracy	±0.004°
Resolution	0.001°
Repeatability	±0.0012°
Operating temperature	-10 to +50°C
Weight	2.0kg
Dimensions	160mm x 135mm x 150mm
Battery life	>12 hours continuous use
Tiltplate	
Material	Aluminium Alloy PC8A
Dimensions	Ø142mm x 24mm
Weight	240g

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

TLT5 Mems Beam Sensor

Description

The MEMS Beam Sensor measures rotation of structures in the vertical plane. When multiple beams are placed end to end, a di erential displacement pro le of the structure from anchor point to anchor point can be derived.

Features

- **Inter-connecting Smart Sensors**
- **Accurate and precise measurements using MEMS sensors**
- **Multiple beams installed in a chain give a complete displacement profile**
- **Measures tilt along the whole length of the beam Measures vertical rotation**
- **Large measuring range**

Benefits

- **Fast onsite installation with minimal cable management; reduces cable and Datalogger costs**
- **Easy to automate using data acquisition system and 'ARGUS' software**
- **Removes the need for manual monitoring**
- **Recoverable and reusable**
- **Suitable for safety critical applications**
- **Fast onsite installation; no zero level adjustment required**

Specifications

Sensor	
Range	±10°
Accuracy	±0.05% full scale
Resolution	0.001% full scale
Repeatability	±0.006% full scale
Operating temperature	-10 to +50°C
Input voltage	11 - 16 VDC
Current consumption	23mA
Housing material	Aluminium
Ingress protection	IP68
Dimensions	L 1m/2m/3m x W 38mm x H38mm
Weight	1m 1.82kg 2m 2.42kg 3m 3.02kg

TLT6 Mems Tiltsensor

Description

The MEMS Tiltsensor is designed to monitor vertical rotations of structures.

Mounted within an Aluminium housing is a biaxial MEMS sensor that delivers a large measuring range with high sensitivity and relative immunity from the e ects of long cable lengths.

Features

- **Accurate and precise measurements using MEMS sensors**
- **Available in biaxial versions**
- **Inbuilt temperature compensation**

Benefits

- **Easy to automate using data acquisition systems and 'ARGUS' software**
- **Removes the need for manual monitoring**
- **Compact**
- **Recoverable and reusable**
- **Suitable for safety critical applications**
- **Low power consumption**

Specifications

Sensor Type	MEMS Sensor
Calibrated ranges	±3° ±5° ±10° ±15°
Sensor accuracy	±0.05% full scale
Resolution*	0.008% full scale
Repeatability	±0.01% full scale
Operating temperature	-20 to +80°C
Input voltage	10 -16V DC
Current consumption	17mA (biaxial)
Output signal at full range	±2.5V DC differential
Housing material	Aluminium
Ingress protection	IP67
Dimensions	L 115mm x W 45mm x H 45mm
Weight (without cable)	370g

TLT6 Mems Tiltsensor Submersible

Description

The MEMS Tiltsensor measures rotation of structures in the vertical plane.

The measurement of vertical rotation perpendicular to the structure is obtained by using an optional 90° angle bracket.

Features

- **Simple, well proven device, ideal for measuring tilt in structures**
- **Accurate and precise using MEMS sensors**
- **Measures vertical rotation**
- **Stainless Steel submersible, waterproof to 2000kPa**

Benefits

- **Easy to automate using data acquisition systems and 'ARGUS' software**
- **Removes the need for manual monitoring**
- **Compact**
- **Recoverable and reusable**
- **Suitable for safety critical applications**
- **Low power consumption**

Specifications

Sensor Type	MEMS Sensor
Calibrated ranges	±3° ±5° ±10° ±15°
Sensor accuracy	±0.05% full scale
Resolution*	0.008% full scale
Repeatability	±0.01% full scale
Operating temperature	-20 to +80°C
Input voltage	10 -16V DC
Current consumption	9mA (uniaxial) 17mA (biaxial)
Output signal at full range	±2.5V DC differential
Housing material	Stainless Steel
Ingress protection	IP68 to 200mH_2O (2000kPa)
Dimensions	192mm x 32mmØ
Weight (without cable)	540g

TLT7 Tilt Logger

Description

The Tilt Logger is a standalone MEMS Tiltsensor with integrated datalogger and GSM/GPRS modem that measures the rotation of structures in the vertical plane.

Readings are stored on a local SD card and are transmitted to any FTP site via the on-board GSM/GPRS modem.

Features

- **Uniaxial MEMS sensor**
- **Data delivered in engineering units**
- **Completely cable free**
- **Intelligent alarming with 6 user defined thresholds and alarm notification via SMS and FTP**
- **Low power; requires one D-Cell Battery**
- **Micro SD card**

Benefits

- **MEMS Sensor provides highly accurate and stable data**
- **Data delivered direct to 'ARGUS' via FTP**
- **Quick and easy to install**
- **Swift notification of changes in site conditions, alerting multiple users**
- **Battery life of up to 2 years**
- **Internal logging of millions of data points**

Specifications

Sensor	
Range	±15°
Accuracy	±0.2° full scale
Resolution	0.005°
Repeatability	±0.01°
Operating temperature	-20 to +80°C
Frequency band	Quad band 850/900/1800/1900/MHz
Battery life	up to 2 years
Material	Glass fibre, reinforced polyester, corrosion free
Dimensions	162mm x 82mm x 60mm
Weight	1kg

Temperature

T2 Resistance Temperature Sensor

Description

The PT100 Resistance Temperature Sensor measures the resistance of a platinum element. The resistance is then converted to temperature.

Features

- **Accurate and robust with good long-term stability**
- **High resolution**
- **Suitable for manual or remote reading, scanning and datalogging**

Benefits

- **Strong, screened and flexible cable**

Specifications

Type	PT 100 resistance
Range	-30 to +100°C
Accuracy	±0.2°C
Resolution*	0.01°C
Housing material	Stainless Steel
Dimensions	80mm x 15.8mmØ
Cable	4 core, screened, 7/0.20
Readings	Manual or remote

T3 Vibrating Wire Temperature Sensor

Description

The Vibrating Wire Temperature Sensor comprises a Stainless Steel body which houses a Vibrating Wire sensing unit/ transducer. As the body expands or contracts due to temperature, this changes the tension in the vibrating wire. The resulting frequency is converted to output temperature.

Features

- **Accurate and robust with good long-term stability**
- **High resolution**
- **Suitable for manual or remote reading, scanning and datalogging**

Benefits

- **Strong, screened and flexible cable can exceed 1000m**

Specifications

Type	Vibrating Wire
Range	-20 to +80°C
Accuracy	±0.5% full scale
Resolution*	0.03°C
Housing material	Stainless Steel
Dimensions	130mm x Ø19mm
Cable	4 core, screened, 7/0.20
Readings	Manual or remote

T4 Thermocouple Temperature Sensor

Description

The Thermocouple Temperature Sensor comprises two dissimilar conductors joined at one end to form a hot junction. This junction produces a voltage so as the junction is heated or cooled, the voltage changes and is converted to return the temperature.

Features

- **Accurate with good long-term stability**
- **Fast response time**
- **Suitable for manual or remote reading and datalogging**
- **Low cost option**

Benefits

- **Lightweight cable for easy handling**
- **100m cable lengths possible**

Specifications

Type	Type 'T' Thermocouple
Range	-10 to +150°C
Accuracy	±1°C
Resolution*	0.1°C
Housing material	PVC bonded sheath
Dimensions	30mm x 5mmØ
Cable	2 core, 13/0.20
Readings	Manual or remote

Qualifiers apply to the product specifications marked with a ***** symbol. Please refer to the product datasheet for the complete specifications and full product information.

Readouts

RO-1-VW-NOTE

VWnote - Vibrating Wire Note

Description

The VWnote is a handheld readout unit and datalogger which reads most commercially available geotechnical Vibrating Wire (VW) sensors and built-in thermistor temperature sensors. Readings are stored in its internal memory for transfer to a PC via a USB pen drive.

Features

- **Portable and rugged**
- **Compatible with nearly all VW sensors**
- **Real-time display of VW sensor readings in engineering units as well as in Hz, Hz2/1000 and period**
- **Reads with user definable sweep range**

Benefits

- **Easy to carry and operate in all site conditions**
- **Readings are accurate, repeatable and free from interference**
- **Taking readings on site is simple, fast and error free**
- **Selectable higher 15V excitation ensures quality readings for sensors with long cables**
- **Logging function**

Specifications

Vibrating Wire Inputs	
Frequency range	450-6000 Hz
Resolution | Accuracy	0.1Hz | 0.01% of full scale
On-board excitation	5V and15V square wave (user selectable)
Temperature Inputs	
Temperature sensor	NTC 3k Ω
Measurement range	-50 to +150°C
Resolution | Accuracy	0.01°C | ±0.2°C
Data Storage | Power	
Memory size	2 GB internal SD memory card
Power Supply	Nominal 6V DC NiMH rechargeable battery

RO-1-VW-READ

VWread - Vibrating Wire Readout

Description

The VWread is a handheld readout that reads most commercially available geotechnical Vibrating Wire (VW) sensors and built-in thermistor temperature sensors.

Features

- **Portable and rugged**
- **Compatible with nearly all VW sensors**
- **Real-time display of VW sensor readings in Hz, Hz2/1000 and period**
- **Reads with user definable sweep range**

Benefits

- **Easy to carry and operate in all site conditions**
- **Readings are accurate, repeatable and free from interference**
- **Taking readings on site is simple, fast and error free**
- **Selectable higher 15V excitation ensures quality readings for sensors with long cables**

Specifications

Vibrating Wire Inputs	
Frequency range	450-6000 Hz
Resolution | Accuracy	0.1Hz | 0.01% of full scale
On-board excitation	5V and15V square wave (user selectable)
Temperature Inputs	
Temperature sensor	NTC 3k Ω
Measurement range	-50 to +150°C
Resolution | Accuracy	0.01°C | ±0.3°C
Power	
Power Supply	Nominal 6V DC NiMH rechargeable battery
Low battery voltage warning	4.1V

C17-3

Rugged Field PC

Description

The Field PC is a rugged handheld computer designed for the most demanding field applications.

The Field PC is drop proof, waterproof and dustproof with a long battery life and can operate in extreme temperatures.

Features

- **Bluetooth wireless communication**
- **Water and dustproof to IP68 rating**
- **Shockproof; multiple drops from 1.5m**
- **Long battery life up to 20 hours**
- **Sunlight readable display**
- **Operation in extreme temperature up to 60°C**

Benefits

- **User definable keys**
- **LED backlit keys**
- **8GB Flash storage**
- **3.75GB Modem**

Specifications

Size	184mm x 91mm x 38mm
Weight	590g
Operating system	Microsoft Windows Mobile 6.5.3
Software	Microsoft Office Mobile
Multiple Languages	English, French, Spanish, German, Portuguese
Processor	1.0GHz ARM Cortex A8 i.MX53 processor
Memory	512 MB low power RAM
Bluetooth	21 +EDR, Class 1.5, range greater than 30m
WiFi	802.1 b/g/n with extended range
3.75G modem	Pentaband Worldwide

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

ROAD APPLICATION

Products	Page	Type of Measurement	Where is it used?	
VW Crackmeter, VW Triaxial Jointmeter Mechanical Jointmeter	6	Joint & Crack	Used to measure and monitor joints or cracks in embankment walls	
VWLOG2, VWLOG8 GPRS, ARGUS Monitoring Software	8	Datalogger	Used to read, record and display the data from sensors with the option for remote cellular transmission	
Digital Inclinometer, Inclinometer Casing Smart In-place Inclinometer"	13	Inclination	Used to monitor horizontal subsurface failure in a slope and possible slip plane movement	
Magnetic Extensometer, Digital Tape Extensometer, Continuous Rod Extensometer	20	Extension	Used to monitor vertical displacement in foundation/embankments due to consolidation of soils	
Electrolevel Tiltsensor	25	Tilt	Monitoring the differential displacement profile of a structure	
VW Readout	30	Readouts	Handheld Readout for VW and Thermistor sensors	
VW Load Cell, Strain Gauge Load Cell	35	Load & Pressure	Used to measure load in retaining anchors	
VW Piezometer, Standpipe Piezometer Water Level Meter	39	Water	Used in the foundations of embankments to measure pore pressure build up due to consolidation of soils	
Settlement Profiler	43	Settlement	Monitoring of horizontal profiles of settlement beneath embankments.	
VW Strain Gauges, Spot Weldable Strain Gauges	44	Strain	Measuring strain in steel members or mass concrete	

We are acknowledged experts in the monitoring of road works, landslides and earthworks. Our geotechnical monitoring teams have worked on numerous major projects.

This table illustrates the comprehensive range of instrumentation we typically supply within Road applications.

soil INSTRUMENTS

Load & Pressure

L1 Hydraulic Load Cell

Description

The hydraulic load cells are mounted directly at the fixing point of the anchor and measure tension on the anchor in a precise and cost-efficient way.

The load measuring units are used for constant monitoring of the forces weighing on ground anchors, soil nails and cables.

Features

- **Compression force**
- **Measuring forces on ground anchors**
- **Environment temperature -30 to +60°C**
- **Housing and piston galvanized steel, stainless steel as an option**
- **Piston displacement ≤ 0,5 mm**
- **Available with or without power consumption**

Benefits

- **They can be used for:**
- **Long-time monitoring of anchor loads**
- **Monitoring of anchor- and vertical loads in tunnel building or mining, in the construction of foundations and construction pits, retaining walls, slopes and other applications**
- **Pile loads and pile testing**

Specifications

Type	Gauge	4-20mA
Range	0-200kN to 0-10,000kN	
Accuracy	±1.0% Full Scale	±0.5% Full Scale
Output	Optical	4-20mA (2 wire)
Temperature Range	-30°C to +60°C	
Supply Voltage	N/A	10 to 30 VDC
Fill Medium	Glycerine/Water	
Material	Galvanised steel	
Thermistor resolution*	N/A	0.1°C

L2 Vibrating Wire Load Cell

Description

The Vibrating Wire Load Cell is designed to directly measure load in piles, rock bolts and between tunnel supports, as well as tension in cable anchors. The load cell comprises a set of up to six Vibrating Wire gauges mounted parallel to the cell axis and spaced at equal distances radially in a cylindrical housing.

Features

- **Accurate readings over long cable lengths**
- **Robust and with long-term stability**
- **Fast response time**
- **Suitable for remote reading and datalogging**
- **Negligible temperature effects compared to oil-filled load cells**

Benefits

- **Connecting cable is strong, screened and flexible so can be used in lengths over 1000m**
- **Uses proven Vibrating Wire technology**
- **Waterproof versions available to 0.5MPa or 1.0MPa**

Specifications

kN Range	500 | 1000 | 1000 | 1500 | 1800 | 2500 | 5000 | 10000
Accuracy*	±0.25% full scale
Resolution*	0.025% full scale minimum
Over range	150% full scale
Temperature range	-20 to +80°C
Excitation method	Pluck or sweep
Frequency range	2200Hz to 2800Hz
Ingress protection*	IP66
Material	Plated Steel
Thermistor type	NTC 3k Ω
Thermistor accuracy	±0.5% full scale
Thermistor resolution*	0.1°C

L3 Strain Gauge Load Cell

Description

The Strain Gauge Load Cell measures compressive and tensile loads in rock bolts, cable anchors and tendons.

The load cell consists of a Stainless Steel cylindrical housing with up to 16 resistance strain gauges in a Wheatstone Bridge configuration.

Available in mV/V or 4-20mA signal

Features

- **Accurate and robust with very good long-term stability**
- **Fast response time**
- **Suitable for remote reading and datalogging**
- **Negligible temperature effects compared to hydraulic load cells**
- **Connecting cable is strong, screened and flexible**

Benefits

- **Option for dynamic monitoring**
- **Effects of uneven and eccentric loads are minimised**
- **Corrosion-resistant**
- **Available with top and bottom load plates for use as a solid centre cell**

Specifications

kN Range	300 | 500 | 750 | 1000 | 1250 | 1500 | 1800 | 2500 | 3000
Accuracy*	±0.5% full scale
Repeatability	0.02% full scale
Sensitivity	2mV/V ±0.1%
Over range	150% full scale
Compensated temperature range	-10 to +50°C
Temperature range	-20°C to +70°C
Excitation	5 -15 V D
Frequency range	2200Hz to 2800Hz
Ingress protection*	IP67
Material	Stainless Steel
Input/Output resistance	700 ± 20 Ω | 700 ± 5 Ω

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

P6 Vibrating Wire Pressure Cell

Description

The Vibrating Wire Pressure Cell is used to measure total pressure, particularly in earth or rockfill structures.

The VW Pressure Cell has two designs; the double face design providing two active faces and the single face design providing one active face.

Features

- **Accurate, reliable and robust**
- **Low, medium and high pressure ranges available**
- **Low volume change and slender profile**
- **Single and double active faces available**
- **Various pressure ranges available**
- **Suitable for manual or remote monitoring**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long-term working life and stability**
- **Arching and stress concentrations minimised**
- **Over-voltage surge arrestor protects against electrical damage**

Specifications

Standard ranges (kPa)	300 | 500 | 700 | 1000 | 1500 | 2000 | 3000 | 4000 | 6000 | 10000 | 15000
Accuracy*	±0.1% full scale
Linearity*	±0.1% full scale
Resolution*	0.025% full scale minimum
Temperature range	-20 to +80ºC
Over range capacity	150% full scale
Material	Stainless/Powder Coated Steel
Excitation method	Pluck or Sweep
Thermistor type	NTC 3K Ω
Thermistor accuracy	0.5°C
Thermistor resolution	0.1°C

P9 Push-In Vibrating Wire Pressure Cell

Description

The Push-In Vibrating Wire Pressure Cell measures total earth pressures in all soil types. The cell is spade-shaped and pointed at one end. A piezometer within the unit allows the measurement of pore water pressure and therefore the derivation of effective pressure.

Features

- **Measures total earth pressures in all soil types**
- **Recoverable push-in casing**
- **Additional integral pore pressure sensor allows derivation of effective pressure**
- **Fitted with thermistor for monitoring temperature variations**

Benefits

- **Push-in design facilitates perfect contact with the soil**
- **Accurate, repeatable readings over long cable lengths**
- **Fast response to low volume pressure changes**
- **Over-voltage surge arrestor protection**

Specifications

STD Ranges (kPa)	300 | 500 | 700 | 1000 | 1500 | 2000 | 4000
Accuracy*	±0.1% full scale
Linearity*	±0.5% full scale
Resolution*	0.025% full scale minimum
Temperature range	-20 to +80°C
Over range capacity	150% of full scale
Material	Powder Coated Steel Cell
Excitation method	Pluck or sweep
Thermistor type	NTC 3K Ω
Thermistor accuracy	0.5°C
Thermistor resolution	0.1°C

P10 Vibrating Wire Concrete Stress Cell

Description

The Vibrating Wire Concrete Stress Cell measures radial and tangential stresses in shotcrete, concrete and rock, usually in tunnel linings.

The cell consists of a rectangular flat jack formed from two plates of steel welded together around the periphery.

Features

- **Measures stress on and within linings of underground excavations**
- **Monitors stress distribution in rock**
- **Compensation tube offsets the effects of concrete hydration shrinkage, restoring cell contact pressure**
- **Internal thermistor monitors temperature variations**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long-term, stability, reliability and working life**
- **Suitable for remote reading and data logging**
- **Over-voltage surge arrestor protection**

Specifications

STD Ranges (kPa)	300 | 500 | 700 | 1000 | 1500 | 2000 | 3000 | 4000 | 6000 | 10000 | 15000
Accuracy*	0.1% full scale
Linearity*	±0.1% full scale
Resolution*	±0.025% full scale minimum
Temperature range	-20 to +80° C
Over range capacity	150% of full scale
Material	Stainless Steel
Excitation method	Pluck or Sweep
Thermistor type	NTC 3K Ω
Thermistor accuracy	0.5°C
Thermistor resolution	0.1°C

Water

W1 Standpipe Piezometer

Description

The Standpipe Piezometer (Casagrande Piezometer) is used to monitor piezometric water levels in vertical boreholes.

The Standpipe Piezometer typically comprises two parts; at its lowest point is a porous piezometer tip, connected to the tip is a riser pipe which continues upwards out of the top of the borehole.

Features

- **Excellent long-term reliability**
- **Porous plastic or ceramic filter tip**
- **Choice of PVC or galvanized steel riser pipe**
- **Drive-in tip available**
- **Can measure artesian pressures using a Bourdon Gauge readout**

Benefits

- **Simple, low cost system**
- **Ideal for routine site investigation**
- **Used for monitoring piezometric water levels in vertical boreholes**

Specifications

Piezometer Tips		
Type*	Porous Plastic	Drive-in
Element diameter	27mm	27mm
Lengths*	300mm | 1000mm	300mm
Overall diameter	43mm	32mm
Pore diameter	60 micron	60 micron
Permeability	3×10^{-4} m/s (low entry)	
Material*	PVC	Galvanised Steel
Tubing and coupling		
Tubing material	PVC	Galvanised Steel
Tubing lengths	1m | 1.5m | 3m	1m | 3m
Coupling material	PVC	Galvanised Steel

W2 Hydraulic Piezometer

Description

The Hydraulic Piezometer is designed for accurately measuring pore water pressures in fully or partially saturated soil and rock. The system comprises a porous ceramic piezometer tip sealed into the measuring horizon and connected to a remote measuring position via two nylon tubes filled with hydraulic oil.

Features

- **Simple and reliable device**
- **Accurate with excellent long-term stability**
- **Fast response to pressure changes**
- **Inaccuracies due to air entrapment and gas accumulation at the tip are avoided**
- **Capable of measuring pore pressures from 2000 kPa to –50 kPa**

Benefits

- **No electronic components in tip ensures long-term reliability**
- **Twin hydraulic tubing is strong, flexible and suitable for long-term use**
- **Comprises all non-corroding materials**
- **Pressure measurement takes place at the terminal location and not within the piezometer tip**

Specifications

Range (kPa)	Bourdon Gauge: -5 kPa to 5000 kPa	Digital Transducer: -5 kPa to 2000 kPa
Accuracy	Bourdon Gauge: ±1.0% full scale	Digital transducer: ±0.25% full scale
Material	Porous ceramic, PVC, Brass and Nylon	
Filter Types - Porous Ceramic		
50mm Ø	Bull nosed, Cylindrical or Push-in Types	HAE 1 Micron or LAE 60 Microns
Hydraulic Tubing		
Type	Twin Nylon tubes sheathed in Polythene, flat or round in section	
Bend radius	0.3m	
Burst pressure	13.8MPa	
Weight /m	36g	

Qualifiers apply to the product specifications marked with a ***** symbol. Please refer to the product datasheet for the complete specifications and full product information.

W3 Pneumatic Piezometer

Description

The Pneumatic Piezometer is designed for accurately measuring pore water pressures in fully or partially saturated soil and rock.

The Pneumatic Piezometer tip comprises an integral porous element with a high quality diaphragm transducer, installed either down a borehole, by burying in fill or by pushing into shallow depths in soft soil.

Features

- **Low volume change**
- **Can be installed in horizontal and up holes**
- **Suitable for a large pressure range**
- **Pneumatic tubing is strong and flexible and can be installed in lengths of up to 500m**
- **All piezometer components corrosion-proof**

Benefits

- **Small, accurate and reliable design**
- **Fast response**
- **Ideal for underground works**
- **Suitable for flow or no-flow operation**
- **Level of tubing in relation to readout is not critical**

Specifications

Sensor		
Range	+30 to +1000kPa	
Accuracy	±2.0% full scale	
Diameter	38mm outside diameter	
Filter		
Type	HAE Ceramic	LAE Ceramic
Porosity	1 Micron	60 Micron
Length	48mm	
Diameter	38mm	
Material	Brass/PVC	

W4 Heavy Duty Vibrating Wire Piezometer

Description

The Heavy Duty Vibrating Wire Piezometer accurately measures pore water pressure in fully or partially saturated soil. The heavy duty design prevents case stresses from affecting readings in extreme installations.

The transducer is fitted with a low air entry sintered steel or a high air entry ceramic filter.

Features

- **Heavy duty design**
- **Manufactured from high grade 316 Stainless Steel for extended operation**
- **In-built temperature compensation**
- **Hermetically sealed**
- **Highly accurate device**
- **Fitted with thermistor**
- **Capable of measuring negative pore pressures to –50 kPa**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Works in extreme installations and pressures up to15000 kPa**
- **Fast response to pressure changes**
- **Advanced design prevents case stresses from affecting readings**

Specifications

Range (kPa)	150 | 300 | 500 | 700 | 1000 | 1500 | 2000 | 4000 | 6000 | 10000 | 15000
Accuracy	±0.1% full scale
Linearity	±0.1% full scale
Resolution*	0.025% full scale minimum
Over range	200% of full scale
Diaphragm displacement	< 0.001 cm^3
Temperature range	-20 to +80°C
Excitation Method	Pluck or sweep
Material	316 grade Stainless Steel
Diameter	28mm
Weight	980g

W7 Water Level Indicator

Description

Water Level Indicators are used to measure the depth of water in standpipes, wells and boreholes.

The indicator comprises a Stainless Steel probe connected to a flexible graduated tape which is wound on to a hand reel. The reel houses a transistorised switched circuit, audio and visual indicators and a battery.

Features

- **One instrument reads at many locations**
- **Flat, flexible tape for accurate readings**
- **Tape range: 30m–500m,1mm divisions**
- **Lightweight**
- **Simple, reliable and easy to operate**
- **Audible and visual water level alert signals**

Benefits

- **Easily portable**
- **Advanced non-stick material prevents tape adhering to wet surfaces**
- **Economic water level monitoring**
- **Ideal for boreholes with small diameters**

Specifications

Probe		
Type	Standard*	Slimline
Diameter	15mm	12mm
Length	230mm	170mm
Type	Shrouded	
Material	Stainless Steel	
Tape		
Lengths	30m | 50m | 100m | 150m | 200m | 300m | 500m	
Type	Contoured/Stranded steel conductors	
Material	Steel/Polypropylene coated	
Width	9.4mm	
Graduations	m - cm - mm	

W9 Standard Vibrating Wire Piezometer

Description

The Standard Vibrating Wire Piezometer provides accurate measurement of pore water pressures in fully or partially saturated soil.

The transducer is made from high quality 316 grade Stainless Steel and designed to handle pressure ranges from -50 to 4000 kPa.

Features

- **Small diameter**
- **Manufactured from high grade 316 Stainless Steel for extended operation**
- **In-built temperature compensation**
- **Hermetically sealed**
- **Suitable for long-term monitoring**
- **Fitted with thermistor**
- **Capable of measuring negative pore pressures to –50 kPa**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Fast response to pressure changes**
- **Advanced design prevents case stresses from affecting readings**
- **Over-voltage surge arrestor protects against electrical damage**

Specifications

Range (kPa)	300 | 500 | 700 | 1000 | 1500 | 2000 | 4000
Accuracy	±0.1% full scale
Linearity	±0.5% full scale
Resolution*	0.025% full scale minimum
Over range	200% of full scale
Diaphragm displacement	< 0.001 cm^3
Temperature range	-20 to +80°C
Excitation Method	Pluck or sweep
Material	316 grade Stainless Steel
Diameter	19mm
Weight	190g

W9ML Multi Level Vibrating Wire Piezometers

Description

The Multi Level Piezometer provides a convenient and integrated method for the installation of Vibrating Wire Piezometers at different levels within a single borehole.

The assembly of access tubes, piezometer housing, piezometer and cables can be pre-assembled on site.

Features

- **Multi level piezometer installation**
- **Integrated, neat system**
- **Pre-assembled to suit site requirements**
- **Fast installation**
- **Reduces drill rig standing time**
- **Suitable for long-term monitoring**

Benefits

- **Self-supporting assembly**
- **Easier removal of drill rig casing**
- **Easier installation**
- **Long working life, long-term stability and reliability**

Specifications

Range (kPa)	300 | 500 | 700 | 1000 | 1500 | 2000 | 4000
Accuracy	PVC/316 grade Stainless Steel
Linearity	±0.5% full scale
Resolution*	0.025% full scale minimum
Over range	200% Of full scale
Diaphragm displacement	< 0.001 cm^3
Temperature range	-20 to +80°C
Diameter	64mm
Material	PVC/316 grade Stainless Steel
Weight (without cable & filter)	240g

W9P Drive-In Vibrating Wire Piezometers

Description

The Drive-In Vibrating Wire Piezometer has been developed to meet the stresses involved with installation of piezometers into soft ground and fill material, without pre-forming of a borehole, such as with cone penetration type installations.

Features

- **Robust body, designed to support the stresses of push-in techniques**
- **Sharp nose cone to reduce pushing soil resistance**
- **Body equipped with spigot to adapt to pushing rods**
- **Fitted with flexible screened cable**
- **Integral thermistor**

Benefits

- **Manufactured from 316 Stainless Steel**
- **Robust design prevents push-in stresses from affecting sensor performance**
- **Reduces installation time**
- **Reduces installation costs**
- **Push-in method can reduce soil re-stabilisation time compared with borehole formation**

Specifications

Range (kPa)	300 | 500 | 700 | 1000 | 1500 | 2000 | 4000
Accuracy	±0.1% full scale
Linearity	±0.5% full scale
Resolution*	0.025% full scale minimum
Over range	200% Of full scale
Diaphragm displacement	< 0.001 cm^3
Temperature range	-20 to +80°C
Diameter	36mm
Material	316 grade Stainless Steel
Weight (without cable & filter)	320g

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

W10 V-Notch Weir Monitor

Description

The V-Notch Weir system is used to measure water flow volume. It is used predominately in dams, open channels such as streams and in tunnels.

The system comprises a Stainless Steel plate with a notch profile chosen to suit predicted flow rates.

Features

- **Uses Vibrating Wire technology**
- **Suitable for manual or remote monitoring**
- **Accurate and sensitive water level monitoring**
- **Rectangular or triangular notched plate available**
- **Easy to automate via data acquisition software**

Benefits

- **Low cost, low maintenance system**
- **Simple principle of operation in manual version**
- **Accurate, repeatable readings over long cable lengths when using VW system**
- **Long-term stability and reliability**
- **Connecting cable is strong, screened and flexible**

Specifications

VW Precision Water Level Sensor		
Type	Automated/ Remote	Optical
Range	300mm	300mm
Accuracy*	0.5% full scale	±1mm
Linearity	±0.5% full scale	
Resolution*	0.025% full scale min	1mm
Operating temperature	+5 to +60°C	
Dimensions	150mm x Ø32mm	
Weight (sensor only)	600g	
Material	Stainless Steel	
Excitation	Pluck or sweep	

W12 4-20mA Piezometer

Description

The 4-20mA Piezometer is designed for accurately measuring pore water pressures in fully or partially saturated soil and rock.

The transducer is fitted with a sintered Stainless Steel filter disc and is available as a vented (gauge) piezometer or a non-vented (absolute) piezometer.

Features

- **Accurate with excellent long-term stability**
- **Fitted with thermistor for temperature monitoring**
- **Fast response to pressure changes**
- **Advanced design prevents case stresses from affecting readings**
- **Capable of measuring negative pore pressures to -50 kPa (non-vented unit)**

Benefits

- **Small diameter device**
- **Manufactured from high grade 316 Stainless Steel for extended operation**
- **Hermetically sealed, ensures long working life**
- **Connecting cable is strong, screened and flexible**

Specifications

Range (kPa)	100 | 200 | 350 | 700 | 2000 | 3500
Accuracy	±0.1% full scale
Linearity	±0.5% full scale
Resolution*	0.025% full scale (minimum)
Over range	200% of full scale
Diaphragm displacement	< 0.001 cm3
Temperature range	-20 to +80°C
Excitation method	4-20mA loop
Material	316 grade Stainless Steel
Diameter	19mm
Weight	130g

W15 MEMS piezometer modem logger

Description

The MEMS Piezometer Modem Logger combines a high capacity GSM/GPRS enabled datalogger with a small diameter MEMS Piezometer for use in fully or partially saturated soil and rock.

Features

- **Integrated barometer sensor**
- **High grade sensor element and filter**
- **Data delivered in engineering units**
- **Intelligent alarming with 5 user defined thresholds and alarm notification via SMS and FTP**
- **Micro SD card**

Benefits

- **Enables measurements of pore water pressure only**
- **Ensures low noise and excellent stability**
- **Up to 2 year battery life**
- **Intelligent dual sensor capability**
- **Atmospheric pressure compensation**
- **Internal logging of millions of data points**

Specifications

Range (kPa)	250 (absolute)	
Accuracy	±0.1% full scale	
Resolution*	0.01kPa	
Over range	400% full scale	
Diameter	18mm	
Output	0-10V	4-20mA (2 wire)
Weight (without cable & filter)	115g	
Temperature range	-20 to +80°C	
Max cable length	50m	500m
Material	Glass fibre, reinforced polyester, corrosion free	

W16 Kompakt Piezometer

Description

The Kompakt economical vibrating wire piezometer provides accurate pore measurements.

The transducer is designed to handle pressure ranges from 0 to 500kPa. It incorporates an over voltage surge arrestor that offers protection from a lightening strike.

Features

- **Small diameter**
- **Uses proven Vibrating Wire technology**
- **In built temperature compensation**
- **Hermetically sealed**
- **No electric components in sensor module**
- **Fitted with thermistors for temperature monitoring**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Fast response to pressure changes**
- **Design prevents case stresses from affecting readings**
- **Over-voltage surge arrestor protects against electrical damage**
- **Connecting cable is strong, screened and flexible**

Specifications

Range (kPa)	300 | 500 | 700 | 1000 | 1500 | 2000 | 4000
Accuracy	±0.1% full scale
Linearity	±0.5% full scale
Resolution*	0.025% full scale minimum
Over range	200% of full scale
Diaphragm displacement	< 0.001 cm^3
Temperature range	-20 to +80°C
Excitation Method	Pluck or sweep
Material	316 grade Stainless Steel
Diameter	19mm
Weight	190g

Settlement

S1 Hydraulic Overflow Settlement Cell

Description

For the remote measurement of vertical movement at discrete and inaccessible site locations.

Features

- **Simple, accurate and inexpensive**
- **Up to 300m tubing lengths can be used as standard**
- **No vertical rods or tubes to interfere with construction activities**

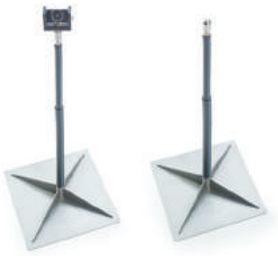
Benefits

- **Unaffected by temperature or barometric pressure changes**
- **Long working life, long-term stability and reliability**

Specifications

Standard ranges	1m or 2.5m of settlement
Accuracy*	±1mm
Resolution	1mm
Repeatability*	±1mm

S10 Mechanical Settlement System



Description

Mechanical Settlement Systems are simple instruments used to monitor: Settlement in the ground beneath surcharges or embankments. Measurement and monitoring the settlement of individual soil layers. Heave (uplift) resulting from excavation or grouting. Settlement associated with dewatering. Subsidence in marine fills/land reclamation.

Features

- **Readout by optical survey of the top of the inner pipe or by measuring the length of added tube**
- **Various sizes of settlement plates available**
- **Different lengths of stainless steel measuring rods available**
- **Adapter for optical targets available**

Benefits

- **Low costs**
- **Reliable, simple to install and read**
- **Monitoring of settlement parallel to construction progress**
- **Measuring rods can simply be added to extend the measuring point**

Specifications

Settlement Plate Dimensions	
Square settlement plate	500 x 500 x 5mm 2 inch BSP socket
Standard settlement plate	300mm diameter x 10mm 2 inch BSP socket
Large round settlement plate	750mm diameter x 10mm 2 inch BSP socket
Square settlement plate	500 x 500 x 20mm 2 inch BSP socket
Heavy duty settlement plate	Plate: 500 x 500 x 12.5mm Upright: 2 inch diameter tube, 1m length, support buttresses, including a 2 inch BSP socket
Settlement Tubing Dimensions	
60mm diameter tube	1m length, mild steel, 2 inch BSP thread either end, includes coupling
75mm diameter spigot and socket tube	1m length, plastic tube, for use with 60mm settlement tube

S8 Vibrating Wire Settlement Cell

Description

The Vibrating Wire Settlement Cell measures settlement and heave in soil and rockfill.

The cell consists of a Vibrating Wire pressure transducer connected via a pair of water filled nylon tubes to a hydraulic datum pot located on stable ground.

Features

- **Uses proven Vibrating Wire technology**
- **15m and 30m ranges available**
- **Borehole and trench types available**
- **No vertical rods or tubes to interfere with construction activities**
- **Twin liquid lines allow for recirculation of water through the system after installation**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Over-voltage surge arrestor protects against electrical damage**
- **Measurements unaffected by lateral movements**

Specifications

Settlement Cell/Transducer	15 metres	30 metres
Range (kPa)	150	300
Accuracy | Linearity	±0.1% full scale	
Resolution*	0.025% full scale	
Over range capacity	200% full scale	
Diaphragm displacement	<0.001cm^3	
Temperature range	-20 to +80°C	
Excitation method	Pluck and sweep	
Operating frequency	1600 to 3000Hz	
Thermistor type	NTC 3k Ω	
Thermistor accuracy	0.5°C	
Thermistor resolution*	0.1°C	
Transducer material	316 Stainless Steel	
Casing material	PVC	

S8 Vibrating Wire Settlement Cell Low Profile

Description

The Vibrating Wire Settlement Cell measures settlement and heave in soil and rockfill.

The cell consists of a Vibrating Wire pressure transducer connected via a pair of water filled nylon tubes to a hydraulic datum pot located on stable ground.

Features

- **Uses proven Vibrating Wire technology**
- **15m and 30m ranges available**
- **No vertical rods or tubes to interfere with construction activities**
- **Twin liquid lines allow for recirculation of water through the system after installation**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Over-voltage surge arrestor protects against electrical damage**
- **Measurements unaffected by lateral movements**

Specifications

Settlement Cell/Transducer	15 metres	30 metres
Range (kPa)	150	300
Accuracy | Linearity	±0.1% full scale	
Resolution*	0.025% full scale	
Over range capacity	200% full scale	
Diaphragm displacement	<0.001cm^3	
Temperature range	-20 to +80°C	
Excitation method	Pluck and sweep	
Operating frequency	1600 to 3000Hz	
Thermistor type	NTC 3k Ω	
Thermistor accuracy	0.5°C	
Thermistor resolution*	0.1°C	
Transducer material	316 Stainless Steel	

S17 Hydrostatic Profile Gauge

Description

The Digital Hydrostatic Profile Gauge is used to monitor the profile of settlement or heave and is predominately used for monitoring beneath embankments or structures where access to the surface is not possible.

Features

- **Provides a settlement monitoring profile**
- **Bluetooth connection between cable reel and Field PC**
- **Single ended access**
- **Enhanced, easy interface software compatible with most office systems and applications**
- **Repeatable position control using metal markers**

Benefits

- **No field connections required**
- **Large data storage capacity**
- **Uses low cost access tubing**
- **Cost effective over many profile measurements**
- **Portable system**
- **No need for special borehole casing (such as inclinometer casing)**

Specifications

Range*	+1m to -3.5m
Accuracy	±10mm
Resolution	1mm
Repeatability	±10mm
Operating temperature	-10 to +50°C
Tubing	
Tube lengths*	50m | 100m | 200m
Tube diameter	12mm
Graduation interval	1m
Graduation marker material	Stainless Steel

Qualifiers apply to the product specifications marked with a ***** symbol. Please refer to the product datasheet for the complete specifications and full product information.

Strain

ST1 Vibrating Wire Spot Weldable Strain Gauge

Description

The Vibrating Wire Spot Weldable Strain Gauge measures strain in steel members. It consists of a sealed tube containing a Vibrating Wire element with weldable anchors at each end.

A factory fitted, four-core screened cable connects the coil to the readout unit.

Features

- **Suitable for manual or remote reading**
- **Removable coil unit**
- **Range is adjustable to suit compression or tension**
- **Contains an integral thermistor**
- **Waterproof to 700 kPa**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Coils are re-useable**
- **Small, low profile design**

Specifications

Range	3000 Microstrain
Accuracy	±0.5% full scale
Resolution*	0.4 Microstrain
Temperature range	-20 to +80°C
Active gauge length	50.4mm
Excitation method	Pluck or sweep
Sensor material	Stainless Steel
Sensor weight	6g
Sensor dimensions	65mm L x 13mm W x 6mm H
Thermistor type	NTC 3k Ω
Thermistor accuracy	±0.5°C
Thermistor resolution*	0.1°C

ST2 Vibrating Wire Arc Weldable Strain Gauge

Description

The Vibrating Wire Arc Weldable Strain Gauge measures strain in steel members. It consists of a coil assembly, Vibrating Wire element and two weldable anchors.

The Strain Gauge incorporates O-ring seals to provide waterproofing, and allows the tube to remain unstressed.

Features

- **Suitable for manual or remote reading**
- **Range is adjustable to suit compression or tension**
- **Contains an integral thermistor**
- **O-ring seals provide waterproofing**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Robust and reliable**

Specifications

Range	3000 Microstrain
Accuracy*	±0.1% full scale
Resolution*	1 Microstrain
Temperature range	-20 to +80°c
Active gauge length	141.4mm
Excitation method	Pluck or sweep
Sensor material	Stainless Steel
Sensor weight	50g
Sensor dimensions	157mm L x 12.7mm Ø
Thermistor type	NTC 3k Ω
Thermistor accuracy	±0.5°C
Thermistor resolution*	0.1°C

ST3

Vibrating Wire Concrete Surface Mount Strain Gauge

Description

The Vibrating Wire Concrete Surface Mount Strain Gauge measures strain in concrete members. It consists of a coil assembly, Vibrating Wire element and two groutable anchors to embed the unit in the concrete structure to be monitored. A factory fitted, four-core screened cable connects the coil to the readout unit.

Features

- **Adjustable strain gauge for the most effective use of the instrument range**
- **Individually calibrated**
- **Integral thermistor**
- **Waterproof**
- **Gauge and coils are re-useable**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Can be used with long cable lengths with no degradation of signal**
- **Suitable for remote reading and data logging**

Specifications

Range	3000 Microstrain
Accuracy*	±0.1% full scale
Resolution*	1 Microstrain
Temperature range	-20 to +80°C
Active gauge length	141.4mm
Excitation method	Pluck or sweep
Sensor material	Stainless Steel
Sensor weight	50g
Sensor dimensions	157mm L x 12.7mm Ø
Mounting Anchors	
Material | Finish	Steel | Zinc Plated
Dimensions	25mm L x 25mm H x 16mm W

ST4

Vibrating Wire Embedment Strain Gauge

Description

The Vibrating Wire Embedment Strain Gauge is used for measuring strain in mass concrete.

The 150mm long gauge, which is made from Stainless Steel, may be pre-attached to rebar or by attachment to a 2, 3 or 4 directional rosette, thereby measuring strain in several directions.

Features

- **Located within concrete**
- **Uses proven Vibrating Wire technology**
- **Suitable for manual or remote monitoring**
- **Fully waterproof**
- **Fitted with thermistor for temperature monitoring**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Over-voltage surge arrestor protects against electrical damage**
- **Connecting cable is screened and flexible**

Specifications

Range	3000 Microstrain
Accuracy*	±0.1% full scale
Resolution*	1 Microstrain
Temperature range	-20 to +80°C
Active gauge length	150mm
Excitation method	Pluck or sweep
Sensor material	Stainless Steel
Sensor weight	58g
Sensor dimensions	157mm x Ø19mm
Thermistor type	NTC 3k Ω
Thermistor accuracy	±0.5°C
Thermistor resolution*	0.1°C

ST5 Vibrating Wire Rebar Strain Gauge

Description

The Vibrating Wire Rebar and Sisterbar Strain Gauges measure strain in concrete and consist of a coil assembly and a Vibrating Wire element with rebar extensions at each end.

Rebar Strain Gauges are welded into the reinforcing cage and must be matched to the size and grade of the rebar forming the cage.

Features

- **Located within rebar cage**
- **Individually calibrated**
- **Integral thermistor**
- **Waterproof**

Benefits

- **Accurate, repeatable readings over long cable lengths**
- **Long working life, long-term stability and reliability**
- **Suitable for remote reading and data logging**
- **Unaffected by bending**

Specifications

Range	
Sisterbar	1000 Microstrain
Rebar	1500 Microstrain
Accuracy	±0.25% full scale
Resolution*	<0.4 Microstrain
Temperature range	-20 to +80°C
Length	900mm
Excitation method	Pluck or sweep
Material	Stainless Steel
Rebar strain gauge diameters	16mm | 18mm | 20mm | 22mm | 25mm | 28mm | 32mm | 36mm | 40mm
Sister bar diameter	12mm
Frequency range*	1800-2800Hz
Coil Housing Type	Integral, with Thermistor

Qualifiers apply to the product specifications marked with a * symbol. Please refer to the product datasheet for the complete specifications and full product information.

DAM APPLICATION

Products	Page	Type of Measurement	Where is it used?	
VW Crackmeter, VW Triaxial Jointmeter Mechanical Jointmeter	6	Joint & Crack	Monitoring the opening and closing of fissures in rock/concrete faces	
VWLOG2, VWLOG8 GPRS, ARGUS Monitoring Software	8	Datalogger	Used to read, record and display the data from sensors with the option for remote cellular transmission	
Digital Inclinometer, Inclinometer Casing Smart In-place Inclinometer"	14	Inclination	Used to monitor horizontal subsurface failure in a slope and possible slip plane movement	
Pendulum System	12	Inclination	Used for precision monitoring of horizontal displacement within dam foundations and of large dam structures - dam body and intake tower	
VW Piezometer, Standpipe Piezometer Water Level Meter	37	Water	Measuring pore pressures within the soil around dams	
VW Strain Gauges, Concrete Embedment Strain Gauges	44	Strain	Measuring strain in steel members or mass concrete	

Soil Instruments has over 50 years' experience in the monitoring of dams, reservoirs and associated projects, working on structures and environments on a global scale.

This table illustrates the comprehensive range of instrumentation we typically supply within Dam applications.

soil INSTRUMENTS

Soil Instruments around the world

Soil Instruments supply geotechnical and structural instrumentation worldwide through our two main offices situated in UK and Germany and our long standing global network of distributors.

- Soil Instruments Ltd UK
- Interfels Germany
- Distributor network in over 30 countries worldwide.

For details on these distributors please visit our website **soilinstruments.com** and view our distributors section.

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