INTERFELS PRODUCTS
• MEMS-based digital inclinometer systems
• Incremental Extensometer (INCREX) System
• Jointmeter/Crackmeter
• Convergence
• Vibrating Wire and electric piezometers, pressure and load cells
• Tilt sensors
• Automatic data acquisition systems
• Data presentation software

INTERFELS EXPERIENCE
INTERFELS GmbH is known throughout the world for our geotechnical instrumentation including tunnel and bridge monitoring. Dam installation is something that we pride ourselves on, with our experience and equipment is vast and second to none. Listed below are some of the larger dam bridge projects in the world where INTERFELS have installed geotechnical equipment:
• Birecik Dam   Turkey
• Karun 1 and 3 Dam  Iran
• Tehri Dam   India
• Oresund Bridge  Sweden to Denmark

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INTERFELS HISTORY OF INTERFELS GMBH
INTERFELS was founded in the year 1961 in Salzburg/Austria by 32 members of the so-called, Salzburg Geomechanics’ Circle led by Leopold Müller. According to its original charta, the objective of the company was technological testing of rock masses in all countries of the world, scientific research in the field of Geomechanics and issuing of official test certificates. The INTERFELS tradition has over the years been embraced by innovations in the field of manufacturing geotechnical instrumentation and monitoring, data acquisition, software and technologies.

In 1996 INTERFELS was acquired from Boart Longyear. In 2001 ITM-Soil Ltd Purchased INTERFELS. The acquisition increases ITM-Soil’s geotechnical manufacturing and service base, bringing not only specialist products such as Argus monitoring and the incremental extensometer INCREX, but also a merged employees and a new factory based in Bad Bentheim, Germany. As December 2009 INTERFELS is certified to DIN ISO 9001:2008.

INTERFELS CUSTOMER’S
Most of our national and international customers have been with INTERFELS for many years. We are proud of the quality of our instruments and the service we provide to our customers. We recognise that every site and project is unique and our experienced sales engineers always ensure that our customers receive the best possible support and information from us before during and after sales.

OUR GROUP
The ITM-Soil Group operates geotechnical and structural monitoring companies throughout the world:
• Soil Instruments Ltd, UK
• ITM Ltd, UK
• INTERFELS GmbH, Germany
• ITM-Soil Pty Ltd, Australia
• Beijing Soil Instruments, China
APPLICATIONS
The Digital Bluetooth, Uniaxial Horizontal Inclinometer provides high resolution and accurate profiles of settlement or heave in geotechnical and civil engineering structures such as dams, embankments, bridge piers and abutments, storage tanks and landfill areas.

FEATURES
• Fast and simple data gathering and highly accurate readings of ground deflection
• Bluetooth communication between the probe and a rugged PDA (Personal Digital Assistant) avoids cable resistance, noise issues and connector problems
• The PDA interfaces with most office systems and applications with the software offering a range of presentations
• Solid state electronics ensure long and trouble-free use in a site environment
• Metal marker/cable gate system ensures high degree of accuracy and repeatability
• Strong, lightweight and portable

VERTICAL INCLINOMETER SYSTEM
APPLICATIONS
The Vertical Digital Bluetooth Inclinometer provides accurate profiles of lateral deflections in two perpendicular planes (i.e. biaxial). These include:
• Embankments, landslide zones and retaining walls
• Dams and slopes (natural or man made)
• Bridge piers, abutments and landfills
• Ground deformation due to tunnelling and excavation

FEATURES
• Fast and simple data gathering and highly accurate readings of ground deflection
• Bluetooth communication between the probe and a rugged PDA (Personal Digital Assistant) avoids cable resistance, noise issues and connector problems
• The PDA interfaces with most office systems. Data reduction, graphing and reporting are performed using In-Site Inclinometer Software
• Surface mount electronics ensure long and trouble-free use in a site environment
• Metal marker/cable gate system ensures high degree of accuracy and repeatability
• Strong, lightweight and portable

SPECIFICATIONS
Probe gauge length 500mm (20")
Probe diameter 28.5mm (1")
Calibrated ranges ±30° (±250mm), ±60° (±433mm) or ±90° (±500mm)
Resolution ±0.01° (±0.001"")
Sensor accuracy ±0.05° (±0.001")
Operating temperature -10 to +50°C
Repeatability ±0.008° full scale
System accuracy1 (over 25m) ±2mm
Minimum casing internal diameter 48mm

HORIZONTAL INCLINOMETER SYSTEM
APPLICATIONS
The Digital Bluetooth, Uniaxial Horizontal Inclinometer provides high resolution and accurate profiles of settlement or heave in geotechnical and civil engineering structures such as dams, embankments, bridge piers and abutments, storage tanks and landfill areas.

FEATURES
• Fast and simple data gathering and highly accurate readings of ground deflection
• Bluetooth communication between the probe and a rugged PDA (Personal Digital Assistant) avoids cable resistance, noise issues and connector problems
• The PDA interfaces with most office systems and applications with the software offering a range of presentations
• Solid state electronics ensure long and trouble-free use in a site environment
• Metal marker/cable gate system ensures high degree of accuracy and repeatability
• Strong, lightweight and portable

IN-SITE INCLINOMETER DATA PRESENTATION SOFTWARE
APPLICATIONS
In-Site is a Microsoft Windows based data presentation application, designed primarily for the INTERFELS inclinometer systems but able to be used with most commercially available inclinometer systems. In-Site’s main functions are data reduction, graphing and reporting. Based on the Microsoft Access Database format, In-Site allows your site-specific databases to grow with your monitoring projects. Licence distribution with a USB dongle allows the freedom to use your In-Site licence for multiple computers.

FEATURES
• Data entry by direct retrieval, single or multiple file import and manual input
• Useful borehole administration tools allowing data management, data reduction, cumulative and incremental displacement plotted against depth or elevation, viewable in graphical and tabular format
• Option to plot site investigation borehole logs against depth and elevation for advanced analysis of movement
• Reports can be previewed on screen before printing and can be fully customised, with graphical and tabular presentation and the ability to add annotations, company details and company logos
• Multiple databases can be opened at the same time
• Inclinometer data can be copied between databases by simply dragging and dropping

SPECIFICATIONS
Probe gauge length 500mm (20")
Probe diameter 44mm
Calibrated ranges ±10° (±86.8mm)
Resolution ±0.01° (±0.001"")
Sensor accuracy ±0.025% full scale
Operating temperature -10 to +50°C
Repeatability ±0.008% full scale
System accuracy1 (over 25m) ±2mm
Minimum casing internal diameter 48mm
Maximum casing internal diameter 83mm

1. Derived empirically from surveys that include systematic and random errors introduced by casing, probe and operator.
INCLINATION INCLINOMETER SPECIFICATIONS
Housing Diameter 40mm
Maximum casing internal diameter 70mm
Signal output ±2.5VDC // 4-20mA
Operating temperature -20 to +70°C
Ingress protection IP68 to 100mH2O
Tube Diameter 28mm (stainless steel)
Sensor Null Repeatability <0.0008 arc
Sensor Symmetry@ ½ linear scale <2%

APPLICATIONS
For horizontal chains only
1. Dependent on readout equipment

FEATURES
1. Accurate readings of ground deflection (electrolytic tilt sensors)
2. Uniaxial and biaxial versions available
3. Available for vertical or horizontal profiling of ground deflection
4. Heavy-duty mechanical design ideally suited for multiple use on many different projects and applications
5. For use with inclinometer casing
6. Real time monitoring; ideal for continuous, unattended monitoring, can deliver readings in near real-time

SPECIFICATIONS
Calibrated ranges ±3° or ±10°
Sensor Resolution<0.0003 arc degrees/ <0.0005 arc degrees
Sensor Symmetry½ linear scale <2%
Sensor Null Repeatability <0.0006 arc degrees/ <0.001 arc degrees
Operating temperature 20 to +70°C
Signal output ±25VDC // 4-20mA
Minimum casing internal diameter 62mm
Maximum casing internal diameter 76mm
Housing Diameter 40mm
Tube Diameter 28mm (stainless steel)
Ingress protection IP68 to 100mH2O (1000kPa)
Housing material brass (nickel plated)

ELECTROLEVEL IN-PLACE INCLINOMETER
APPLICATIONS
Ideally suited for automated near real time measurements of lateral displacement of soil, rock and man-made structures with the following specific applications:
1. Stability of natural and cut slopes, slurry walls, sheet piling and tie-back walls around excavations
2. Lateral ground movement due to excavation and tunnel or shaft construction
3. Lateral deformation of embankments, earthfill dams and retaining walls

FEATURES
1. Accurate readings of ground deflection (electrolytic tilt sensors)
2. Uniaxial and biaxial versions available
3. Available for vertical or horizontal profiling of ground deflection
4. Heavy-duty mechanical design ideally suited for multiple use on many different projects and applications
5. For use with inclinometer casing
6. Real time monitoring; ideal for continuous, unattended monitoring, can deliver readings in near real-time

SPECIFICATIONS
Calibrated ranges ±3° or ±10°
Sensor Resolution<0.0003 arc degrees/ <0.0005 arc degrees
Sensor Symmetry½ linear scale <2%
Sensor Null Repeatability <0.0006 arc degrees/ <0.001 arc degrees
Operating temperature 20 to +70°C
Signal output ±25VDC // 4-20mA
Minimum casing internal diameter 62mm
Maximum casing internal diameter 76mm
Housing Diameter 40mm
Tube Diameter 28mm (stainless steel)
Ingress protection IP68 to 100mH2O (1000kPa)
Housing material brass (nickel plated)

STANDARD INCLINOMETER CASING
APPLICATIONS
An essential and integral part of inclinometer systems used for measuring movements in soil, rock and structures. Designed for easy assembly and installation providing accurate inclinometer data in short and long term monitoring. The economical casing is assembled using couplings, rivets and sealing tape, ensuring strong joints.

FEATURES
1. Installable in boreholes and piles, set into concrete or attached to structures
2. Manufactured from ABS plastic which is flexible, impact and corrosion resistant thus ensuring long service life
3. Precision extruded keyway ensures low spiral and perfect fit for the inclinometer probe wheels rendering accurate inclinometer data
4. Special couplings at joints safeguard against ingress of water or grout
5. Telescopic sections with a 150mm range for accommodating settlement or heave
6. Compatible with all inclinometer, settlement probes and IPI sensors
7. Available in 70mm and 85mm diameter

SPECIFICATIONS
Material ABS
Groove spiral < 0.3°/3m
Collapse rating 1960kPa (1770kPa)
Bend rating 3.07N (2.69N)
Maximum temperature 80°C
Tensile strength 705kgF (700kgF)
Collapse rating 1960kPa
Bend rating 252N
Maximum temperature 80°C
Tensile strength 585kgF
Cone diameter 76mm
Cone taper angle 40°
Cone weight 5.7kg

EASY CONNECT INCLINOMETER CASING
APPLICATIONS
An integral part of inclinometer systems used for measurement of lateral movements of soil in highway and railway embankments. Designed for installation into pre-formed window sampling holes or where ground conditions permit, pushed to required depth, using CPT equipment.

FEATURES
1. End cone ensures excellent fixity and therefore a stable datum
2. Quick and simple assembly offers significant saving in installation costs
3. Self aligning integral coupling reduces casing spiral significantly
4. Installable in boreholes and piles, set into concrete or attached to structures
5. Manufactured from ABS plastic which is flexible, impact and corrosion resistant thus ensuring long service life
6. Precision extruded keyway ensures low spiral and perfect fit for the inclinometer probe wheels rendering accurate inclinometer data
7. Provision of O rings at the joints ensures against ingress of water or grout
8. Telescopic sections with a 300mm range for accommodating settlement or heave
9. Compatible with all inclinometer, settlement probes and IPI sensors
10. Available in 70mm and 58mm diameter

SPECIFICATIONS
Material ABS
Groove spiral < 0.5°/3m
Collapse rating 1960kPa
Bend rating 252N
Maximum temperature 80°C
Tensile strength 585kgF
Cone diameter 58mm
Cone taper angle 40°
Cone weight 4kg

QUICK DRIVE INCLINOMETER CASING
APPLICATIONS
The Hanging and Inverted Pendulum Systems are designed for accurate measurement of horizontal movements associated with the rotation or tilting of a structure. Typical applications include determination of horizontal movements of dams, dam foundations, abutments, bridges, piers, towers, nuclear power stations and tall buildings. Inverted and hanging pendulums often installed in the same structure.

FEATURES
1. High accuracy and resolution rendering quality data which is better than surveying
2. Provides a primary reference for geodetic surveying
3. Very reliable long term monitoring system
4. Measurements can be taken at one or several points along the wire
5. Provides frequent reading intervals without the need for costly and troublesome geodetic surveying
6. Options for manual data monitoring or full remote logging system

SPECIFICATIONS
Hanging and Inverted Pendulum Systems
Facility length ±75mm in X and Y
Automatic System
Range ±50mm in X or ±50mm in Y or ±500mm in X and Y
Tolerance ±0.1mm
Resolution ±0.01mm
Repeatability ±0.1mm
Operating temperature -15 to +60°C
Output RS-485 or 4-20mA signal

PENDULUM SYSTEMS
APPLICATIONS
Hang and Inverted Pendulum
• Provides frequent reading intervals without the need for costly and troublesome geodetic surveying
• Options for manual data monitoring or full remote logging system

SPECIFICATIONS
Manual System
Range ±75mm in X and Y
Accuracy ±0.1mm
Resolution 0.1mm
Repeatability ±0.1mm
Weight 4kg

Automatic System
Range ±50mm in X or ±50mm in Y or ±500mm in X and Y
Tolerance ±0.1mm
Resolution ±0.01mm
Repeatability ±0.1mm
Operating temperature -15 to +60°C
Output RS-485 or 4-20mA signal

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www.interfels.com
FEATURES

- Rugged with low power consumption
- Powered by mains, battery or solar panels
- Up to 4MB internal memory in CR1000 and further capacity through the addition of a Compact Flash Module (CR1000 only)
- Various options for data retrieval e.g. GSM, MD485, TCP/IP, 2.4GHz radio
- Output data in simple ASCII format enables easy importing to monitoring software or spreadsheets
- Real time datalogging and analysis
- Reads most sensors common to geotechnical and structural engineering instrumentation
- Alarm triggering facilities
- Networking of multiple loggers possible

APPLICATIONS

Instrumentation systems for geotechnical and structural monitoring often entail monitoring large numbers of sensors of different types with dataloggers often being installed in remote, inaccessible and hostile locations. INTERFELS have configured numerous loggers for a diverse range of Structural and Geotechnical Engineering applications worldwide. The loggers are built around the Campbell Scientific CR800 and CR1000 modules and can be used with monitoring software such as ARGUS giving a complete solution for remote monitoring of projects independent of the user’s location. Typical applications include monitoring dams, bridges, steel or concrete structures, tunnels, mines, railway tracks, embankments, slopes, pile testing, flood control, etc.

ARGUS MONITORING SOFTWARE

ARGUS Monitoring Software is a web-based data management, calculation and presentation software. It provides a reliable and cost efficient method for processing and monitoring ASCII files with numerical data. ARGUS will handle all data processing requirements, starting with storage of data into a MySQL database, then performing the required calculations on the data, presenting the results in graphical and numerical format, generate alarm messages, creating automated PDF reports and much more.

ARGUS Monitoring Software is server based. Users interact with the software using their web-browser. Working with ARGUS is therefore platform independent and can be accomplished from the local network or, when connected to the internet, from any location in the world.

Instead of purchasing the software to run on your own server, INTERFELS also provides hosting services for your projects (i.e. for a monthly rental fee you will have access to your ‘website’ running ARGUS Monitoring Software).

ARGUS FEATURES

- Multiple users per project, no licences to pay for additional users, no software to install on PCs
- 8 different plot types being time-based, coordinate based, sensor vs sensor, a 2-plot combination and a 3-plot combination
- Unlimited amount of plots (pre-defined) per project – dynamic updating of plots with latest data
- Zoom in on an area of the plot to obtain more detail
- Download data from the plot in zipped tab-separated format for import in spreadsheet applications
- Multiple views of the project (user specified images for example CAD drawings or project photos) with measurement value and sensor status displayed on top
- Create backups & archives from data and configuration settings in the database
- Add-ins/Plug-ins add project specific functionality like inclinometer, Filemanager or Logbook Addin to exchange additional project information
- Support for multiple languages currently for Dutch, German, English, French, Chinese, Spanish and Finnish, easily expanded with new languages
- Datum readings can be applied in the sensor configuration or in the plot, allowing both absolute and relative evaluations simultaneously
- Consistent further development to satisfy new upcoming requirements

MORE ARGUS FEATURES

- Multiple views of the project (user specified images for example CAD drawings or project photos) with measurement value and sensor status displayed on top
- Automated & manual import of ASCII files with measurement data, manual input of single measurements
- Watchdog function to generate an email alarm in case of “no data received since x minutes”
- Build complex formulas with references to any sensor in the project
- Create ‘virtual sensors’ to calculate specific values like averages, absolute or relative measurements, corrected and uncorrected data, etc.
- Apply filters and filter out “bad” data, minimum and maximum values and mean values
- Configure up to 8 alarm levels per sensor – alarm level changes and confirmations are issued via E-Mail and can also be received on mobile phones by using the email2SMS service of your mobile phone operator.
- Detailed alarm & alarm confirmation logging including username, remark, alarm value and confirmation time
- Automatic generation of PDF reports (daily, weekly, monthly) issued via E-Mail which may include up to 12 plots per report, sensor values, alarms and text
- Create and set privileges for users and email groups (to receive the alarms & PDF reports)
- ASCII export can be configured to automatically export calculated data in ASCII files for import in third party databases
- Create backups & archives from data and configuration settings in the database
- Add-ins/Plug-ins add project specific functionality like inclinometer, Filemanager or Logbook Addin to exchange additional project information
- Support for multiple languages currently for Dutch, German, English, French, Chinese, Spanish and Finnish, easily expanded with new languages
- Datum readings can be applied in the sensor configuration or in the plot, allowing both absolute and relative evaluations simultaneously
- Consistent further development to satisfy new upcoming requirements
- And much more...

Please refer to the ARGUS website for additional information: www.argusmonitoringsoftware.com

INTERFELS uses the highest quality cables, manufactured to German and EC standards. They have excellent electrical properties, are waterproof and suitable for burial in soil or concrete over long periods of time. Typically, the cables are armoured (especially in earth dams) with a high resistance to tensile loading. PU sheathing provides waterproofing (although other jackets are available) and shielded pairs with drain wires provide for electrical noise protection. Cables with 2 up to 48 conductors are available.

FEATURES

- Interfels GmbH 2010/11
- www.interfels.com
**SPECIFICATIONS**

**MAGNETIC EXTENSOMETER**

- **APPLICATIONS**
  - The Magnetic Probe Extensometer is a simple and inexpensive method for monitoring large magnitudes of settlement and heave in excavations, fills, foundations, dams and embankments. It is also adaptable for installation behind retaining walls, sheet pile walls and slurry walls, and above underground openings including tunnels and shafts.

- **FEATUERS**
  - Reliable, accurate, simple to install and operate
  - Multiple points can be monitored at little extra cost and without changing the borehole diameter
  - Magnet targets and sections of access tubing can be excavated or added
  - In conjunction with a biaxial inclinometer the system will yield a three-dimensional profile of movement
  - The magnetic probe reads the relative elevations of magnet targets installed permanently against the access tube in the ground

- **SPECIFICATIONS**
  - **Range**: 30m, 50m, 100m, 150m, 200m
  - **Resolution**: 1mm
  - **Repeatability**: ±2mm
  - **Operating temperature range**: -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/polypropylene coated
  - **Abel material**: stainless steel/polypropylene hub
  - **Battery life**: 12hrs continuous use
  - **Dependent on operator experience**

**MULTIPOINT BOREHOLE (MPBX) EXTENSOMETER**

- **APPLICATIONS**
  - Multipoint borehole rod extensometers serve to measure lengths between one or more anchor points in a borehole and a reference head at the borehole collar. They ensure high precision, even at great installation depths. Typical areas of application include the monitoring of:
  - Movements of rock and soil, caused by fracturing, landslides and weathering
  - Underground settlements and deformations of foundations and abutments
  - Relaxation and deformation of rock around tunnel walls, shafts, pillars, roofs and caverns

- **FEATURES**
  - Robust and economical construction
  - Suitable for short or long term monitoring
  - Packer Anchors (for soil and fractured rock) or Grout Anchors (for solid rock)
  - Up to 5 measuring points per extensometer (6 on special request)

- **SPECIFICATIONS**
  - **Mechanical & automated versions**
    - **Extensometer Rods**: Fibreglass 10mmØ, PEH protective tubing 16x2mm
    - **Stainless Steel**: 14mm Ø, PEH protective tubing 20x2mm
  - **Packer Anchor**: Stainless Steel & Geotextile 3” Ø, 600mm length, 1-3 point extensometer, 65-90mm borehole size
  - **4” Ø**: 600mm length, 1-4 point extensometer, 90-120mm borehole size
  - **5” Ø**: 600mm length, 1-5 point extensometer, 110-145mm borehole size
  - **Grout Anchor**: Steel 600mm length, 20mmØ
  - **Mechanical Readout**: Dial Gauge 30+50mm
  - **Digital Calliper**: 130mm
  - **Automated Readout**: Potentiometric Displacement Transducers, 25mm, 50mm, 100mm range, voltage output + 4-20mA output
  - **VW Displacement Transducers**: 30mm, 50mm, 100mm
  - **Output Signal**: Potentiometric or 4-20mA

**MEASURING ANCHOR (TYPE MA25)**

- **APPLICATIONS**
  - Measuring anchors can be used in all underground cavities where the formation of a rock-supporting ring is intended by system anchoring. The measuring anchor is a combination of an anchor and an extensometer. Its task is to determine the ranges of depths, where the load is taken up due to loosening effects of the rock.

- **FEATURES**
  - Measuring anchors replace a system anchor
  - No extra borehole is required
  - The measuring anchors will be equipped with 4 measuring points as standard
  - Simple and robust mechanical readout
  - Electrical transducers and automatic data acquisition systems are available
  - The required borehole size is between 43mm and 50mm

**SPECIFICATIONS**

- **Standard lengths**: 2m, 3m, 4m, 4.5m, 6m, 9m (special lengths and models available on request)
- **Measuring lengths**: 0.5m to 9.0m
- **Diameter of Anchor**: 26mm
- **Diameter of equivalent system Anchor**: 22mm
- **Cross Section**: 418mm²
- **Material**: Steel
- **Maximum Tensile Load**: 250kN
- **Youngs Modulus**: 210kN/mm²
- **Manual Readout**: Dial Gauge, 30+50mm, Digital Calliper 130mm
- **Automated Readout**: Potentiometric Displacement Transducers, (depending on user’s experience)
- **Set of 4 Mini Potentiometric Transducers**
- **Measuring Range**: 10mm
- **Resolution**: 0.01mm
- **Output Signal**: Potentiometric or 4-20mA

**APPLICATIONS**

- Multipoint borehole rod extensometers serve to measure lengths between one or more anchor points in a borehole and a reference head at the borehole collar. They ensure high precision, even at great installation depths. Typical areas of application include the monitoring of:
  - Movements of rock and soil, caused by fracturing, landslides and weathering
  - Underground settlements and deformations of foundations and abutments
  - Relaxation and deformation of rock around tunnel walls, shafts, pillars, roofs and caverns

- **FEATURES**
  - Robust and economical construction
  - Suitable for short or long term monitoring
  - Packer Anchors (for soil and fractured rock) or Grout Anchors (for solid rock)
  - Up to 5 measuring points per extensometer (6 on special request)
APPLICATIONS
The INCREX (Incremental Extensometer) system utilises the well proven electro-magnetic induction principle and, together with inclinometer casing, facilitates highly accurate measurements of ground movements in the direction of the borehole axis.

Typical applications include the monitoring of:
- Vertical and lateral deformations around underground openings
- Settlement in differing ground layers especially in near surface tunnelling
- Settlement during construction of dams
- Settlement due to subsurface erosion formed by the dissolution of soluble rocks
- Stability of caverns in underground mines
- Monitoring settlement and heave in the foundations of dams and power plants

FEATURES
- High accuracy and resolution
- Operable with orientation varying from vertical to horizontal
- Utilises 70mm inclinometer casing
- Dedicated software for mapping profiles of settlement/heave along the borehole axis
- When combined with inclinometer data allows determination of 3-dimensional deformation profiles

SPECIFICATIONS
- Measuring range (at each point) ± 20mm
- Sensor resolution 0.001mm
- Overall system accuracy ± 0.02mm
- Sensor accuracy ± 0.01mm
- Operating temperature -5 to +105°C
- Water ingress protection IP68 to 1500kPa
- Probe outside diameter 46mm
- Probe overall length 1550mm
- Probe weight 5.0kg
- Gauge length 1m

APPENDIX
1. Of the micrometer
2. Dependent on operator experience

DIGITAL TAPE EXTENSOMETER
APPLICATIONS
For quick and accurate measurement of relative distances between pairs of reference points on the surfaces of structures including:
- Radial movements and convergence of tunnels, shafts, linings and caverns
- Deformation of excavations in underground power houses, caverns and adits
- Displacements of retaining walls, cuttings, bridge piers, arches and abutments

FEATURES
- Lightweight and rugged design which can be easily read and operated by one person
- Precision punched stainless steel tape incorporating a repeatable tensioning system and digital readout unit
- One unit reads at many locations
- Variety of reference studs available

SPECIFICATIONS
- Range 20m or 30m
- Accuracy ± 0.001mm
- Resolution 0.001mm
- Repeatability ± 0.001mm
- Operating temperature -5 to +40°C
- Tape tension 1 kg
- Optical tension indicator
- Weight excluding tape 1 kg
- Power off automatic (after 10 minutes of no use)
- Power on automatic (upon movement of the micrometer)

CONVERGENCE TAPE KM
APPLICATIONS
The convergence tape is used for measuring:
- Stress relieve in the walls of underground openings such as caverns, tunnels and shafts
- Movement of walls in foundation pits
- Distortion, lifting or displacement of structures

FEATURES
- Compact and lightweight
- Can be operated with one person
- Stainless steel measuring tape
- Easy to read digital gauge
- One unit reads at many locations
- Variety of convergence bolts available
- Repeatable Measurements
- The convergence tape provides repeatable measurements over spans up to 30 metres
- Economic design: Calibrations can be performed on-site as well as the easy replacement of the various components

SPECIFICATIONS
- Range 15m (KM 15) or 30m (KM 30)
- Reading accuracy ± 0.01mm
- Resolution 0.01mm
- Repeatability ± 0.1mm
- Operating temperature -10 to +60°C
- Tensioning force 120N (KM 15)/200N (KM 30)
- Tape Material Stainless Steel
- Weight of system 4 kg
- Dimensions 650 x 100 x 300 mm
- Gauge length 12 mm

1. Of the micrometer
2. Dependent on operator experience
JOINT/CRACKMETER

**JOINT/CRACKMETER**

**APPLICATIONS**
The Jointmeter is designed to measure movement in three axes across any joint, if it is a construction joint in concrete or a tension crack in rock.

**FEATURES**
- Highly accurate and robust design
- Easy installation and excellent long term stability
- Fully waterproof to IP68
- Option for fitting a thermometer enables examination of temperature effects
- Options for manual or remote monitoring
- Good accuracy achievable with cable length in excess of 1 km

**SPECIFICATIONS**
- Maximum Joint Size 350mm
- (other available on request)
- Measuring Range (mechanical) 12.5mm (in each direction), 50mm dial gauge/130mm digital gauge
- Measuring Range (electrical) 12.5mm (in each direction), Transducers 8mm and 25mm
- Resolution1 0.025% full scale
- Accuracy ±0.2% full scale
- Temperature range -20 to +80°C
- Material Stainless Steel
- Dimensions 380x100x100mm (mechanical), 420x150x150mm (electrical)

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**VIBRATING WIRE CRACKMETER**

**APPLICATIONS**
The Vibrating Wire Crackmeter is designed for measuring movements across the surface cracks and joints in soil, rock, concrete, asphalt, etc. This is particularly useful for the early warning of performance problems or the effects of nearby excavation or construction activities on existing structures.

**FEATURES**
- Good accuracy achievable with cable
- Strong, flexible armored cable
- Corrosion resistant frames and stainless steel measuring/reference points
- Remote and automated monitoring
- Accurate, robust and very good long term stability
- Easy installation and excellent long term stability
- Fully waterproof to IP68
- Option for fitting a thermometer enables examination of temperature effects
- Options for manual or remote monitoring
- Good accuracy achievable with cable length in excess of 1 km

**SPECIFICATIONS**
- Maximum Joint Size 350mm
- (other available on request)
- Measuring Range (mechanical) 12.5mm (in each direction), 50mm dial gauge/130mm digital gauge
- Measuring Range (electrical) 12.5mm (in each direction), Transducers 8mm and 25mm
- Resolution1 0.025% full scale
- Accuracy ±0.2% full scale
- Temperature range -20 to +80°C
- Material Stainless Steel
- Dimensions 380x100x100mm (mechanical), 420x150x150mm (electrical)

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**VIBRATING WIRE COMBINATION CRACKMETER**

**APPLICATIONS**
The Vibrating Wire Jointmeter is ideal for measuring movement of joints in mass-concrete structures.

**FEATURES**
- Highly accurate and robust design
- Easy installation and excellent long term stability
- Versatile to accommodate any lateral movement up to 11 mm
- Option for fitting a thermometer enables examination of temperature effects
- Options for manual or remote monitoring of the output
- Good accuracy achievable with cable length in excess of 1 km
- Strong, flexible armored cable

**SPECIFICATIONS**
- Maximum Joint Size 350mm
- (other available on request)
- Measuring Range (mechanical) 12.5mm (in each direction), 50mm dial gauge/130mm digital gauge
- Measuring Range (electrical) 12.5mm (in each direction), Transducers 8mm and 25mm
- Resolution1 0.025% full scale
- Accuracy ±0.2% full scale
- Temperature range -20 to +80°C
- Material PVC/316 grade stainless steel
- Dimensions 380x100x100mm (mechanical), 420x150x150mm (electrical)

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**VIBRATING WIRE PERIMETRIC JOINTMETERS**

**APPLICATIONS**
The Vibrating Wire Perimetric Jointmeter has been designed specifically for use on concrete-faced dams to measure movement across the perimetric joint between the concrete face and pitlin, either perpendicular or parallel to the perimetric joint, in the plane of the concrete face or normal to it.

**FEATURES**
- Accurate, robust and very good long term stability
- Corrosion resistant frames and stainless steel measuring/reference points
- Cable lengths in excess of 1 km possible
- Remote and automated monitoring

**SPECIFICATIONS**
- Maximum Joint Size 350mm
- (other available on request)
- Measuring Range (mechanical) 12.5mm (in each direction), 50mm dial gauge/130mm digital gauge
- Measuring Range (electrical) 12.5mm (in each direction), Transducers 8mm and 25mm
- Resolution1 0.025% full scale
- Accuracy ±0.2% full scale
- Temperature range -20 to +80°C
- Material PVC/316 grade stainless steel
- Dimensions 380x100x100mm (mechanical), 420x150x150mm (electrical)

---

**VIBRATING WIRE EMBEDMENT JOINTMETERS**

**APPLICATIONS**
The Vibrating Wire Embedment Jointmeter is designed for measuring movement of joints in mass-concrete structures.

**FEATURES**
- Highly accurate and robust design
- Easy installation and excellent long term stability
- Versatile to accommodate any lateral movement up to 11 mm
- Option for fitting a thermometer enables examination of temperature effects
- Options for manual or remote monitoring of the output
- Good accuracy achievable with cable length in excess of 1 km
- Strong, flexible armored cable

**SPECIFICATIONS**
- Maximum Joint Size 350mm
- (other available on request)
- Measuring Range (mechanical) 12.5mm (in each direction), 50mm dial gauge/130mm digital gauge
- Measuring Range (electrical) 12.5mm (in each direction), Transducers 8mm and 25mm
- Resolution1 0.025% full scale
- Accuracy ±0.2% full scale
- Temperature range -20 to +80°C
- Material PVC/316 grade stainless steel
- Dimensions 380x100x100mm (mechanical), 420x150x150mm (electrical)
### APPLICATIONS

The Vibrating Wire Load Cell is designed for the measurement of compressive and tensile loads in rock bolts. All cells are manufactured with a centre hole to accommodate rock bolts, tendons or anchor cables. For use as a solid centre load cell the instrument can be supplied with top and bottom load plates. Applications include:

- Structural beams and piles
- Tunnel lining segments and arch tunnel supports
- Internal bracing and tie-backs in deep excavations

### FEATURES

- Up to 16 resistance strain gauges in a Wheatstone Bridge configuration equally spaced in a stainless steel low profile cylindrical housing
- Effects of uneven and eccentric loads are minimised
- Accurate, robust with good long term stability
- Negligible temperature effects compared with oil-filled load cells
- Fast response time
- Suitable for remote reading and data-logging
- Connecting cable is strong, screened and flexible
- Not susceptible to partial collapse which can be experienced with leakage from hydraulic load cells

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Standard ranges</th>
<th>from 300kN to 2500kN (30 to 250 tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy(^1)</td>
<td>±0.25% full scale</td>
</tr>
<tr>
<td>Resolution(^2)</td>
<td>0.025% full scale minimum</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-20 to +80°C</td>
</tr>
<tr>
<td>Over-range capacity</td>
<td>150% full scale</td>
</tr>
<tr>
<td>Excitation</td>
<td>2-15VDC</td>
</tr>
<tr>
<td>Output Signal</td>
<td>voltage or 4-20mA</td>
</tr>
<tr>
<td>Over-range capacity</td>
<td>150% full scale</td>
</tr>
<tr>
<td>Ingress protection</td>
<td>IP66</td>
</tr>
</tbody>
</table>

1. System accuracy is dependent on load bearing conditions
2. Data logging

---

### APPLICATIONS

Strain Gauge Load Cells are ideally suited for measuring compressive and tensile loads in rock bolts, cable anchors and tendons. They can also be used with:

- Structural beams and piles
- Loads between tunnel lining segments and arch tunnel supports
- Internal bracing and tie-backs in deep excavations

### FEATURES

- Accurate, robust with good long term stability
- 3 to 6 gauges utilised depending upon the cell capacity
- High quality alloy steel, precisely machined and heat treated to provide a stable load bearing ring
- Effects from uneven and eccentric loads can be minimised
- Cables are strong, screened, flexible and can exceed 1km in length
- Fitted with thermistor to account for effect of temperature variations on the cell

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Standard ranges</th>
<th>from 100kN to 5000kN (10 to 500 tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Version Manometer</td>
<td></td>
</tr>
<tr>
<td>Accuracy(^1)</td>
<td>±1.0% full scale (at 23°C)</td>
</tr>
<tr>
<td>Electrical Version Transducer with 4-20mA output signal</td>
<td></td>
</tr>
<tr>
<td>Accuracy(^2)</td>
<td>±0.5% full scale (at 23°C)</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>10…30 VDC</td>
</tr>
<tr>
<td>Filling medium</td>
<td>Glycerine/Water</td>
</tr>
<tr>
<td>Cylinder stroke</td>
<td>0.5mm (maximum)</td>
</tr>
<tr>
<td>Material</td>
<td>galvanised steel</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-30° to +60°C</td>
</tr>
</tbody>
</table>

1. System accuracy is dependent on load bearing conditions
2. Data logging
VIBRATING WIRE EARTH PRESSURE CELL

APPLICATIONS
The Vibrating Wire Earth Pressure Cells provide useful information on the direction, distribution and magnitude of total stresses within a soil mass. The cell is equally applicable for measuring stresses at the contact surface between soil and structure.

Typical applications include measurement of:
- Total stress distribution within embankments and dams
- Contact pressures on diaphragm and retaining walls, piers and abutments
- Foundation bearing pressures
- Pressures on and within linings of underground excavations
- Stresses in rock walls in unfilled caverns and tunnels

FEATURES
- Accurate, reliable and robust with long term stability
- Rugged stainless steel construction
- Single and double active faces available
- Various ranges in terms of size and pressure available
- Good signal transfer with cable length in excess 1km
- Manual or automated monitoring

SPECIFICATIONS
- Standard ranges (kPa): 300; 500; 700; 1000; 1500; 2000; 3000; 4000; 6000; 10,000; 15,000
- Resolution: 0.025% full scale (minimum)
- Accuracy: ±0.1% full scale
- Linearity: ±0.1% full scale
- Temperature range: -20°C to +80°C
- Over-range capacity: 150% full scale
- Material: stainless steel or powder coated steel

VIBRATING WIRE CONCRETE STRESS CELL

APPLICATIONS
For the measurement of tangential and radial stresses in concrete and shotcrete tunnel linings:
- Pressures on and within linings of underground excavations
- Monitoring of the stress distribution within the rock

FEATURES
- A compensation tube is incorporated to expand the cell to offset effects of concrete hydration shrinkage
- Accurate, reliable and robust with long term stability
- Vibrating Wire technology allows for long cable lengths of over 1km
- Low, medium and high pressure ranges available
- Stainless steel cell construction
- Internal thermistor to monitor temperature variations
- Oil filled
- Readings can be taken with Vibrating Wire readouts, recorders or dataloggers

SPECIFICATIONS
- Standard ranges (kPa): 300; 500; 700; 1000; 1500; 2000; 3000; 4000; 6000; 10,000; 15,000
- Resolution: 0.025% full scale (minimum)
- Accuracy: ±0.1% full scale
- Linearity: ±0.1% full scale
- Temperature range: -20°C to +80°C
- Over-range capacity: 150% full scale
- Material: stainless steel

PUSH-IN VIBRATING WIRE PRESSURE CELL

APPLICABLE FOR MEASURING TOTAL EARTH PRESSURES IN UNDERGROUND EXCAVATIONS

APPLICATIONS
The Vibrating Wire Push-In Pressure Cell is suitable for measuring total earth pressures in clay soils. The incorporation of a Vibrating Wire Piezometer enables pore water pressure to be measured and therefore the effective stress can be determined. Used to monitor changes in earth pressure associated with the construction of excavations, embankments and dams.

FEATURES
- Radial, horizontal and vertical stresses around tunnels
- Total pressure within tailings dams
- Foundation bearing pressures
- The measurement of in-situ stresses in the ground prior to any construction

SPECIFICATIONS
- Standard ranges (bar): 3, 5; 7; 10; 15; 20; 30; 40; 50; 60; 80; 100
- Resolution: 0.025% full scale
- Accuracy: ±0.1% full scale
- Linearity: ±0.1% full scale
- Temperature range: -20°C to +80°C
- Over-range capacity: 2x range
- Material: powder coated steel

STRESS MONITORING STATIONS

APPLICATIONS
Stress Monitoring Stations comprise Total Pressure Cells (TPC) which are permanently installed in boreholes for measuring absolute stresses and stress changes in the ground. Typical applications are:
- Dimensional measurements of stress and stress changes during tunnel advance in TBM tunnelling
- Deep Injection/Grouting of Shafts, etc
- Monitoring of the stress distribution within rock or soil

FEATURES
- Accurate, reliable and robust with long term stability
- Different layouts/versions available (use of circular, tangential and/ or radial TPC)
- Measurement parallel to borehole axis and/ or perpendicular to borehole axis in different directions possible
- Low, medium and high pressure ranges available
- Frequency (VW) or 4-20mA Sensors available
- Readings can be taken with Portable readouts, recorders or dataloggers
- Stress Monitoring Stations can be equipped with additional Piezometer

SPECIFICATIONS
- Standard ranges (bar): 3, 5; 7; 10; 15; 20; 30; 40; 50; 60; 80; 100
- Resolution: 0.025% full scale
- Accuracy: ±0.1% full scale
- Linearity: ±0.1% full scale
- Temperature range: -10°C to +60°C
- Over-range capacity: 2x range
- Material: powder coated steel
- Output Signal: Frequency (VW) or 4-20mA Sensors available on request

- Interfels GmbH 2010/11
- www.interfels.com

Translated from German, provided by "Translate".
**READOUTS**

**VIBRATING WIRE DATA RECORDER**

**APPLICATIONS**
The Vibrating Wire Data Recorder is designed to measure most types of commercially available Vibrating Wire instruments requiring a sweep excitation signal. The recorder is robust and designed for use in harsh environments. A backlight is incorporated into the display for use in low light conditions. It is capable of storing and displaying the frequency signal from the instruments in either Hz or F²/1000.

The data recorder will also simultaneously measure the thermometer which is commonly incorporated into Vibrating Wire instruments and display the reading in °C.

**FEATURES**
- User selectable excitation ranges
- Date and time stamped data recording
- Storage capacity for 1920 reading sets
- Rechargeable battery
- Auto switch off after 15 minutes of non use
- The data recorder and associated electronics are housed in a shock-resistant and water-resistant case so it is well suited for harsh environments.

**SPECIFICATIONS**
- Resolution 0.1 in Hz and F²/1000
- Operating temperature -10 to +50°C
- Data recording units Hz, period, F²/1000 and engineering units

**4-20MA SENSOR HANDHELD READOUT**

**APPLICATIONS**
The 4-20mA sensor handheld readout is a portable, lightweight and robust unit capable of reading all commercially available two wire 4-20mA instruments. It is designed for one-handed operation for ease of use.

**FEATURES**
- Readout in mA
- Cost effective
- Compact case with protective holster
- Robust (1m drop test)
- Powered by rechargeable/replaceable 9V AA batteries
- Backlit display for night operation
- IP67 rated enclosure, encased in a protective rubber jacket ensuring the unit can survive the harshest of conditions

**SPECIFICATIONS**
- Resolution 0.01 in any of the selectable engineering units
- Operating temperature -10 to + 55°C
- Battery Life 18 hours typical, at 12 mA
- Loop Power while measuring mA 24V
- Battery Life 18 hours typical, at 12 mA
- Operating temperature -10 to +55°C

**TERMINAL BOXES**

**APPLICATIONS**
INTERFELS produces various types of terminal boxes according to project requirements. These are able to be used with almost any type of sensor.

**SMALL TERMINAL BOX – NON-SWITCHING**
- These boxes are inexpensive units for terminating Vibrating Wire, thermistors and 2 wire type instruments
- Manufactured 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 multicore cable. Standard units cater for 12, 24 or 48 instruments

**TERMINAL/JUNCTION BOX - SWITCHING**
- For projects that require multiple instrument cables to be integrated into a single multicore cable but also have the ability to take manual readings at this point
- Surge protection units are available on request
- Non standard terminal units and junction boxes can be produced to suit customers’ special requirements
Applications
The Hydrostatic Profile Gauge (HPG) comprises of a portable probe which is drawn through an access tube buried beneath an embankment or structure in order to monitor settlement or heave. This is particularly useful where large movements might be expected during or after construction such as on dams, roads, railways and storage tanks.

Features
- Wireless Bluetooth communication between the sensor and the PDA (Personal Digital Assistant) offering fast and simple data gathering
- For determination of settlement or heave profiles
- Enhanced PDA software offers ease of use and full data security
- The PDA will easily interface with most office systems and applications
- Surface mount electronics ensure long and trouble-free use in a site environment
- Special borehole lining (e.g. inclinometer casing) is not required

Specifications
- Range +1m to -3.5m
- Resolution 1mm
- Accuracy ±10mm
- Repeatability1 ±10mm
- Operating temperature -10 to +50°C

Features
- Wireless, simple to install and read
- Readout by optical survey of the top of the inner pipe or by measuring the length of added tube
- Monitoring of settlement parallel to construction progress
- Various sizes of settlement plates available
- Different lengths of stainless steel measuring rods available
- Measuring rods can simply be added to extend the measuring point
- Adapter for optical targets available

Specifications
- Settlemnt Plate-Dimensions 300x300mm, reinforced
- Settlemnt Plate-Material stainless steel
- Measuring rods-Dimensions Diameter 14mm, M12 thread, 0.5m, 1.0m, 1.5m lengths
- Measuring rods-Material stainless steel
- Protective Tubing PEH, 20x2mm
- Measuring head-Material stainless steel
- Adapter M12 to 3/8”

Features
- Reliable, simple to install and read
- No vertical rods or tubes to interfere with construction
- Manual or automated monitoring
- Measurements can be made beneath concrete and earth structures at locations, which are inaccessible to other types of instruments
- Available in borehole and trench type with ranges of 15m and 30m
VIBRATING WIRE SPOT WELDABLE STRAIN GAUGE

APPLICATIONS
Used for measuring strain in steel members, the strain gauge can be spot welded to load bearing beams, tunnel segments, struts, sheet pile walling and tendons. The gauge is adjustable to suit compression or tension.

For the measurement of strain in steel structures including:
- Piles
- Beams
- Bridges
- Reinforcement bars
- Suspension bars

FEATURES
- Removable coil unit
- Small, low profile design
- Accurate, easy to use with excellent long term stability
- Can be used with long cable lengths with no degradation of signal
- Thermistor incorporated in coil housing
- Suitable for remote reading and datalogging
- Over-voltage surge arrestor fitted to protect against electrical damage

SPECIFICATIONS
- Range: 3000 microstrain
- Resolution: 0.4 microstrain
- Accuracy: ±0.5% full scale
- Temperature range: -20 to +80°C
- Sensor material: stainless steel
- Waterproof: to 700kPa

VIBRATING WIRE ARC WELDABLE STRAIN GAUGE

APPLICATIONS
Used for measuring strain in steel members, load bearing beams, tunnel segments, struts, sheet pile walling and tendons. The gauge is adjustable to suit compression or tension.

For the measurement of strain in steel structures such as:
- Piles
- Beams
- Bridges
- Reinforcement bars
- Suspension bars

FEATURES
- Robust, reliable and easy to use
- Can be used with long cable lengths with no degradation of signal
- Thermistor incorporated in coil housing
- Suitable for remote reading and datalogging

SPECIFICATIONS
- Range: 3000 microstrain
- Resolution: 1 microstrain
- Accuracy: ±0.1% full scale
- Temperature range: -20 to +80°C
- Sensor material: stainless steel

VIBRATING WIRE CONCRETE SURFACE MOUNT STRAIN GAUGE

APPLICATIONS
For the measurement of strain in reinforced or mass concrete structures, including:
- Concrete members and struts
- Piles and mass concrete
- Monitoring of strain due to load
- Monitoring strain and load during construction and service life

FEATURES
- Robust, reliable and easy to use
- Strain gauge held with groutable mounting blocks
- Can be used with long cable lengths with no degradation of signal
- Strain gauge can be adjusted to allow for the most effective use of its range
- Thermistor incorporated in coil housing
- Suitable for remote reading and datalogging

SPECIFICATIONS
- Range: 3000 microstrain
- Resolution: 1 microstrain
- Accuracy: ±0.1% full scale
- Temperature range: -20 to +80°C
- Sensor material: stainless steel

VIBRATING WIRE REBAR/SISTERBAR STRAIN GAUGE

APPLICATIONS
The Vibrating Wire Rebar and Sisterbar Strain Gauges are designed to measure the strain in concrete. Both consist of a coil assembly and Vibrating Wire element with rebar extensions at both ends. Rebar Strain Gauges are welded into the reinforcement cage while Sisterbars can be installed alongside existing lengths of rebar within the cage. Primarily designed to be directly embedded in structures including:
- Mass concrete structures
- Caissons and cast in place concrete piles
- Diaphragms and slurry walls
- Concrete beams
- Bridges
- Foundation slabs

FEATURES
- Robust, reliable, waterproof and easy to use
- Can be used with long cable lengths with no degradation of signal
- Suitable for remote reading and datalogging
- Thermistor incorporated in coil housing

SPECIFICATIONS
- Range: 100/1500 microstrain
- Resolution: 0.4 microstrain
- Accuracy: ±0.5% full scale
- Temperature range: -20 to +80°C
- Length: 900mm
- Rebar diameters: 16mm to 40mm
- Sisterbar diameter: 12mm
- Material: steel

VIBRATING WIRE EMBEDMENT STRAIN GAUGE

APPLICATIONS
The Vibrating Wire Embedment Strain Gauge is used for measuring strain in concrete structures and is suitable for direct burial. Also used in:
- Piles
- Concrete beams and columns
- Bridges
- Tunnel segments
- Concrete foundation slabs

FEATURES
- Robust, reliable and easy to use
- Can be used with long cable lengths with no degradation of signal
- The gauge has low profile for installation to reduce the “inclusion effect”
- Suitable for remote reading and datalogging
- Thermistor incorporated in coil housing

SPECIFICATIONS
- Range: 3000 microstrain
- Resolution: 1 microstrain
- Accuracy: ±0.3% full scale
- Temperature range: -20 to +80°C
- Length: 1500mm
- Sensor material: stainless steel
- Diaphragm and slurry walls

STRAIN GAUGE SPOT WELDABLE

Waterproof to 700kPa

Active gauge length: 50.4mm

Temperature range: -20 to +80°C

Resolution: 1 microstrain

Range: 3000 microstrain

1. Dependent on readout

2. ±0.1% full scale with individual calibration, ±0.5% full scale with standard batch calibration

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www.interfels.com
**APPLICATIONS**

Highly accurate instrument for measuring temperature in concrete, soil and rock including:
- Monitoring the temperature during the curing of concrete
- Soil and rock temperature adjacent to ground freezing operations and liquid gas storage tanks
- Interpretation of temperature effects on other installed instruments
- Air temperature measurements on structure surfaces
- Interpretation of temperature related stress and volume changes in dams

**FEATURES**

- Accurate, robust, high resolution and good long-term stability
- Manual or remote readings
- Suitable for remote reading, scanning and datalogging
- Strong, screened and flexible connecting cable can exceed 1km

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Range</th>
<th>-20 to +80°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±0.5% full scale</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.03°C</td>
</tr>
</tbody>
</table>

1. Dependent on readout

---

**APPLICATIONS**

Resistance Temperature Sensors are used for the measurement of temperature in air, water, concrete, rock and soil including:
- Monitoring temperature evolution during concrete curing
- Soil and rock temperatures adjacent to ground freezing operations and liquid gas storage tanks
- Measurement of water temperatures in reservoirs and in boreholes
- Monitoring seasonal variations of temperature within the ground and structures
- Air temperature measurements on structure surfaces
- Interpretation of temperature related stress and volume changes in mass concrete structures (dams, etc.)
- Determination of critical moment for injecting of joints within mass concrete structures, such as concrete dams and storage tank bases

**FEATURES**

- Accurate, robust, high resolution and good long-term stability
- Different designs for various measuring purposes available
- Robust housings
- Cost effective (AD592)
- Suitable for either manual or data-logged reading (Pt100)
- Provides precise, stable readings, even in demanding environments
- Robust case, LCD Display, Auto switch-off
- °C/°F Function, wide temperature ranges
- Accurate performance: 0.2% of reading
- SpeedRead – for quicker indicative readings
- Automatic zero calibration for added accuracy
- Last settings memorised
- Long battery life (500 hours typical)

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>P100</th>
<th>Range</th>
<th>±0.1°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.06°C</td>
<td></td>
</tr>
</tbody>
</table>

1. Dependent on readout

<table>
<thead>
<tr>
<th>AO102 (only for data-logging)</th>
<th>Range</th>
<th>±0.2°C of reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.15°C</td>
<td></td>
</tr>
</tbody>
</table>

1. Dependent on readout

---

**APPLICATIONS**

Used for reading manually all Pt100 Temperature Sensors (Thermocouples- and Thermistor. Readout on request) for different applications such as:
- Monitoring temperature evolution during concrete curing
- Soil and rock temperatures adjacent to ground freezing operations and liquid gas storage tanks
- Interpretation of temperature effects on other installed instruments
- Measurement of water temperatures in reservoirs and in boreholes
- Monitoring seasonal variations of temperature within the ground and structures
- Air temperature measurements on structure surfaces
- Interpretation of temperature related stress and volume changes in mass concrete structures, such as concrete dams and storage tank bases

**FEATURES**

- Provides precise, stable readings, even in demanding environments
- Robust case, LCD Display, Auto switch-off
- °C/°F Function, wide temperature ranges
- Accurate performance: 0.2% of reading
- SpeedRead – for quicker indicative readings
- Automatic zero calibration for added accuracy
- Last settings memorised
- Long battery life (500 hours typical)

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Range</th>
<th>-150 to +800°C // -238°F to +1472°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±0.2% of reading (±0.1°C // ±0.2°F over range -150 to +800°C // -238°F to +1472°F)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1°C</td>
</tr>
</tbody>
</table>

1. Dependent on readout
**ELECTROLEVEL (EL) TILTMETERT**

**APPLICATIONS**
The EL Tiltmeter is a narrow angle, high resolution device for monitoring changes in the inclination of a structure. Applications for the Tiltmeter include:
- Changes in inclination of a structure (heave or settlement) of the structure and any important differential movement can be identified. Typical applications include:
  - Effects of deep excavations and drilling wall construction on adjacent existing structures
  - Monitoring the movement and rotation of concrete dams, slope faces and crests
  - Ensure stability of structures affected by tunneling and mining activities
  - Evaluating the performance of bridges and beams under load

**FEATURES**
- Robust, simple and reliable
- High Resolution
- Uniaxial and biaxial versions available
- Easy to Install: The compact, low profile EL Tiltmeter fits nearly anywhere.
- Remote Readout: In construction-control applications, EL Tiltmeters are connected to a data acquisition system that continuously monitors movements and can trigger an alarm when threatening movements are detected
- Cost Effective

**SPECIFICATIONS**
- Range: ±3 arc degrees/±10 arc degrees
- Sensor Resolution: ±0.0003 arc degrees/±0.0005 arc degrees
- Sensor Symmetry: ±0.1° linear scale 2%
- Sensor Null Repeatability: <0.001 arc degrees
- Output Signal: ±2.5VAC/4-20mA
- Input Current (max): 10mA/30mA
- Sensor material: Ceramic
- Housing material: Polyglass
- Housing dimensions: 110x70x70mm
- Operating temperature: -20° to +70°C
- Ingress protection: IP66

---

**ELECTROLEVEL BEAM SENSOR**

**APPLICATIONS**
Electrolevel Beam Sensors offer an inexpensive and simple method for monitoring rotation in structures. A number of beams installed horizontally will provide a profile of vertical movements (heave or settlement) of the structure and any important differential movement can be identified. Typical applications include:
- Effects of deep excavations and drilling wall construction on adjacent existing structures
- Monitoring deformation within tunnels including convergence
- Monitor structures undergoing foundation treatment, compaction, grouting and underpinning
- Monitor structural stability in landslide areas

**FEATURES**
- Robust, accurate, simple and reliable
- Can be used vertically or horizontally
- Very cost effective as compared to other settlement profiling systems
- High resolution device for monitoring inclinations
- Versatile and suitable for many applications
- Options for manual reading or fully remote datalogging

**SPECIFICATIONS**
- Range: ±45 arc minutes (±13mm/m)
- Accuracy: ±0.1mm/m
- Resolution: 0.02° full scale
- Repeatability: ±0.005° full scale
- Excitation voltage: 2.5VAC
- Current consumption: <1mA
- Output signal: ratiometric AC
- Zero adjustment range: ±5° fine
- Adjustment: ±29° coarse
- Ingress Protection: IP66

---

**DIGITAL PORTABLE TILTMETERT**

**APPLICATIONS**
The Digital Portable Tiltmeter offers a versatile means for measuring tilt in almost any structure revealing potential hazards associated with structural instability. It also serves to assess any rotation caused by construction activities such as mining, tunneling, excavation and soil compaction. Other typical applications include:
- Monitoring rotation in buildings, dams, embankments and open pits, retaining walls, landslides, rock masses and pipelines

**FEATURES**
- Compact, lightweight, rugged and reliable using proven solid state electronics
- Utilisation of Bluetooth technology offers a totally cable-free solution for taking readings
- Enhanced PDA software allows defining a site with the relevant tilt-plates, taking readings, downloading data and transferring the results to a PC
- Unlimited number of monitoring points using as many inexpensive tilt-plates and only one Tiltmeter
- Heavy duty tilt-plates are dimensionally stable and weather resistant
- Easily installed with rapid data gathering by one person

**SPECIFICATIONS**
- Range: ±10°
- Accuracy: ±0.05° full scale
- Resolution: <0.004°
- Repeatability: ±0.004°
- Excitation voltage: ±0.001°
- Weight: ±0.0012°
- Operating temperature: -20 to +50°C
- Dimensions: 160mm x 135mm x 150mm
- Battery life: >12hrs continuous use

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**BASSETT CONVERGENCE SYSTEM**

**APPLICATIONS**
The Bassett Convergence System (BCS) is an effective tool in monitoring the performance of tunnels and underground openings. The system was developed by Dr. Richard Bassett. Specific applications include:
- Ensuring safety during construction and controlling the rate of construction
- Verifying that actual performance conforms to predictions
- Monitoring the effects of nearby construction activities and any other ground movements

**FEATURES**
- Rapid determination of deformation profile ensures continuous safety of tunnel users
- The System is installed close to tunnel walls and can be shaped to bypass obstructions or allow extra clearance for normal traffic flow
- The BCS can complete a survey of a tunnel section, process the readings and generate displacement data
- Data reduction, processing and presentation software is available. The software applies sensor calibration factors, performs necessary calculations and generates screen displays for up to 99 BCS rings
- Customised software displays deformation profile in near real time
- Fully automated logging system
- Insensitive to variations in the refractive index of air in the tunnel
- Tolerant to vibrations, temperature fluctuations and electromagnetic emissions
- Near real-time data

**SPECIFICATIONS**
- Short arm sensor: Range: ±173.65mm/metre (±10 arc degrees)
  - Resolution: 0.0089 full scale
  - Accuracy: ±0.05° full scale
- Long arm sensor: Range: ±34.9mm/metre (±2 arc degrees)
  - Resolution: 0.0089 full scale
  - Accuracy: ±0.05° full scale

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WATER APPLICATIONS

Placed in boreholes or embedded infill materials, the Pneumatic Piezometer is a low cost instrument used for the measurement and control of water pressures in soil and rock, including:

- Stability investigations of natural and cut slopes
- Control of permeability testing, de-watering and drainage
- Monitoring water table elevation
- Construction control and stability monitoring of tunnels and other underground works
- Stability monitoring of foundations, embankments and dams

FEATURES

- Short response time even in low permeability soils such as clay
- Excellent stability
- High and low air entry filters available
- Simple, accurate and reliable design with over 50 years of use worldwide

SPECIFICATIONS

- Range from -5m to +100m head of water
- Accuracy ±2% full scale
- Filters ceramic, 60 micron and 1 micron
- Diameter 27mm (borehole); 35mm (embankment)
- Lengths 200mm (borehole); 270mm (push in); 210mm (embankment)
- Temperature range -10 to +60°C

PNEUMATIC PIEZOMETER

VIBRATING WIRE PIEZOMETER

APPLICATIONS

The Vibrating Wire Piezometer is used for the long term, accurate measurement of pore water pressures in partially or fully saturated soils or rock. Typical applications include:

- Monitoring pore water pressures to determine slope stability
- Monitoring pore water pressures to determine safe rates of fill or excavation
- Monitoring the effects of dewatering systems used for excavations
- Monitoring pore pressures to check the performance of earth fills and embankments
- Map subsurface water flow and to predict both the volume of water in an aquifer and its recharge rate

FEATURES

- Application specific versions are available for installation in soil, boreholes and open wells or for placement in infill material
- Accurate, reliable and robust with long term stability
- Rapid Response
- All VW Piezometers are equipped with a Thermistor
- Good signal transfer with cable length in excess of 1km
- Manual or automated monitoring

SPECIFICATIONS

- Standard ranges (bar) 3.5; 5; 10; 15; 20; 40
- Material 316 grade stainless steel
- Accuracy ±0.1% full scale
- Linearity ±0.5% full scale
- Resolution 0.025% full scale (minimum)
- Over range 2x range
- Filter Types Sintered stainless steel 5µ (borehole); push in P
- Ceramic 1µ (embankment P)
- Diameter 27mm (borehole); 35mm (embankment)
- Lengths 200mm (borehole); 270mm (push in); 210mm (embankment)
- Temperature range -10 to +60°C

4-20MA BOREHOLE PIEZOMETER

APPLICATIONS

The INTERFELS 4-20mA Piezometers are designed for accurate measurement of pore water pressures in fully or partially saturated soil and rock. The borehole version is a general purpose Piezometer. Typical applications include:

- Monitoring pore water pressures to determine safe rates of fill or excavation
- Monitoring the effects of dewatering systems used for excavations
- Monitoring pore water pressures to determine slope stability
- Map subsurface water flow and to predict both the volume of water in an aquifer and its recharge rate
- Monitor streams for forestry, agriculture, power companies and metropolitan water districts

FEATURES

- Piezometer comprises a porous/ sintered stainless steel filter tip element integral with a diaphragm type piezoresistive pressure transducer
- Sensor and electronics are stored in proof stainless steel housing
- 4-20mA borehole Piezometer is available for absolute and for relative (no barometric reference measurements required) measurement
- Piezometer for absolute measurements is equipped with a Thermistor

SPECIFICATIONS

- Standard ranges (bar) 1; 2; 5; 10; 20
- Material 316 grade stainless steel
- Accuracy ±0.25% full scale
- Supply voltage 12–30VDC
- Output Signal 4–20mA
- Filter Types Sintered stainless steel
- Filter Size 5µ
- Diameter 22mm
- Lengths 200mm (borehole); 160mm (embankment)
- Weight (without cable) 300g
- Temperature range -10 to +80°C

Total system accuracy is limited by the type of readout used.
STANDPIPE PIEZOMETER

APPLICATIONS
Standpipe Piezometers offer a simple and economic method for measuring water pressures in soil and rock.
Typical applications include monitoring of water pressures for the control or assessment of:
- Stability of natural or cut slopes
- Performance of vertical drains, sand drains, and dynamic compaction
- Dewatering and drainage schemes
- Performance of earthfill dams and embankments
- Containment systems at landfills and tailings dams
- Seepage and ground water movements in embankments, landfill dykes and dams
- Uplift pressures in dams or other foundations when fitted with a Bourdon Gauge

FEATURES
- Simple and reliable long term measurement of pore water pressures
- Manual reading using water level meters or automated reading by installing a pressure transducer down the standpipe
- Maintenance possible using downhole video cameras
- In conjunction with Bourdon type gauges allows measurement of uplift or artesian pressures

SPECIFICATIONS
- Porous plastic tip
  - 300/1000mm x 32mm diameter
  - 60 micron filter
- Drive-in tip
  - 300mm x 43mm diameter
  - 60 micron filter

WATER LEVEL LOGGER

APPLICATIONS
- For the measurement of water levels in wells, open standpipes and boreholes in soils and rock, including:
  - Site investigations
  - Water levels in open boreholes
  - Control of dewatering and drainage operations
  - Hydrological and hydro-geological investigation of water resources
  - Stability investigations of natural and cut slopes
  - Pollution and environmental studies
  - Pumping tests

FEATURES
- Shrouded probe available in 12mm and 16mm diameters
- Reliable, simple to operate and read
- Visual or audio indication when probe makes contact with the water
- Battery operated, lightweight, portable and robust
- Design of tape prevents sticking to borehole sides
- Components are protected against corrosion and mechanical damage
- One instrument reads at many locations
- Replacement tape available

SPECIFICATIONS
- Probe type: shrouded
- Probe diameters: 12mm and 16mm
- Probe length: 230mm
- Material: stainless steel
- Tape material: polypropylene coated
- Width: 9.4mm
- Graduations: mm/cm
- Indicators: audio & visual
- Sensitivity control: internal
- Battery life: 12 hours continuous use
- Real material: steel frame/polypropylene hub
- Weight: 380g
- Temperature range: -10 to +40°C

WATER LEVEL INDICATOR

APPLICATIONS
- Simple and reliable long term measurement of pore water pressures
- Manual reading using water level meters or automated reading by installing a pressure transducer down the standpipe
- Maintenance possible using downhole video cameras
- In conjunction with Bourdon type gauges allows measurement of uplift or artesian pressures

FEATURES
- Sensitivity control internal
- Indicators audio & visual
- Graduations mm/cm
- Weight: 60g
- Temperature range: -10 to +40°C

SPECIFICATIONS
- Probe type: shrouded
- Probe diameters: 12mm and 16mm
- Probe length: 230mm
- Material: stainless steel
- Tape material: polypropylene coated
- Width: 9.4mm
- Graduations: mm/cm
- Indicators: audio & visual
- Sensitivity control: internal
- Battery life: 12 hours continuous use
- Real material: steel frame/polypropylene hub
- Weight: 380g
- Temperature range: -10 to +40°C

V-NOTCH WEIR MONITOR

APPLICATIONS
- V-Notch (triangular) Weirs are typically installed in open channels such as streams to determine discharge (flow rate).
- They are ideally suited to the long term monitoring of drainage systems in dams & tunnels.
- The main component beneath the weir plate itself is on the one hand a cylindrical weight suspended from a Vibrating Wire force transducer. With a change in water level the changing buoyancy force on the cylinder acts directly on a Vibrating Wire transducer. Alternatively an Ultrasonic Water Level Sensor (distance transducer) can be used.

FEATURES
- Simple low cost and robust instrument
- Manual Readout possible
- Ultrasonic Water Level Transducer (4-20mA output)
- Vibrating Wire precision water level sensor (frequency output)
- Accurate and sensitive water level monitoring
- Low maintenance system
- Easy to automate via data acquisition and ARGUS monitoring software

SPECIFICATIONS
- Ultrasonic Water Level Sensor
  - Range: can be calibrated between 100mm and 800mm
  - Resolution: 0.25mm
  - Repeatability: 0.25mm
  - Linearity: <0.5% full scale
  - Operating temperature: -20 to +90°C
  - Output Signal: 4-20mA
- VW Buoyancy Water Level Sensor
  - Range: 300mm
  - Resolution: 0.25% full scale (minimum)
  - Accuracy: ±0.5% full scale
  - Components: ±0.5% full scale
  - Operating temperature: -5 to +60°C
  - Dimensions: (sensor only) 150 x 32mm
  - Weight: (sensor only) 600g

1. Dependent on readout
2. Linearity
3. Resolution
4. Temperature over long periods of time.
5. Battery powered instrument designed to record pressure/ water depth and temperature over long periods of time.
6. Typical applications for the water level logger are:
   - Environmental projects
   - Mining and open-pit mining
   - Construction sites, Tunneling projects
   - Monitoring of aquifers, Pumping tests
   - Water reservoirs, Lakes and rivers
7. Reliable, simple to operate and read
8. Battery Life: The lithium battery allows pressure measurement of uplift or artesian pressures
9. One instrument reads at many locations
10. Replacement tape available
11. Easy of use: The lithium battery is field replaceable and the software is easy to understand
12. Reading capacity: The Water level logger can be recorded only when it is required (at pre-set events or changing water levels).
13. Memory: The lithium battery allows ten-year operation based on one reading per hour
14. Compensated version available
15. Easy to automate via data acquisition and ARGUS monitoring software
FURTHER INSTRUMENTS/ SERVICES AVAILABLE FROM INTERFELS

- Weather Stations
- Wireless Sensors
- Liquid Leveling Systems
- Seismic Measurement
- Vibration Measurement
- In-Situ Instruments
- Geodetic Equipment
- Hydrometric Equipment
- Rentals
- Technical Services