innovation in
geotechnical
instrumentation

CATALOG
geotechnical instruments

GEOTECHNICAL . MINING . ENVIRONMENTAL . STRUCTURAL

www.rstinstruments.com

innovation in geotechnical instrumentation

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PROFILE

Headquartered in Maple Ridge, British Columbia, Canada, RST Instruments Ltd. has been at the forefront of the engineering instrumentation industry since 1977. RST has established itself as a world leader in the manufacturing and distribution of quality geotechnical, mining, environmental and structural monitoring equipment.

From the conceptual design of site-specific products to the exceptional post-sale calibration and repair service offered by the company's technical department, RST's commitment to client satisfaction is a goal common to staff, management, and distributors alike.

RST is committed to developing new products to meet our customer's needs, offer the highest quality instrumentation possible, and provide the necessary technical support and field-proven engineering experience.

Custom Development

More than half of all instruments manufactured at RST Instruments are specifically engineered to meet individual project requirements. We are capable of providing custom engineered solutions to site-specific problems, either on a design-build basis or in co-operation with the client. Many of RST's products have been designed in conjunction with client input following field-testing or based on project requirements. In-depth technical support is provided, and senior staff members are always available to work with clients until a solution is found to meet the project requirements.

Complex data acquisition systems are a specialty for RST since our flexDAQ Dataloggers allow for a custom design for each monitoring project.

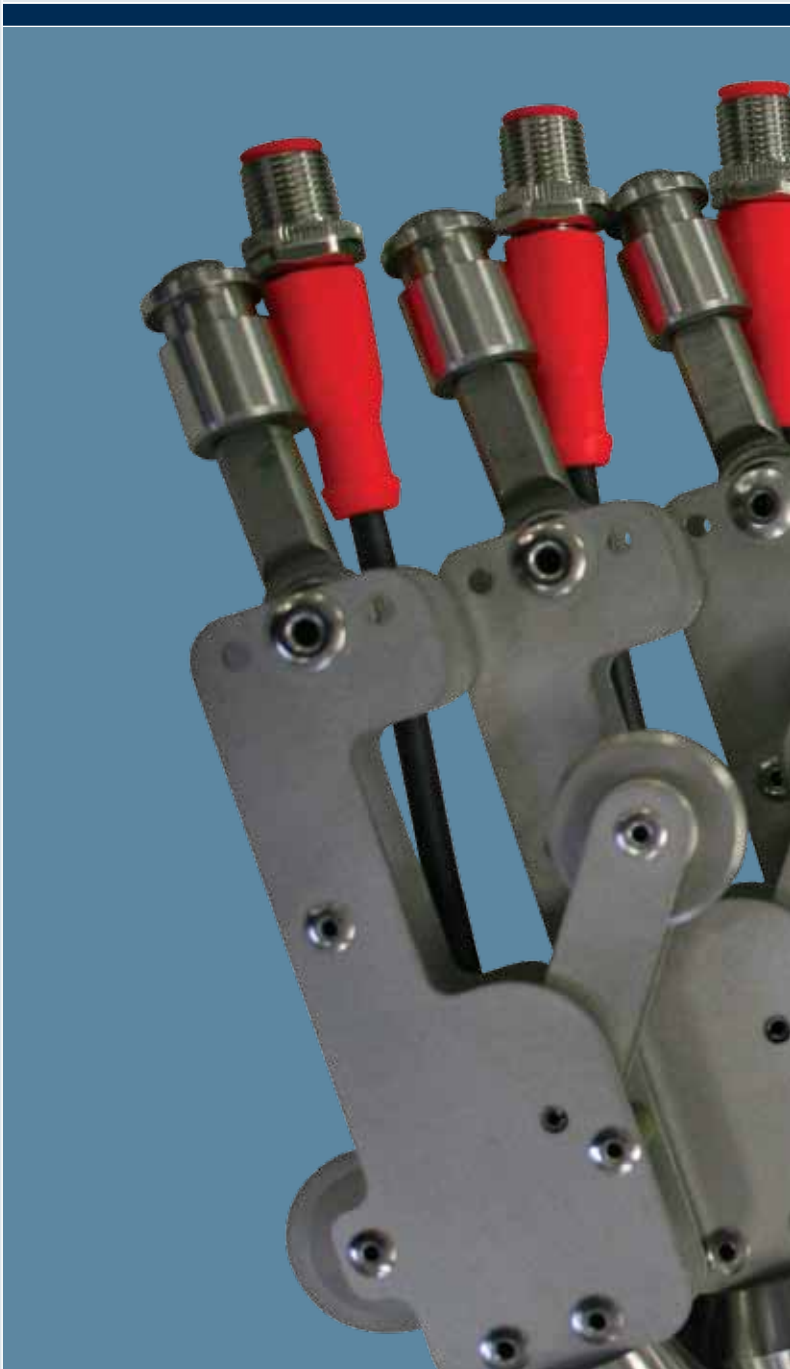
Technical Assistance and Field Services

RST's senior staff members offer a combined total of over 100 man-years of geotechnical instrumentation experience. Our team consists of highly trained and experienced professionals who are available to provide and assist you in:

- Selection of instrumentation
- Training
- Installation
- Inspection and troubleshooting
- Supervision
- Modernization and optimization of existing monitoring systems

Rental Units

Various instrument rentals are available for water level meters, data loggers & readouts, load cells, packers, pumps, water quality meters and seismographs. All rental units are subject to availability. RST provides same day shipping and no calibration fees. Daily, weekly and monthly rental rates are available.



QUALITY

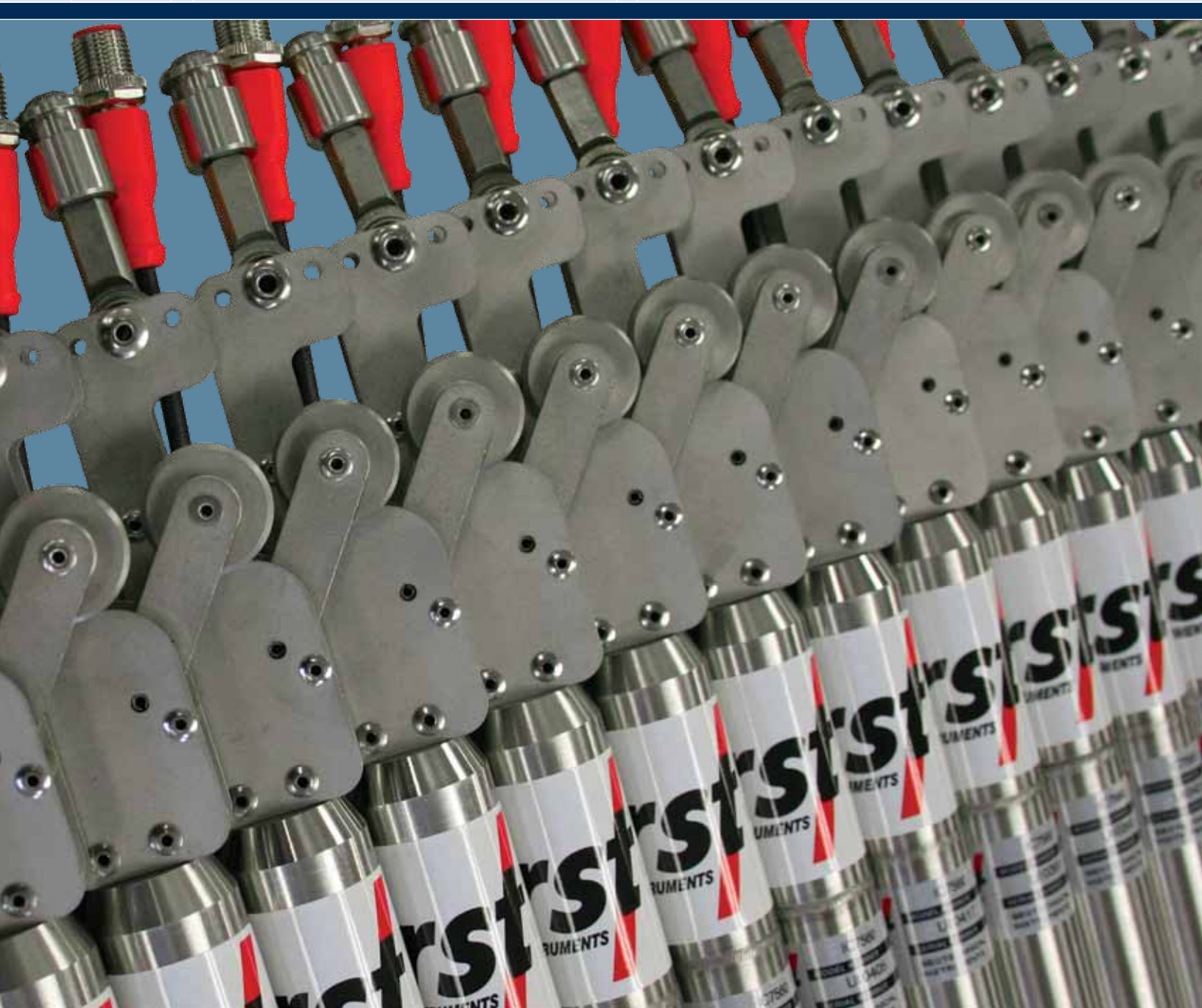
Certified System ISO 9001

The RST Instruments Ltd. management system is certified to ISO 9001. The ISO 9001 certification is established on evidence of absolute corporate commitment to quality in management responsibility, design control, inspection and testing, internal quality audit procedures, training and servicing. With ISO 9001 certification, RST Instruments Ltd. guarantees to customers that a quality control management system is in place and being strictly followed.

POLICY

"It is our stated policy to provide the highest standards in product and service quality. It is a matter of pride to us that we provide first class quality instrumentation that is excellent by international standards and meets our performance commitments."

Robert Taylor, P.Eng.
President



rst INSTRUMENTS

innovation in geotechnical instrumentation

PRODUCTS

Cross-Compatibility

RST Instruments Ltd. conveniently manufactures many geotechnical instruments that are designed to be used in conjunction with other RST products. To assist you with recognizing our cross-compatible products, the words “WORKS WITH” is displayed above each product logo that can be used with other associated products. Here is a list of these logos used throughout this catalog:

WORKS WITH C108 pneumatic readout

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH single channel vw datalogger

WORKS WITH TH 2016B thermistor readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped “ready to run”

WORKS WITH DIGITAL MEMS INCLINOMETER SYSTEM

WORKS WITH inclinalysis digital inclinometer analysis software

WORKS WITH VIBRATING WIRE & THERMISTOR DATA LOGGER SERIES

WORKS WITH rstar ARRAY RADIO SERIES

WORKS WITH GeoViewer REAL-TIME MONITORING

Product Categories

In addition, all products are assigned to their relevant category and have been designated recognizable icons which are displayed on the left and right side of each page. These icons are shown below with their respective category names:

- inclinometers + tilt sensors
- piezometers + transducers
- readouts + dataloggers
- borehole packers + accessories
- grout flow monitors
- load + stress + pressure
- extensometers + convergence
- settlement systems
- thermistors + temperature systems
- environmental products + pipe
- analysis software
- vibration + overpressure
- carlson concrete instruments

PROJECTS

RST Instruments Ltd. is proud to have been, and currently remains, key international suppliers of Geotechnical Instruments for major engineering projects. The list shown here is only representative of a small portion of our entire list of projects that we have been involved with since 1977. Please contact RST for complete information regarding the scope of all our projects.

DAMS & HYDROPOWER

- La Yesca Dam - Mexico
- Buhang Dam - South Korea
- El Zapotillo Dam - Mexico
- Punta Negra Dam - Argentina
- El Bato Dam - Chile
- Guandi Dam - China
- Lampao Dam - Thailand
- Xiluodu Dam - China
- Song Tranh 2 Dam - Vietnam
- Yechon Pumped Storage HPP - South Korea
- Cua Dat Dam - Vietnam
- Shuanggou Hydroelectric Project - China
- Egat and Rid Dams Upgrade - Thailand
- Song Ba Ha Hydropower Project - Vietnam
- Pleikrong Hydropower Project - Vietnam
- Gampo Dam - Korea
- Yixing Pumped Storage - China
- Corumba Dam IV & Hydroelectric Scheme - Brazil
- Ralco Dam - Chile
- Terzaghi Dam - Canada
- WAC Bennett Dam - Canada
- Seven Mile Dam - Canada
- Gardiner Dam - Canada
- Brilliant Dam Expansion Project - Canada
- Greater Vancouver Regional District, Cleveland Dam - Canada
- Seymour Falls Dam, Seismic Upgrade - Canada
- Lajeado Dam - Brazil
- South Fork Tolt River Dam - USA
- Seven Oaks Dam - USA Army Corps. Of Engineers
- Tianhuangping Pumped Storage - China
- Mica Dam - Canada

INFRASTRUCTURE

- Tunnel Emissor Oriente - Mexico
- Gateway Program, Vancouver BC - Canada
- Marquette Interchange Project, Illinois - USA
- I-5 SB Plantable Geosynthetic Reinforced Wall, California - USA
- Taejon Test Tunnel - Korea
- Checkerboard Creek BC Hydro - Canada
- Trans Alta Utilities - Canada
- Caltrans – State Routes 880/262 - California, USA
- State Highway 130, Texas - USA
- Greater Vancouver Regional District, Highway 10 & 15 - Canada
- Border Infrastructure Program, Surrey BC - Canada
- President George Bush Turnpike Highway Project, Texas - USA
- CP Rail: Roger's Pass - Canada
- MTR – Hong Kong
- KCRC West Rail Contracts - Hong Kong
- Eastern Harbour Tunnel - Hong Kong
- Seoul Subway Corporation - Korea
- Highways Hong Kong Contract - Hong Kong
- Hong Kong Airport - Hong Kong
- Bakun - Philippines
- Petronas, Kota Kinnabalu - Malaysia
- Tseung Kwan O Building Development- Hong Kong
- MTRC Rail Extension, Tseung Kong O Line - Hong Kong
- Tung Hu Slope Monitoring Project - Taiwan

ALTERNATIVE ENERGY

- Shell Canada Energy - Canada
- Sakhalin Energy - Russia
- U1 Underground Oil Storage Project - Korea
- Trans Alta Utilities - Canada
- CNRL - Horizon Oil Sands Project
- Suncor Energy - Canada
- Syncrude - Canada
- Taichung Power Plant - Taiwan
- Electric Power Research Institute - Taiwan

MINING

- Codelco, Chuquicamata Division - Chile
- Yanacocha Mine - Peru
- Cerro Verde Mine - Peru
- Diavik Diamond Mines - Canada
- New Afton Mine - Canada
- Ekati Diamond Mine - Canada
- McArthur River Operation, Saskatoon - Canada
- Codelco, Andina, Chuqicamata Mine - Chile
- Georgetown Mine - Guyana
- Inco Ltd. (various mines) - Canada
- Highland Valley Copper - Canada
- Kumtor Gold Mine - Kyrgyzstan
- San Juan Mine, New Mexico - USA
- Pascua Lama Mine - Chile
- Quintette Coal Mine - Canada
- Konkola Copper Mines PLC - Zambia
- Sao Bento Mineracao - Brazil
- Cemento Melon, Mina Navio - Chile
- PT Kaltim Prima Coal - Indonesia
- Codelco, El Teniente Division - Chile
- Tara Mines - Ireland
- Island Copper Mine, BHP Ltd. - Canada

ENVIRONMENTAL

- San Jacinto River Project - USA
- Penny's Bay Reclamation - Hong Kong
- Sentosa Reclamation Project - Singapore
- Delaware Solid Waste Landfill - USA

OTHER PROJECTS

- District of North Vancouver, Berkeley Rd. Landslide - Canada
- Roger's Sugar Silo/Horizon Engineering - Canada
- Bema Gold Corporation - Russia
- Gaia - Canada

Northwest Wall Chaquicocha Open Pit – Minera Yanacocha – Peru, Subsidiary of Newmont

CONTENTS

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inclinometers and tilt sensors

fast facts: inclinometers + tilt sensors

RST Instruments Ltd. offers an array of inclinometers & tilt sensors. These types of instruments are used for many applications such as measuring lateral movement down in the earth; lateral deformation of concrete dams, tall structures and bridge piers; and tilt of structures in either one or two axial planes. Many of these instruments are designed to be permanently or temporarily installed to provide long term/short term observation with maximum resolution and sensitivity. Manual monitoring or remote data acquisition options are available for many instruments in this category.

MEMS TILT & INCLINATION SERIES

precision + durability

The MEMS Tilt & Inclination Series from RST Instruments Ltd., incorporates cutting edge MEMS (Micro-Electro-Mechanical Systems) technology in our complete line of tilt and inclination monitoring instruments. Compared to previous technologies, the new MEMS equipped models provide users with unmatched precision and higher durability. Digital bus is also available for all tilt sensors.

Digital MEMS Inclinometer System

A complete Digital MEMS Inclinometer System shown with included accessories. Ultra-Rugged Field PC shown with actual screenshot of Digital Inclinometer Software.

The Digital MEMS Inclinometer System uses a stainless steel MEMS inclinometer probe that is lowered into the inclinometer casing that may have become deformed from any lateral movement down in the earth.

The system is comprised of a MEMS Digital Inclinometer probe, cable system, reel with battery power, and an Ultra-Rugged Field PC that functions as a readout, analysis, and data storage device. Wireless communication between the inclinometer control cable and the Ultra-Rugged Field PC ensures ease of use and reliability.

Accessories included: data collection & transfer software, cable reel with case and spare battery, probe with carrying case, 12V automobile adapter and universal battery charger. The Ultra-Rugged Field PC ships with a rechargeable Li-Ion battery, USB cable, screen protector, and user documentation.

SPECS

Sensor Type	*Biaxial, MEMS Accelerometer* (Micro-Electro-Mechanical Systems)
Wheelbase	*0.5 m*
Probe Diameter	*25.4 mm*
Probe Length (including connector)	*710 mm*
Full-scale Range	*30 degrees* (other ranges available)
Repeatability	*±0.002°*
Data Resolution	*0.005 mm per 500 mm*
System Accuracy	*±2 mm per 25 m*
Memory	*>1,000,000 readings*
Temperature Rating	*-40°C to +70°C*
Probe Material	*Stainless steel*
Readout	*Ultra-Rugged Field PC*

WORKS WITH inclinalysis digital inclinometer analysis software

Inclinometer Casing

Inclinometer Casing is suited to be installed in boreholes, embankments, piles, set into concrete or attached to structures. The casing serves as an access tube to guide a MEMS-based probe in the two orthogonal directions of measurement. Changes in the output of the probe caused by the deformation of the casing, is proportional to the sine of the angle of inclination of the long sensor axis from vertical. These displacements are incrementally summed to provide profiles of total displacement versus depth.

RST Instruments manufactures two sizes of Inclinometer Casing in either “Snap Seal” or “Glue & Snap” coupling styles. Both provide alignment and displacement measurements in numerous applications.

Also available as an option in both sizes, High Endurance Casing offers a very homogeneous tubing with extra reinforcement at the location of the connection between casing sections in order to ensure maximal torsional, compressive and bending strength. The High Endurance casing is used in situations where extra robustness is required. Contact RST for more details.

SPECS

STANDARD CASING	
Length	*1.5 or 3 m* (5 and 10 ft. standard stock lengths)
Groove Spiral	*≤ 0.3 deg. / 3 m*
OD	*70 or 85 mm*
ID	*59 or 73 mm*
TELESCOPIC SECTION	
OD	*76.96 mm or 91.44 mm*
Compressed Length	*457 mm*
Extended Length	*609 mm*

WORKS WITH DIGITAL MEMS INCLINOMETER SYSTEM

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped “ready to run”

Probe Style In-place MEMS Digital Bus Inclinometer

Standard in-place inclinometers may not be able to track in casings deformed by active ground movement. The Probe Style In-place MEMS Digital Bus Inclinometer is designed to remotely monitor, and continuously measure, underground vertical movement as a result of construction and excavation and any settlement that may occur around tunnels, dams, embankments and landfills.

did you KNOW?

With only a 25 mm diameter, RST has the smallest diameter of any other In-place Inclinometer currently available on the market.

Digital Tilt Logger

Digital Tilt Logger shown in typical installation with Mounting Bracket.

The Digital Tilt Logger is a low cost, battery powered data logger and tilt meter in a single, compact unit. It measures tilt in either one or two perpendicular axes in the plane of the base. The unit is intended to be permanently installed to provide long term observation with maximum resolution and sensitivity, and is conveniently designed for manual monitoring or remote data acquisition with RST's rstar Array Radio Series which takes advantage of the latest wireless technology.

The Digital Tilt Logger consists of one or two MEMS tilt sensors, a battery supply, non-volatile memory, USB cable and Windows® host software. The tilt meter may either be uniaxial or biaxial. The electronics are housed in a NEMA 4X (IP-66) enclosure for environmental protection, and is typically bolted to the structure via mounting plate or bracket. The internal MEMS accelerometer is the same as used in the In-place MEMS Digital Tilt Meter models IC6554 and IC6654.

**Microsoft Windows® is a registered trademark of Microsoft Corporation in the United States and/or other countries.*

SPECS

TILT SPECIFICATIONS
Sensor Type | *MEMS Accelerometer, Uniaxial or Biaxial (Micro-Electro-Mechanical Systems)*
Range | *±15° (other ranges upon request)*
Resolution | *±2 arc sec. (±0.0006°) (0.01 mm/m)*
Repeatability | *±0.0125% F.S. (±0.002°) (0.03 mm/m)*
Operating Temperature | *-40 to 60°C*
DATA STORAGE SPECIFICATIONS
Memory | *4 MB*
Data Transfer | *> 5,000 data points per second*
Interval Mode | *10 seconds to 1 day*
Visible Rate Mode | *16 user programmable sampling rates*
Time Format | *Month / day / year Hour / minute / second*
Memory Full Behaviour | *"Wrap around" or "fill & stop" option*
READOUTS
Ultra-Rugged Field PC
rstar - Array Radio Series

In-place MEMS Tilt Meter

In-place MEMS Tilt Meter shown with Vertical Mounting Bracket.

SINGLE CABLE BUS SYSTEM DIGITAL

MEMS TILT & INCLINATION SERIES

In-Place MEMS Tilt Meters measure tilt in either one or two axial planes perpendicular to the surface of the base plate. The unit is intended to be permanently installed to provide long term observation with maximum resolution and sensitivity, and is designed for manual monitoring or remote data acquisition.

MEMS systems consist of a tilt meter mounting plate, interconnecting cable, and data logger or readout instrument. The tilt meter may either be uniaxial or biaxial and is available in both horizontal and vertical versions. The electronics are housed in a NEMA 4X (IP-65) enclosure for environmental protection, and is typically bolted or bonded to the structure.

A variety of signal outputs are available: analog (+/-5 V, loop-powered 6-20 mA), digital and digital bus allowing several tilt meters to be daisy-chained on a single cable up to 1200 meters in length.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

Sensor Type | *MEMS Accelerometer, Uniaxial or Biaxial (Micro-Electro-Mechanical Systems)*
Range | *±15° (other ranges upon request)*
Resolution - Analog | *±5 arc sec. (±0.025 mm/m) (10Hz BW)*
Resolution - Digital | *±2 arc sec. (±0.0006°) (0.01 mm/m)*
Repeatability - Analog | *±0.025% F.S. (±0.004°) (0.06 mm/m)*
Repeatability - Digital | *±0.0125% F.S. (±0.002°) (0.03 mm/m)*
Operating Temperature | *-40 to 85°C*
Single Cable Digital Bus System also available.
READOUTS
Analog | *MEMS Readout IC6800-V*
Digital | *Ultra-Rugged Field PC*
DATALOGGER
Digital and Analog | *flexDAQ Dataloggers*

Time Domain Reflectometry

Time Domain Reflectometry is a simple and economical way of detecting and interpreting rock and soil mass response to underground and surface mining using coaxial cables grouted in boreholes. Time Domain Reflectometry can be used effectively to locate rock and soil mass movements.

WORKS WITH GeoViewer REAL-TIME MONITORING

Vertical In-place MEMS Inclinometer

Vertical In-place MEMS Inclinometer Systems are designed to measure lateral movement of soil and rock or deflection of man made structures such as piles or retaining walls, when remote and continuous monitoring is required.

In-place inclinometers consist of one or more MEMS inclinometer sensors housed in a 31.75 mm (1.25 in.) diameter, water-tight, stainless steel enclosure. Each sensor is separated from the next by stainless steel rods and wheel assemblies. Rod lengths can be varied to alter the gauge length and sensors can be concentrated in areas of expected movement.

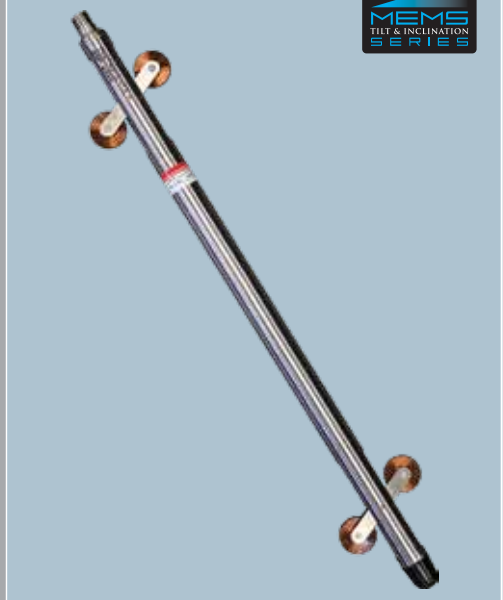
Wheel assemblies are sized to fit 70 mm (2.75 in.) or 85 mm (3.34 in.) O.D. inclinometer casing. As movement occurs and the inclinometer casing deforms, each sensor can be automatically monitored and can be read at a remote readout location.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

Sensor Type	*MEMS Accelerometer, Uniaxial or Biaxial* (Micro-Electro-Mechanical Systems)
Range	*±15° (other ranges upon request)*
Resolution - Analog	*±5 arc sec. (±0.025 mm/m) (10Hz BW)*
Resolution - Digital	*±2 arc sec. (±0.0006°) (0.01 mm/m)*
Repeatability - Analog	*±0.025% F.S. (±0.004°) (0.06 mm/m)*
Repeatability - Digital	*±0.0125% F.S. (±0.002°) (0.03 mm/m)*
Operating Temperature	*-40°C to 85°C*
Probe Material	*Stainless steel*
Single Cable Digital Bus System also available.	
READOUTS	
Analog	*MEMS Readout IC6800-V*
Digital	*Ultra-Rugged Field PC*
DATALOGGER	
Digital and Analog	*flexDAQ Dataloggers*

Digital MEMS Inclinometer Spiral Sensor



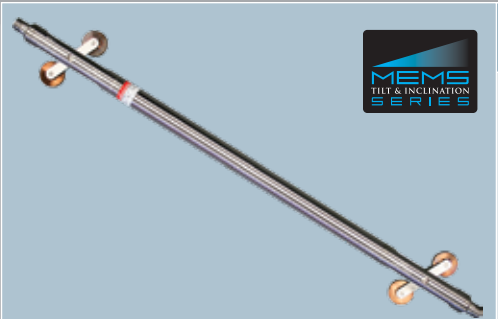
The RST Digital MEMS Inclinometer Spiral Sensor is used to determine down-hole helical deformation of installed inclinometer casing. Spiral is typically of concern only in deep installations; however, should poor installation be suspected, or installed spiral be of interest, a spiral survey must be conducted utilizing the Digital MEMS Inclinometer Spiral Sensor.

Operation is similar to the RST Digital Inclinometer, using the same cable, reel, and hand-held readout. It is only necessary to read one data set; no 180 degree second reading set is required. RST Inclinalysis™ Digital Inclinometer Analysis Software processes the resulting spiral data set.

WORKS WITH inclinalysis™ digital inclinometer analysis software

SPECS

Material	*Stainless steel*
Weight	*1 kg*
Overall Length	*570 mm*
Gauge Length	*400 mm*
Accuracy	*±1° per 30 m typical*
Resolution	*0.1°*
Compatible Casing Sizes	*70 and 85 mm*



Digital Horizontal MEMS Inclinometer

The Digital Horizontal MEMS Inclinometer System measures settlement or heave under embankments, dams, roadways, storage tanks, and landfills.

Essentially being a horizontal version of the RST Digital MEMS Inclinometer System, settlement profile surveys are conducted by running the probe in an inclinometer casing installed horizontally rather than vertically. Wireless communication between the inclinometer control cable and the Ultra-Rugged Field PC ensures ease of use and reliability. A Horizontal In-place MEMS Inclinometer is also available, contact RST for details.

WORKS WITH inclinalysis™ digital inclinometer analysis software

Submersible MEMS Tilt Meter

The RST Submersible Tilt Meter provides precision real-time remote monitoring of tilt of submerged structures. It consists of a MEMS inclinometer sensor and electronics mounted inside a rugged waterproof enclosure.

The instrument housing is machined from solid stainless steel, providing extreme endurance for long-term high-pressure underwater service. The cable entry is a submarine grade connector, which provides watertight performance at depths exceeding 200 meters.

The tilt meter can be mounted directly on horizontal, vertical or inclined surfaces. In all three situations, no precision levelling of the instrument is required as the wide measurement range of the MEMS tilt sensor (+/-15°) allows for latitude in installation. Repeatability and other metrological specifications of the tilt sensor are unchanged at the center or at the ends of the measurement range.

SPECS

Sensor Type	*MEMS Accelerometer, Uniaxial or Biaxial* *(Micro-Electro-Mechanical Systems)*
Range	*±15° (other ranges upon request)*
Resolution - Analog	*±5 arc sec. (±0.025 mm/m) (10Hz BW)*
Resolution - Digital	*±2 arc sec. (±0.0006°) (0.01 mm/m)*
Repeatability - Analog	*±0.025% F.S. (±0.004°) (0.06 mm/m)*
Repeatability - Digital	*±0.0125% F.S. (±0.002°) (0.03 mm/m)*
Operating Temperature	*-40°C to 85°C*
READOUTS	
Analog	*MEMS Readout IC6800-V*
Digital	*Ultra-Rugged Field PC*
DATALOGGER	
Digital and Analog	*flexDAQ Dataloggers*

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

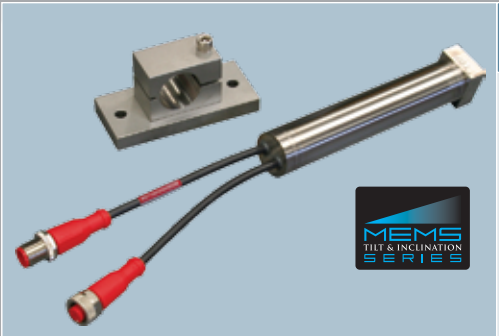
Portable MEMS Tilt Meter

The RST Portable MEMS Tilt Meter utilizes a MEMS tilt meter to measure tilt in either one or two axial planes perpendicular the surface of the base plate. Depending on the model, the output is an analog DC signal or digital output and is directly proportional to the sine of angle of tilt. In the horizontal position the DC output is zero. Portable MEMS Tilt Meters require placing the tilt meter in a reproducible position on a reference plate attached to the surface being monitored. It is designed for applications where a large number of measuring points are to be observed.

Portable MEMS Tilt Meter systems consist of the tilt meter, interconnecting cable, stainless steel tilt plates, and the readout instrument. Tilt plates are bolted or bonded to the structure to accurately, and repeatedly, locate the sensor. When not in use, the plates should be shielded from damage with an optional, UHMW plastic protective cover. Readout is achieved with the Portable Tilt Meter Readout, or with the RST Field PC for the Digital Tilt Meter model.

SPECS

TILT SENSOR	
Sensor Type	*MEMS Accelerometer, Biaxial* *(Micro-Electro-Mechanical Systems)*
Range	*±15° (other ranges upon request)*
Resolution - Analog	*±5 arc sec. (±0.025 mm/m) (10Hz BW) (or better, readout method dependent)*
Resolution - Digital	*±2 arc sec. (±0.0006°) (0.01 mm/m)*
Repeatability - Analog	*±0.025% F.S. (±0.004°) (0.06 mm/m)*
Repeatability - Digital	*±0.0125% F.S. (±0.002°) (0.03 mm/m)*
Material	*Stainless steel / Aluminum NEMA 4X (IP-65) weather proof enclosure*
TILT PLATE	
Material	*316 Stainless steel*
Dimensions	*140 O.D. x 63 I.D. x 14 mm*
Weight	*0.77 kg*
READOUTS	
Analog	*Portable Tilt Meter Readout IC6800-S*
Digital	*Ultra-Rugged Field PC*



Profile Monitoring System for Tunnel Concrete Segments

This system contains a series of tilt meters fixed to the tunnel wall on each of the precast concrete segments erected in place as tunnel lining by a Tunnel Boring Machine (TBM). The system is based on the assumption that each concrete segment is a rigid body and that the complete ring deforms by rotation of the individual segments, one relative to the other, and the rotation points are the contact surfaces between adjacent segments. Digital bus systems are also available.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

WORKS WITH GeoViewer REAL-TIME MONITORING

SINGLE CABLE BUS SYSTEM DIGITAL

MEMS Tilt Beam

MEMS Tilt Beams measure differential movements in structures and consist of a MEMS sensor mounted on a rigid, fibreglass beam. The beam is mounted on anchor bolts set into the structure. They can be installed on any structure by joining together lengths of beams and are extremely accurate in generating movement profiles over long distances. Readings are taken with a manual readout by connecting at the end of the single cable linking all the bussed beams, or with a datalogger at a remote monitoring station. Site specific, near-real time monitoring software is available.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

Sensor Type	*MEMS Accelerometer, Uniaxial or Biaxial (Micro-Electro-Mechanical Systems)*
Range	*±15° (other ranges upon request)*
Resolution - Analog	*±5 arc sec. (±0.025 mm/m) (10Hz BW)*
Resolution - Digital	*±2 arc sec. (±0.0006°) (0.01 mm/m)*
Repeatability - Analog	*±0.025% F.S. (±0.004°) (0.06 mm/m)*
Repeatability - Digital	*±0.0125% F.S. (±0.002°) (0.03 mm/m)*
Operating Temperature	*-40°C to 85°C*
Single Cable Digital Bus System also available.	
FIBREGLASS BEAM *(mounting brackets included)*	
Dimensions	*51 x 51 mm*
Gauge Length	*1, 2 or 3 m*
READOUTS	
Analog	*MEMS Readout IC6800-V*
Digital	*Ultra-Rugged Field PC*
DATALOGGER	
Digital and Analog	*flexDAQ Dataloggers*

Pendulum System

Inverted Pendulum shown with RxTx Telependulum.

RST's direct and inverted pendulums are simple, reliable and accurate systems used to monitor internal lateral deformations of concrete dams, dam foundations and abutments, tall industrial buildings and bridge piers.

The direct pendulum (plumbline) consists of a stainless steel wire attached to a fix point at the top of a structure to be monitored; a weight; and a tank containing damping fluid to damp movements of the weight due to wind and air circulation.

Displacements relative to the wire can be measured by a portable coordinometer or the RxTx Telependulum, which allows remote continuous monitoring of deformations.

The inverted pendulum uses the same readout units, and includes a stainless steel wire anchored in the structure foundation with a float fixed at its upper end. The float, which is free to move in a tank, tensions the wire and keeps it vertical. Once anchored in stable point in foundation it measures absolute deformation of the structure and it's used as a reference for surface geodetic surveying.

SPECS

PORTABLE COORDINOMETER	
Measuring Range	*x:150 mm, y:50 mm*
Accuracy	*better than 0.1 mm*
RXTX TELEPENDULUM	
Measuring Range	*x:50 mm, y:50 mm*
Precision	*±0.05 mm*
Resolution	*7.5 µm*
Operating Temperature	*-10°C to +40°C*
Data Storage Capacity	*370 readings*
Clock	*Real-time*
Sensor	*CCD*
Frequency	*60/50 Hz ±10%*
Relative Humidity	*up to 95% non-condensing*

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

Track Monitoring System

The Track Monitoring System is intended for monitoring settlement and twist of railroad tracks which may be affected by nearby construction activity, such as tunnelling or adjacent excavation, or which are located near hazardous zones such as potential washout or landslide areas.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

WORKS WITH GeoViewer REAL-TIME MONITORING

piezometers and transducers

fast facts: piezometers + transducers

Piezometers are mainly designed to measure pore water pressure during fill or excavation. They are invaluable in slope stability investigations and for assessing the stability of earth fill dams and embankments. Piezometers from RST Instruments Ltd. are built to withstand the most demanding site conditions and can be customized to suit your application. The C108 Pneumatic Readout or the VW2106 Vibrating Wire Readout are the main readouts used for reading piezometers. Remote data acquisition configurations with alarm triggering can also be utilized.

Vibrating Wire Piezometers

From top: VW2100 - Standard, VW2100-HD and VW2100-DP

Vibrating Wire Piezometers contain a high tensile steel wire with a fixed anchor at one end and are attached to a diaphragm in contact with water pressure at the other end. The wire is electrically plucked, with the resonant frequency of vibration proportional to the tension in the wire. This frequency induces an alternating current in a coil which is detected by the readout unit, such as the VW2106 Vibrating Wire Readout, and can then be converted to a pressure. The frequency output is immune to external electrical noise, and able to tolerate wet wiring common in geotechnical applications. Highly reliable lightning protection is incorporated in the vibrating wire transducer.

RST produces various models with varying pressure ranges and sizes. Contact RST for complete details.

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

- Over Range | *2 X F.S.*
- Resolution | *0.025% F.S. minimum*
- Accuracy | *0.1% F.S.*
- Operating Temperature | *-20°C to 80°C*
- Housing | *Hermetically sealed stainless steel*
- Thermistor Resolution | *0.1°C*
- Filter | *50 micron sintered filter*
- MODELS *(contact RST for ranges)*
- VW2100 | *Standard model*
- VW2100-HD and VW2100-XHD | *Heavy duty for direct burial in fills and large dam embankments*
- VW2100-HHP | *High pressure transducer with NPT port*
- VW2100-DP | *Drive point model with CPT adapter*
- VW2100-L | *Low pressure, unvented*
- VW2100-LV | *Low pressure, vented*
- VW2100-M | *Miniature version – 17.5 mm diameter*
- VW2100-MM | *Micro-miniature – 11.1 mm diameter*

Pneumatic Piezometers

From left: P-100 Miniature, P-102-SS Wellpoint and P100-1 Standard

Pneumatic Piezometers utilize a direct reading pneumatically operated diaphragm that makes operation simple while ensuring long term stability and high accuracy at a low cost.

Employing the lowest (0.002 cc) displacement available, measurements can be made under essentially zero volume change conditions. Time lag problems are minimized, and accuracy is improved.

RST Pneumatic Piezometers are assembled to client specified length, tested, calibrated, and ready to install.

Three models are available: P-100 Miniature, P100-1 Standard, P-102-SS Wellpoint and the P-104-D High Air Entry Series. Contact RST for complete details.

WORKS WITH C108 pneumatic readout

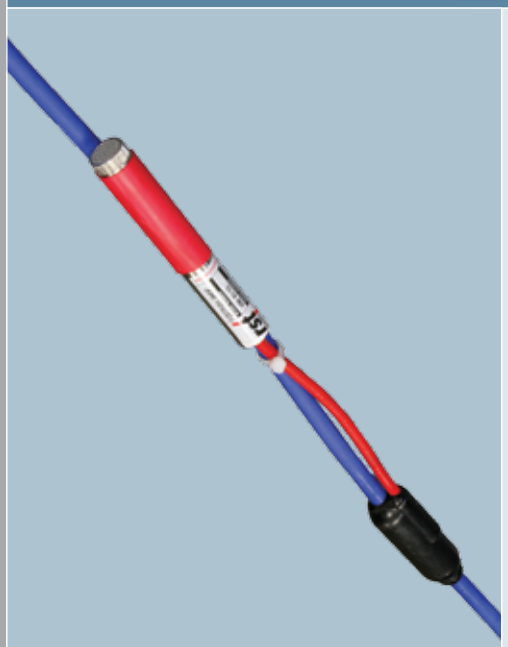
SPECS

- Sensitivity | *0.1% F.S.*
- Displacement | *0.002 cc*
- Materials | *Nylon 12 with EP diaphragm*
- Accuracy | *±0.25% F.S.*
- Standard Resolution | *1 kPa / 0.1 psi or 0.1 kPa / 0.01 psi with C-108 readout*
- Repeatability | *±0.35 kPa / ±0.05 psi*
- Range | *0-2000 kPa / 0-200 psi with standard C-108 readout and T-102 tubing*
- Linear Range | *21-2000 kPa / 3-200 psi with standard C-108 readout and T-102 tubing*
- Sensor | *CCD*
- Frequency | *60/50 Hz ±10%*
- Max Range | *0-14,000 kPa / 0-2000 psi*

Push-in Standpipe Piezometer

RST's Push-in Standpipe Piezometer consists of four simple parts that are designed for extremely quick and easy field assembly. A protective steel tube threads on to the base of a stainless steel drive-point and houses a PVC pipe and adapter that are inserted from the top opening and pushed into the opening base of the drive-point tip at the bottom of the assembly.

Fully Grouted Multi-point Piezometer String



Fully grouted installation permits multiple piezometers to be simply, and reliably, installed in a single borehole when more than one piezometer reading is needed at various depths - at the same location. The piezometer string and grout pipe are placed in the borehole and cement-bentonite grout is pumped until the borehole is filled.

Multi-point Piezometer Strings allow for multiple Vibrating Wire Piezometers to be connected on a single cable. This facilitates the installation of fully grouted multiple piezometers. No conductors are shared to maximize independent reliability of each sensor.

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

Individual Vibrating Wire Piezometer specifications can be viewed on previous page.

Due to the semi-custom nature of Multi-point Piezometer Strings, please contact RST Instruments for complete specifications. Ordering info will be dependent on required cable depth, number of piezometers per string and measurement parameters regarding pressure and/or temperature.

Casagrande Standpipe Piezometer

RST's Casagrande Standpipe Piezometer tip consists of a slotted PVC body that encloses and protects a porous plastic filter element. A PVC Riser Pipe (available from RST) is connected to the tip and extended to the surface. A CPVC body is available for leachate extraction.

The Casagrande Standpipe Piezometer is mainly used for measurement of piezometric levels and pore water pressures in soil and rock formations where the time lag and high displacement requirements inherent in standpipes are not crucial, and where the presence of standpipes will not hinder construction. Water elevation in the riser pipe is measured using a Water Level Meter. Alternatively, a Vibrating Wire Piezometer can be lowered in the pipe to allow remote reading; Bourdon tube gauges may be attached to monitor artesian pressures.

Drive-in models and custom sizes are also available, contact RST Instruments for more details.

SPECS

Maximum O.D. | *3.35 cm*
Filter Area | *243 sq. cm*
Body Material | *1 in. PVC*
Pore Diameter | *70 micron*
Permeability | *3 x 10^{-4} m/s (low air entry)*
SIZES
5.24 cm (6")
30.48 cm (12")
45.72 cm (18")
60.96 cm (24")
Custom sizes and options are available, contact RST Instruments for more details.
Accepts 1, 0.75 and 0.5 in. PVC solvent weld riser pipe.
Non-standard types of riser fittings may be provided on request.

did you KNOW?

At RST we use Meter Marked Cable in a majority of our instruments that require a signal cable such as those used in Vibrating Wire Piezometers, Load/Pressure Cells, Crack Meters, Joint Meters, etc.

A meter mark is clearly displayed on each cable at every 1 meter section. This marking is an extremely convenient feature if, during installation or otherwise, the cable is accidentally severed or damaged.

Strain Gauge and Vibrating Wire Pressure Transducers

Vibrating Wire Pressure Transducer (left) and Strain Gauge Pressure Transducer

Strain Gauge and Vibrating Wire Pressure Transducers are used for uplift measurement in the foundation of concrete dams, overflow settlement measurement in earthfill and rockfill dams, and all other applications where a rugged and reliable pressure transducer is required for measuring fluid pressure in closed circuits.

The pressure transducer comes with a 1/4" NPT thread, or NPT port, for easy connection to pipes or other components of the hydraulic circuit to be monitored. The strain gauge transducers can be read dynamically if required by the application.

Highly reliable lightning protection is standard for the strain gauge transducer with 4-20 mA output and for the vibrating wire transducer.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

STRAIN GAUGE PRESSURE TRANSDUCER	
Accuracy	*±0.1% F.S.*
Standard Pressure Ranges	*0.35 to 21 MPa*
Compensated Temp. Range	*-10°C to 80°C*
Field Rangeability	*Yes*
Pressure Output	*0 to 5 VDC* *4 to 20 mA, RS485*
Dimensions	*109 mm X Ø21 mm*
NPT Thread	*1/4 inch (other sizes available)*
VIBRATING WIRE PRESSURE TRANSDUCER	
Over Range	*2 X F.S.*
Resolution	*0.025% F.S. minimum*
Accuracy	*0.1% F.S.*
Operating Temperature	*-20°C to 80°C*
Housing	*Hermetically sealed stainless steel*
Thermistor Resolution	*0.1°C*

Strain Gauge Piezometer

The Strain Gauge Piezometer is specifically designed to meet the rigorous environments encountered in level measurement applications and to provide repeatable, precision depth measurements. It is available with either a ported nose cap or a piezometer nose incorporating a sintered stainless steel porous filter.

Ideal for small bore applications, and the ability to withstand rigorous environments encountered in ground and sea water depth measurements, the Strain Gauge Piezometer can also be used for dynamic pore pressure measurement applications. Highly reliable multi-stage transient* protection is standard for 4-20 mA and RS-485 output.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

Pressure Range	*0-1 m through 0-300 m*
Accuracy	*±0.1% F.S. T.E.B.***
Compensated Temp. Range	*-10°C to 80°C*
Pressure Output	*0 - 5 VDC* *4-20 mA, RS485*
Electrical Termination	*Vented Hytrel Cable or Sealed Cable*
Level Range *(user specified)*	*Infinite between 0-3 through 0-900 ft. WC*
Dimensions	*109 mm X Ø21 mm*

** Conducted transients from indirect lightning activities.*

*** T.E.B.: Total Error Band: Includes the combined effects of non-linearity, hysteresis and non-repeatability as well as thermal dependencies, over the compensated temperature range, expressed as a percentage of the Basic Range. All intermediate ranges are realized by deranging from standard Basic Ranges of 30, 100, 300 and 900 ft WC.*

Since RST provides a Calibration Record for each instrument using signal cable, the meter cable markings are clearly shown on this record and provide a valuable cross-reference point.

CABLE MARKINGS: 101886 m - 101956 m, as shown on your Calibration Record

readouts, data loggers and terminal stations

fast facts: readouts + dataloggers

RST Instruments Ltd. offers many types of readouts and dataloggers which are used to collect data from sensors in dams, tunnels, bridges, mines, natural slopes and other geotechnical applications. Products in this category offer manual monitoring or remote data acquisition configurations with alarm triggering. Most sensor types and gauges can be read with these products including vibrating wire, thermistor, TENSMEG, linear potentiometer, strain gauge and MEMS.

rstar - Array Radio Series

A WA24N rstar Transceiver attached to an RST Single Channel Vibrating Wire Datalogger and Vibrating Wire Piezometer.

A WA24N rstar Transceiver ready for field installation, mounted on an RST Cable Route Warning Marker. Shown above is the rstar Data Manager.

With minimum per channel cost, the rstar wireless system uses wireless technology to provide continuous data acquisition from existing dataloggers. The system uses IEEE 802.15.4 wireless spread spectrum, operating in the international license-free 2.4 GHz band, to provide a star connection to the wireless Data Manager. The Data Manager may be used with local wired or wireless connection, but it is typically used where wireless mobile data exists.

Cellular data is maintained in secure, offsite, long-term storage and can be accessed at multiple locations via the World Wide Web (www).

A sensor configuration with rstar is also easily incorporated into RST's GeoViewer Software for multi-sensor management.

WORKS WITH VIBRATING WIRE & THERMISTOR DATA LOGGER SERIES

WORKS WITH GeoViewer REAL-TIME MONITORING

NODE SPECIFICATIONS	
Operating Frequency	*2.400 - 2.482 GHz*
Loop Margin, 0dB antennae	*124 dBM*
Outdoor Range	*1 - 2 km* (depending on antenna and line of sight)
Data Throughput	*250 kb/s*
Additional Quiescent Current	*10 uA*
Operating Temperature	*-40° to 60° C*
Module Size	*30 (D) x 70 (L) mm*
Operating Temperature	*-40° to 60° C*
RSTAR DATA MANAGER (GSM) SPECS	
Maximum Nodes	*256*
Memory	*4 MB*
Quiescent Current	*30 mA*
Enclosure Size	*150 x 250 x 300 mm*
Operating Temperature	*-40°C to 60°C*
Radio	*IEEE 802.15.4*
Modem	*GSM*
Battery	*26 A Hr*
Charging Panel	*Solar*

Vibrating Wire Readout VW2106

The portable VW2106 Vibrating Wire Readout reads, displays, and logs both vibrating wire sensors and thermistors. Vibrating wire load cells can be read without any additional accessories.

Accuracy, flexible memory options and ease of use make the VW2106 invaluable for projects requiring vibrating wire sensor monitoring.

In addition to the simple power requirements of only 3 "AA" batteries, the VW2106 comes well-equipped with a large graphics display with backlight, a built-in multiplexer, "no-tools" vibrating wire transducer inputs (eliminating the need for alligator clips), and a convenient on-board speaker for sensor diagnostics.

Data is transferred to a host computer via USB in a compatible file format for major spreadsheet software. User friendly host software for *Microsoft Windows® included.

Excitation Range	*400 Hz to 6000 Hz, 5 V Square Wave*
Resolution	*0.01 µs*
Timebase Accuracy	*±50 ppm*
Supported Temperature Readout Sensors	*NTC3000 (standard), NTC2252, NTC10K, RTD*
Temperature Readout Accuracy	*±0.1°C*
Temperature Readout Range	*-50°C to 80°C*
Display	*Graphic 128 x 64 pixels large character display with backlight*
Max Instrument Locations	*254*
Memory Capacity	*11,400 custom labelled points*
Download Speed	*15 seconds (full memory)*
Battery	*3 "AA" alkaline*
Operating Temperature	*-20°C to 60°C*
Dimensions	*22 W x 19 D x 9.5 H cm*
Weight	*1.1 kg*

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Pneumatic Readout C108

The ideal solution for monitoring all pneumatic transducers, including Total Earth Pressure Cells, the C108 Pneumatic Readout stores up to 170 instrument locations per route, each with a convenient text label and up to 20 time/date stamped data points. User-specified location names and previous data greatly assist the operator in data collection and analysis. Data is transferred to a host computer via RS232 and the file format is compatible with Microsoft Excel® and other spreadsheets.

The C108 Digital Pneumatic Readout ships with C108 Host Software for *Microsoft Windows®.

SPECS

Display	*12.7 mm high with backlight*
Accuracy	*±0.1% F.S.*
Scale Ranges	*1400 kPa / 0-200 psi*
Resolution	*1 kPa/ 0.1 psi*
Operating Temperature	*-20°C to 50°C*
Memory	*128 kB*
Storage Locations	*170*
Storage Per Location	*20 points*
Battery	*Internal lithium cell*
Dimensions	*18.5 x 30 x 45 cm*
Weight	*8 kg.*

**Microsoft Excel®, and Windows® are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.*

Ultra-Rugged Field PC

The Ultra-Rugged Field PC functions as a data collector. It provides a high-level user interface, industry-leading memory, optional Flash data security, on-site data analysis and instant USB synchronization with office computers. It also offers on-board wireless communication options which provide ease of use and reliability since there is no longer any concern with fragile connectors, cable related failure and reliability problems. The Ultra-Rugged Field PC is rock solid and field ready for the most extreme environments.

RST Instruments provides support and interface software to use the Ultra-Rugged Field PC with the following systems and dataloggers from RST: Digital MEMS Inclinometer System, Digital MEMS Tilt Meters/In-place Inclinometers, Digital ThermArray Systems and the DT2011, DT2055 and flexDAQ Dataloggers.

SPECS

OPERATING SYSTEM & MEMORY
**Windows® Mobile Operating System*
Bluetooth Wireless Communication
Internal solid state 512 MB Flash memory
Compact Flash (Type I or II) and SD/SDHC card slots
Both USB Host and Client plus 9-pin RS-232
DISPLAY
Active viewing area of 89 mm diagonal
Sealed, resistive, pressure sensitive touch screen with backlit LCD
POWER
Rechargeable, lightweight Li-Ion battery pack, 14 W-h (nom.)
20 hour battery life on single charge (4 - 6 hours charge time)
ENVIRONMENTAL
Operating temperature: -30°C to 55°C
Waterproof and dustproof, IP67

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Single Channel Vibrating Wire Data Logger DT2011

The Single Channel Vibrating Wire Data Logger is a low cost, battery powered data logger, designed for reliable, unattended monitoring of a single vibrating wire sensor and thermistor.

Ideal for remote locations or instruments that require frequent reliable data recording, it connects to all vibrating wire sensors including piezometers, crack meters, and strain gauges. It will not connect to vibrating wire sensors with auto resonant circuitry.

Data logger setup and data collection is done using the Ultra-Rugged Field PC or a laptop. Multi-Channel Host Software is also included.

SPECS

Frequency Accuracy	*0.01% F.S.*
Resolution	*1 part in 65,000*
Memory	*Over 30,000 records including time, frequency², temperature*
Power Source	*2 standard 'AA' batteries*
Battery Life	*Over 5 years / 20 memory fills depending on temperature and use*
Communication	*RS232. USB adapter available.*
Dimensions	*150 x 65 x 40 mm*
Temperature Range	*-40°C to 60°C*
DATA STORAGE	
Memory	*128K*
Data Transfer	*30 seconds*
Interval Mode	*2 seconds to 1 day*
Variable Rate Mode	*16 user programmable sampling rates*
Time Format	*Mth/day/yr hr/minute/sec*
Memory Full Behaviour	*"Wrap Around" or "Fill & Stop" option*

Ten Channel Data Logger DT2055

The DT2055 10 Channel Data Logger is a low cost, battery powered data logger, designed for reliable, unattended monitoring of up to 10 sensors which may be any mix of vibrating wire sensors and thermistors, typically 5 vibrating wire sensors with their associated thermistors.

It is a purpose built logger ideal for remote locations or instruments that require frequent reliable data recording. It connects to all vibrating wire sensors including piezometers, crack meters, and strain gauges. The DT2055 does not support auto resonant sensors.

Data logger setup and data collection is done using the Ultra-Rugged Field PC or a laptop. Multi-Channel Host Software is also included.

A single gland option (DT2055-T) is also available for Multi-point Vibrating Wire Piezometer Strings or Thermistor Strings.

SPECS

Frequency Accuracy	*0.01% F.S.*
Resolution	*1 part in 65,000*
Memory	*Over 120,000 records, each including: time, 5 channels frequency, frequency², 5 channels temperature*
Power Source	*1 'D' lithium primary battery*
Battery Life	*Over 5 years / 2 memory fills depending on temperature and use*
Communication	*USB type B connector*
Dimensions	*120 x 122 x 91 mm*
Temperature Range	*-40°C to 60°C*
Enclosure	*NEMA 4X (IP65)*
DATA STORAGE	
Memory	*4 MB*
Data Transfer	*5,000 data points/second*
Interval Mode	*10 seconds to 1 day*
Variable Rate Mode	*16 user programmable sampling rates*
Time Format	*Mth/day/yr hr/minute/sec*
Memory Full Behaviour	*"Wrap around" or "fill & stop" option*

Vibrating Wire Isolated Analog Interface VW0420

The VW0420 provides an interface between vibrating wire instruments and factory automation systems which support 4-20 mA sensors. The vibrating wire section measures the natural frequency and temperature of the sensor. The measurements are then converted to engineering units, unit converted etc. as required, and scaled to the 4-20 mA outputs.

Setup of the device is straightforward, using a *Microsoft Windows® host program connected via USB cable.

Because the source of power, the vibrating wire sensor, and the 4-20 mA measurement may be in different locations, there are 4 dielectrically isolated ground subsystems, one for the power, one for the sensor, and one for each of the outputs. This isolation gives maximum flexibility in connecting the system.

SPECS

- Vibrating Wire Sensor Types | *Piezometer, strain gauge, mini-strain gauge, displacement sensor etc.*
- Sweep Types | *A,B,C,D,E,F, user-defined*
- Frequency Input | *450-6000 Hz*
- Update Rate | *2 seconds*
- Vibrating Wire Calibration | *mX+b, polynomial, units conversion, temperature compensation*
- Thermistor Types | *NTC 3000, 2252, 5k, 10k, 2k RTD*
- Current Outputs (2) | *Vibrating Wire, Thermistor*
- Current Output | *4-20 mA nominal, isolated between channels and with respect to sensor to 2500 VAC*
- Vibrating Wire Conversion Base Units | *B units, kPa, psi, mH_2O, με, etc.*
- Temperature Conversion Base | *°C, °F, Ω*
- Operating Temperature | *-40°C to 55°C*
- Power Supply | *9-24 VDC, 8-35 mA, isolated to 1000 VAC*
- Dimensions | *90 x 92x 22.5 mm*

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Flexi-Mux Multiplexer ELGL2042

The RST Instruments Flexi-Mux allows a single channel of data loggers such as the Campbell CR1000 to be sequentially connected to numerous sensors. Each Flexi-Mux can sequentially multiplex 5 groups of 4 lines for a total of 20 lines. Alternatively, internal DIP switch settings permits the multiplexing of 10 groups of 2 lines.

The slim and compact vertical design occupies minimal space in the control box which allows for more Flexi-Mux units to be installed. By utilizing a unique cascade feature, there is theoretically no limit to the number of channels which can be connected to the datalogger. Every line includes built-in transient protection.

The Flexi-Mux is compatible with most sensors including vibrating wire, load cells, pressure transducers, thermistors, potentiometers, and numerous other specialty sensors.

WORKS WITH
flexDAQ
DATALOGGERS
custom, turn-key datalogger systems shipped "ready to run"

SPECS

- Power | *12 Vdc (under load), unregulated*
- Current Drain | *10 μ quiescent; 8 mA active*
- Reset Active Levels *(max.)* | *2.0 V*
- Clock Active Levels *(max.)* | *2.0 V*
- Min. Clock Pulse Width | *1 ms*
- Max. Actuation Relay Time | *20 ms*
- Relay Operation | *Break before make*
- Initial Relay Resistance *(max.)* | *0.1 Ohm*
- Max. Switching Current | *1 A*
- Operating Temperature | *-°40°C to 70°C (-40°F to 55°F) - extended*
- Size | *8.15 H x 1.05 W x 3.17 D in*
- Weight | *0.24 kg*

flexDAQ DATALOGGERS

READY TO RUN

designed to your exact specifications

pre-assembled | pre-wired | pre-tested | pre-programmed

custom, turn-key datalogger systems shipped to you "ready to run"

flexDAQ Datalogger Model CR800 with Flexi-Mux

flexDAQ Datalogger Model CR1000 with Flexi-Mux

flexDAQ Datalogger in standard weatherproof enclosure

flexDAQ Dataloggers are ideal for remote data-logging of various types of geotechnical instrumentation used in dams, tunnels, bridges, mines, and natural slopes. flexDAQ Dataloggers offer precise measurement and reliable data acquisition from various sensor types and gauges including vibrating wire, thermistor, MEMS (analog and digital) TENSMEG, linear potentiometer, strain gauge, LVDT, TDR, etc.

The three main flexDAQ models are the CR200, CR800, and CR1000. All offer extreme flexibility in their design configurations and are custom made to accommodate a variety of sensor types as they pertain to the parameters of your project. The framework for building a flexDAQ Datalogger is dependent on the type, number, precision, and speed of measurements required. Best of all, flexDAQ Dataloggers arrive to you completely pre-assembled, pre-wired, pre-tested, and pre-programmed; ready to be put to work straight out of the box with minimal set-up.

Above: Instrument/datalogger house designed inside a 6ft. container.

From simple stand-alone datalogger enclosures to heavy-duty instrument/datalogger houses, RST can custom build your requested datalogger configuration and ship it to you “ready to run”.

SPECS

All flexDAQ Dataloggers bear similarities in measurement and programming capabilities and can easily incorporate additional sensor and telecommunication options. Multiplexers, such as the RST Flexi-Mux, and/or SDM devices may be added to augment measurement and control capabilities that include:

- Adding extra sensors that can be monitored by the datalogger (RST Flexi-Mux).
- Providing non-volatile data storage and on-board battery-backed clock.
- On-board data processing.
- Initiating measurement and control functions based on time or event.
- Controlling external devices such as pumps, motors, alarms, freezers, valves, etc.
- Using PC support software or keyboard/display to program.
- Operating independently of AC power, computers, and human interaction.
- Consuming minimal power from a 12 Vdc source.
- Interfacing with on-site and telecommunication devices such as telephone modems (including cellular and voice-synthesized), short haul modems, radio transceivers, satellite transmitters, and ethernet interfaces.

Due to the customizable nature of each flexDAQ Datalogger model, specifications can vary greatly in accordance to customer specifications and Flexi-Mux additions. Please contact RST Instruments Ltd. for complete information.

Telemetry flexDAQ Systems (shown above) allow for remote measurement and retrieval of remote data through wireless data transfer mechanisms such as radio, cellular, satellite, etc.

When paired with RST’s GeoViewer, flexible console viewing of large data sets is achievable with support for multiple loggers and sensors that can be configured with your flexDAQ System.

Thermistor Readout TH2016B

The portable TH2016B Thermistor Readout reads, displays, and logs up to 16 thermistor string points at the push of a button.

Unprecedented accuracy, flexible memory options and ease of use make the TH2016 invaluable for projects requiring temperature monitoring involving thermistor strings. Maximum download time is only 15 seconds.

Complementing its high level of accuracy, the TH2016B is also designed for maximum efficiency with the user in mind. Housed in a compact and rugged case the complete readout operates with only 3 “AA” batteries, and comes well-equipped with a large graphics display with backlight.

A short cable with alligator clips, for thermistor, allows quick settling time in adverse cable conditions.

SPECS

- Supported Temperature Readout Sensors | *NTC5K*
- Temperature Curve Conformance | *±0.05°C*
- Resistance Accuracy | *±0.02%*
- Temperature Readout Range | *-50°C to 80°C*
- Operating Temperature | *-20°C to 50°C*
- Display | *Graphic 128 x 64 pixels large character display*
- Display Backlight | *High efficiency LCD with auto off*
- Max Thermistor String Locations | *254*
- Memory Capacity | *3,000 custom labelled and date stamped arrays of 16 points*
- Location Identification String | *Up to 20 characters*
- Download Speed | *15 seconds (full memory)*
- Battery | *3 “AA” alkaline*
- Battery Indicator | *On-screen, low battery indicator*
- Operating Temperature | *-20°C to 60°C*
- Dimensions | *W 22 x D 19 x H 9.5 cm*
- Weight | *1.1 kg*

SURGE Series: Lightning & Transient Protectors

Wiring, particularly long horizontal wiring, can convert transient electrical fields to destructive voltages at sensors and data logger terminals. Transient protection equipment can be used to divert these transients to ground, increasing installed system reliability.

The three available models in this series are:

SURGE 4D (pictured): 4-wire and shield transient protector for DIN rail mounting.

SURGE 4N: 4-wire and shield transient protector in NEMA-4X enclosure.

SURGE 16N: 16-wire and shield transient protector in NEMA-4X enclosure.

The SURGE Series of transient protectors consist of multi-stage devices which includes three terminal gas discharge tubes, thyristor crowbar devices, and coordinating resistors. They are capable of protecting against high-speed (100 volts per microsecond) transients of up to 20,000 amps, letting only 77 volts through before clamping to 4 volts.

SPECS

- Lines Protected | *SURGE 4D: 4+2 shields*
SURGE 4N: 4+1 shield
SURGE 16N: 16+4 shield
- Maximum Transient current per line *(1 event, 8/20 µs)* | *20,000 Amps*
- Minimum Conduction Threshold Voltage | *58 Volts*
- Peak Pass-through Voltage *(common or normal mode)* | *77 Volts*
- Output Clamp Voltage | *4 Volts*
- Series Resistance per Line | *1.6 Ohms*
- Maximum Leakage Current | *5 Microamps*
- Hold Current | *150 Milliamps*
- Maximum AC Current *(1 line cycle)* | *30 Amps RMS*
- Maximum Continuous Current | *2 Amps*

Bridge Transducer Readout SG350

The SG350 reads, displays, and logs bridge transducers.

Unprecedented accuracy, flexible memory options and ease of use make the SG350 Bridge Transducer Readout invaluable for projects requiring monitoring of bridge transducers. Maximum download time is only 15 seconds.

Complementing its high level of accuracy, the SG350 is also designed for maximum efficiency with the user in mind. In addition to the simple power requirements of only 3 “AA” batteries, the SG350 comes well-equipped with standard features such as a large graphics display with backlight and easily accessible USB port and multi-pin transducer connector.

SPECS

- Excitation | *3.3V*
- Resolution | *0.1µV*
- Display | *Graphic 128 x 64 pixels large character display*
- Display Backlight | *High efficiency LCD with auto off*
- Max Instrument Locations | *254*
- Memory Capacity | *11,400 custom labelled points*
- Location Identification String | *Up to 20 characters*
- Download Speed | *15 seconds (full memory)*
- Battery | *3 “AA” alkaline*
- Battery Indicator | *On-screen, low battery indicator*
- Operating Temperature | *-20°C to 60°C*
- Dimensions | *22 W x 19 D x 9.5 H cm*
- Weight | *1.1 kg*

Other Readouts

All readouts in this section are housed in the same rugged case as shown in this image of the VW2110 - Vibrating Wire Readout Calibrator.

rst INSTRUMENTS VW2110 vibrating wire readout calibrator

rst INSTRUMENTS IR420
4-20 mA Transmitter Readout

rst INSTRUMENTS IR5000
Voltage Transmitter Readout

rst INSTRUMENTS QB120
Resistance Strain Gauge Readout

rst INSTRUMENTS LP100
Linear Potentiometer Readout

SPECS

- Dimensions | *W 22 x D 19 x H 9.5 cm*

For complete details on these readouts, or any other readouts, please contact RST.

borehole packers and accessories

fast facts: borehole packers + accessories

Borehole Packers are suitable for a wide variety of applications in open or cased holes and are suitable for monitor well sampling, zone testing and monitoring, permeability testing, hydrofracturing of formations, pressure grouting, and sealing off artesian flows. Alternate sizes and materials are available for custom applications, please contact RST for more information. RST also carries a wide assortment of Borehole Packer Accessories which are invaluable in ensuring a proper installation of the borehole packers.

Borehole Packers

Borehole Packer shown during inflated state.

Borehole Packers are suitable for monitor well sampling, zone testing and monitoring, permeability testing, hydrofracturing of formations, pressure grouting, and sealing off artesian flows in open and cased holes.

Borehole Packers are pneumatically or hydraulically inflatable packers that incorporate one fixed and one sliding head attached to a center shaft. This sliding head allows the packer gland to retract about the center shaft as it inflates.

Packer heads are constructed of either plated steel or aluminum while the shaft is polished stainless steel or aluminum. The packer gland consists of a rubber membrane reinforced with either polyester fabric or steel. Packers made from steel heads, stainless steel shaft and a steel reinforced gland are suitable for medium pressure applications. Packers made from aluminum heads, aluminum shaft and a polyester reinforced gland are suitable for low pressure applications.

SPECS

MEDIUM PRESSURE PACKERS

Materials | *Steel reinforced gland, plated steel heads, stainless steel shaft.*

Contact RST for completed details on |
Deflated and inflated diameters
Working pressures
Gland lengths
Centre shaft I.D.
Shaft thread size

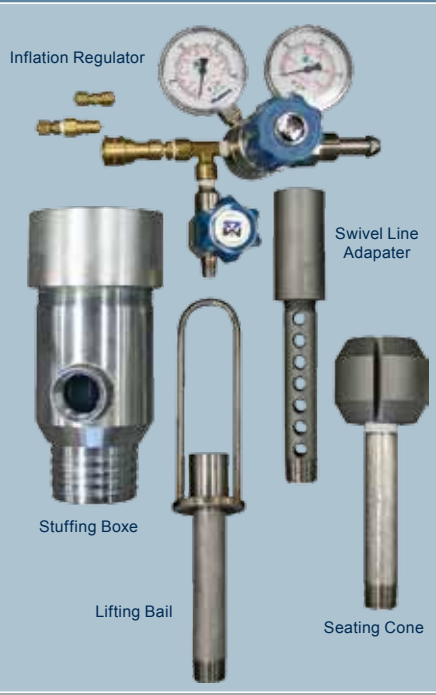
LOW PRESSURE PACKERS

Materials | *Polyester reinforced gland, aluminum heads, aluminum shaft.*

Contact RST for completed details on |
Deflated and inflated diameters
Suitable hole or pipe size
Gland lengths
Central shaft I.D.
Standard differential pressure rating

Due to the extensive specifications for each variety of borehole packer, please contact RST for complete information or visit www.rstinstruments.com

Borehole Packer Accessories



Borehole Packer Accessories are available to ensure proper installation of borehole packers. RST Instruments offers the following accessories and systems:

Inflation Regulators

Lifting Bails

Stuffing Boxes

Seating Cones

Swivel Line Adapter

Feed-through Adapters

Flow System

Water Inflation Systems

Portable Inflation Line Reel

Packer Inflation System

Various Spare Parts

SPECS

Inflation Regulators |
Two models: 0-350 psi and 0-1500 psi.

Lifting Bails | *Used to raise and lower the packer assembly by utilizing the wireline. If a swivel wireline connection is already in place, a modified lifting bale, with threads matching to the swivel connector, is available.*

Stuffing Boxes | *Provide a seal on the drill rods and against the wireline and inflation line.*

Seating Cones |
sets the packer assembly in place at the drill bit.

Feed-through Adapters | *Allow instrument leads to be passed through the packers to pumps and other equipment in the zone below the packer.*

Flow Systems |
Monitor & control water during downhole testing.

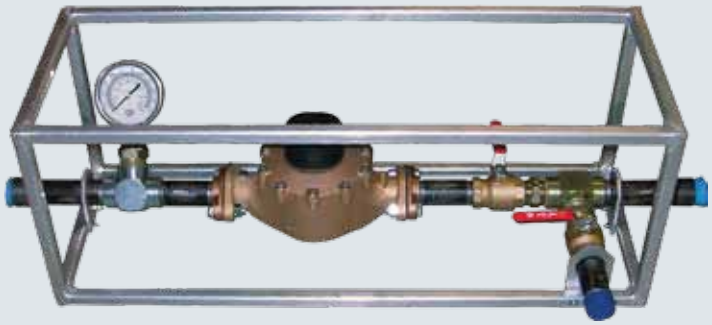
Water Inflation Systems |
Inflate borehole packers hydraulically.

Portable Inflation Line Reel |
Control inflation line during testing and storage.

Packer Inflation System |
Has all the features of an inflation regulator enclosed in a weatherproof case.

Spare Parts | *Contact RST for more information.*

Packer Inflation System



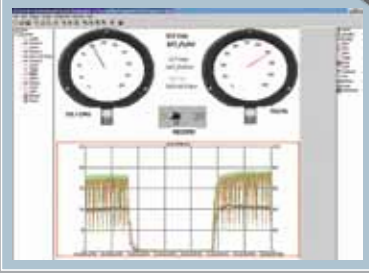
Flow System

grout flow monitors

fast facts: grout flow monitors

Grout Monitors offer a permanent record of key grouting parameters for quality assurance, quantity documentation, pressure and flow readings. The two major types of Grout Monitors offered by RST are the Compaction Grout Monitor and the Permeation Grout Monitor. Both systems are noninvasive with digital flow and analog pressure monitoring. The Compaction Grout Monitor uses Doppler ultrasonic, while the Permeation Grout Monitor uses an Electromagnetic flow meter. Battery operated and rechargeable display are standard.

Compaction Grout Monitor



Screenshot of the Real Time Graphical Display indicating pressure, flow, injected volume and site specific information.

The Compaction Grout Monitor System provides operators and engineers real-time display of key grouting parameters to enhance the understanding of site conditions.

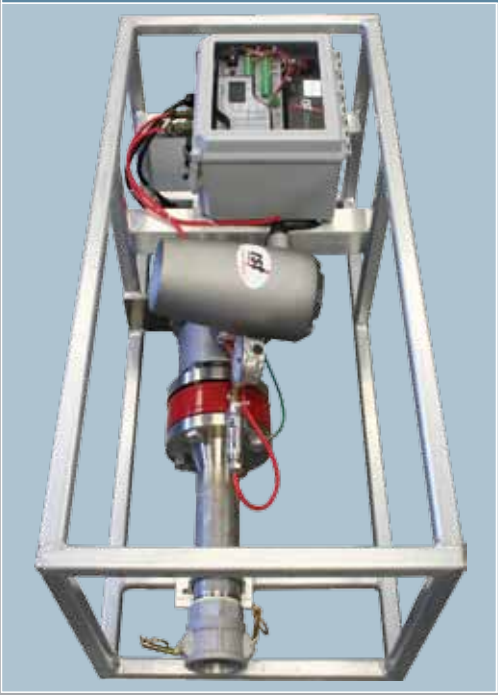
It offers a permanent record of key grouting parameters for quality assurance, quantity documentation, pressure and flow readings.

The RST Compaction Grout Monitor System has been developed and tested for a 2" flow tube. A short (< 50') header connection of high pressure/low dilation, wire braid reinforced hose is recommended. For low mobility/high pressure applications, wired and wireless header pressure monitoring is available.

SPECS

FLOW SPECIFICATIONS
Flow | *0.2 - 5.0 CFS (2.09 - 52.4 GPM)*
Temperature | *-20°C to 85°C*
Grout Pipe Sizes | *2.0 in.*
Materials | *Compaction and low mobility grouts*
Accuracy | *±2% above 0.3 CFS* *(after on-site calibration)*
Pressure Transducer | *0 - 1000 PSI* *0.25% FSO* *(other options available)*
Output | *4 - 20 mA or 0 - 2.5 V*
Connector | *2" heavy duty concrete placement flange*
LOGGER SPECIFICATIONS
Storage | *2 MB standard memory*
Data File | *Comma delimited* *ASCII data file for post processing*
Batch Control | *Keypad display to file*
Reading Rates | *2 to 10 seconds*
Real Time Graphical Display *(English or SI Units)* | *Pressure, Flow, Injected Volume and* *Site Specific Information*

Permeation Grout Monitor



The RST Permeation Grout Monitor System provides operators and engineers near-real-time display of key grouting parameters to enhance the understanding of site conditions.

It is invaluable in providing a permanent record of key grouting parameters for quality assurance, documented quantities and pressure readings.

The datalogger incorporates a radio that transmits data to a portable computer on which an operator can visualize displays of real-time and historical injection pressure and flows. The user-friendly software allows for displaying the trending graphs of pressure and flow, as well as other graphs associated with grouting theories and practices.

SPECS

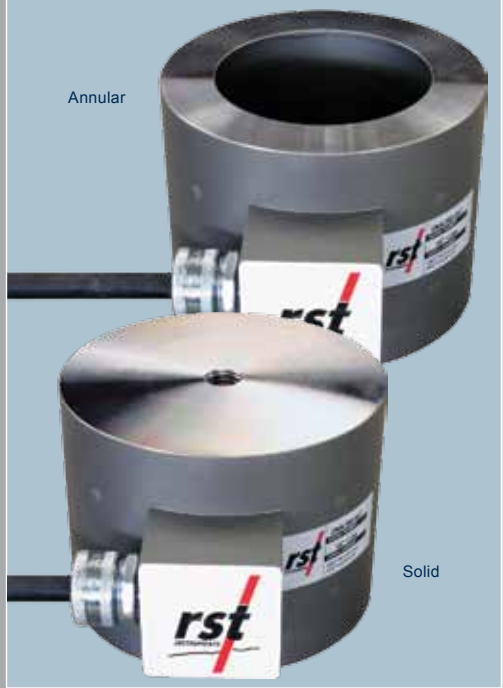
1.0 INCH PIPE
Min. Volumetric Range (gal/min) | *0.782*
Max. Volumetric Range (gal/min) | *78.0*
2.0 INCH PIPE
Min. Volumetric Range (gal/min) | *3.122*
Max. Volumetric Range (gal/min) | *310.0*
ADDITIONAL SPECIFICATIONS
Temperature | *-20°C to 85°C*
Dissolved /suspended Solids | *0 - 40%*
Accuracy | *±1% above 1 FPS* *(after on-site calibration)*
Pressure Transducer | *0 - 1000 PSI* *0.25% FSO* *(other options available)*
LOGGER SPECIFICATIONS
Storage | *2 MB standard memory*
Data File | *Comma delimited* *ASCII data file for post processing*
Batch Control | *Keypad display to file*
Reading Rates | *2 to 10 seconds*
Real Time Graphical Display *(English or SI Units)* | *Pressure, Flow, Injected Volume,* *Site Specific Information, Apparent Lugeon,* *Penetrability Control, GIN, etc.*

load, stress and pressure cells

fast facts: load + stress + pressure cells

RST Instruments Ltd. offers various instruments to measure load, stress and pressure as it relates to rock, soil, concrete and piling type applications. Most instruments in this category are simple and reliable in their function and installation and are equipped with sensors that are vibrating wire, pneumatic or strain gauge. More sensitive options are available for applications requiring higher levels of accuracy and detection and can be discussed with RST. Manual monitoring or remote data acquisition configurations are available for many instruments in this category.

Vibrating Wire Load Cells



Vibrating Wire Load Cells provide measurement of loads in tie-backs, struts, ground anchors and rock bolts. Cells are available in both solid and annular styles to monitor compressive loads.

Solid style cells incorporate 3 vibrating wire strain sensing elements mounted parallel to the longitudinal axis of the cell. Optional spherical platens are available to enhance alignment to the load axis.

Annular cells incorporate 3 to 6 vibrating wire strain sensors, mounted parallel to the longitudinal axis, equidistant around the circumference.

Sensors are read with the pluck and read technique, permitting compatibility with various brands of readouts and loggers including RST's VW2106 Vibrating Wire Readout.

SPECS

Capacity	*225 kN to 10675 kN*
Over Range Capacity	*150% F.S.*
Sensitivity	*0.01% F.S.*
Accuracy	*0.5% F.S.*
Temperature Range	*-40°C to 75°C*
Material	*High tensile, stress relieved steel*
Hole Size	*As requested*
Dimensions	*Solid and annular cell dimensions vary according to model, contact RST for complete details.*

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

Total Earth Pressure Cells

Total Earth Pressure Cells are designed to measure stress acting on plane surfaces. Applications may involve earth embankments and dams; foundations, retaining walls, and piles; pipelines and culverts; railroad bases; beneath raft foundations; tunnel linings and mine backfill monitoring.

The cells are constructed from two circular stainless steel plates, welded together around their periphery. The annular space between these plates is filled with de-aired glycol. The cell is connected via a stainless steel tube to a transducer forming a closed hydraulic system. The stress is then converted to a signal and may be remotely read on a variety of data loggers or portable readout units such as RST's C108 Pneumatic Readout or VW2106 Vibrating Wire Readout.

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH C108 pneumatic readout

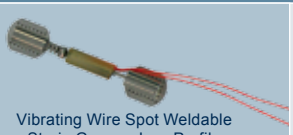
WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

VIBRATING WIRE	
Range	*Up to 34,500 kPa*
Over Range	*200% F.S.*
Accuracy	*0.1% F.S.*
Resolution	*0.025% F.S. minimum*
Cell Diameters	*11.4, 24.1 & 31.7 cm*
STRAIN GAUGE	
Range	*Up to 34,500 kPa*
Over Range	*200 - 500% F.S. (sensor dependent)*
Accuracy	*To ±0.1% F.S. (sensor dependent)*
Resolution	*Infinite*
Cell Diameters	*11.4, 24.1 & 31.7 cm*
PNEUMATIC	
Range	*Up to 13,800 kPa*
Over Range	*2000 psi maximum*
Accuracy	*0.25% or 0.15% F.S.*
Resolution	*Equal to readout instrument*
Cell Diameters	*11.4, 24.1 & 31.7 cm*

Vibrating Wire Strain Gauges

WORKS WITH GeoViewer REAL-TIME MONITORING



Vibrating Wire Spot Weldable Strain Gauge - Low Profile

Vibrating Wire Spot Weldable Strain Gauge

Vibrating Wire Embedment Strain Gauge

Vibrating Wire Arc Weldable Strain Gauge

Vibrating Wire Strain Gauges are designed to be welded to or embedded in various structures for monitoring strain. Vibrating Wire Strain Gauges are available in 3 models: VWSG-A, for arc welding to steel structures; VWSG-S and VWSG-S-LP, for spot welding to steel structures; VWSG-E and VWSG-EL, for embedment in concrete.

Vibrating Wire Strain Gauges consist of two end blocks with a tensioned steel wire between them. As the steel or concrete surface that encompasses the strain gauge undergoes strain, the end blocks will move relative to each other. The tension in the wire between the blocks will change accordingly, thus altering the resonant frequency of the wire. The RST VW2106 Vibrating Wire Readout can be used to read the vibrating wire strain gauges.

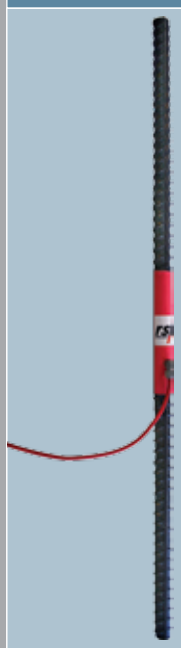
WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

VWSG-A (ARC WELDING)	
Standard Gauge Length	*150 mm*
Strain Range	*3000 με*
Sensitivity	*1.0 με*
Operating Temperature	*-20°C to 80°C*
VWSG-S & VWSG-S-LP (SPOT WELDING)	
Standard Gauge Length	*50.8 mm*
Strain Range	*3000 με*
Sensitivity	*0.5 to 1.0 με*
Operating Temperature	*-20°C to 80°C*
VWSG-E (EMBEDMENT)	
Standard Gauge Length	*153 mm*
Strain Range	*3000 με*
Sensitivity	*1.0 με*
Operating Temperature	*-20°C to 80°C*
VWSGE-EL (EMBEDMENT)	
Standard Gauge Length	*250 mm*
Strain Range	*3000 με*
Sensitivity	*0.5 με*
Operating Temperature	*-20°C to 80°C*

Vibrating Wire Rebar Strain Meter / Sister Bar



Vibrating Wire Rebar Strain Meter - 30 mm

Vibrating Wire Sister Bar - #4 (0.5 in.)

The Vibrating Wire Rebar Strain Meter is used to measure strain in rebars embedded in reinforced concrete. The most common method of installation is to weld it into the existing rebar cage. A vibrating wire strain gage is located axially in the center of the instrumented Rebar Strain Meter. Strain readings are only proportional to the axial load exerted on the rebar.

A Sister Bar is a small diameter Rebar Strain Meter which is installed parallel to existing rebars. The strain measured in the Sister Bar is equal to the strain in the adjacent rebar. The Vibrating Wire Sister bar is also used as a replacement for vibrating wire embedment strain gages in situations where concrete is poured or cast in ways that could damage the embedment strain gage, or simply disturb too much of their orientation; whereas, Sister Bars are more robust and also easier to tie to a rebar cage.

SPECS

Standard Range	*2500 με*
Resolution	*0.4 με*
Accuracy	*±0.25% F.S.*
Temperature Range	*-20°C to 80°C*
Rebar Sizes	*15, 20, 22, 25, 30, 35 mm*
Sister Bar Sizes	*#4 (0.5", 12.7 mm), 10 mm*
Length	*1105 mm*
Output	*1800-2800 Hz (approximately)*

WORKS WITH VW 2106 vibrating wire readout

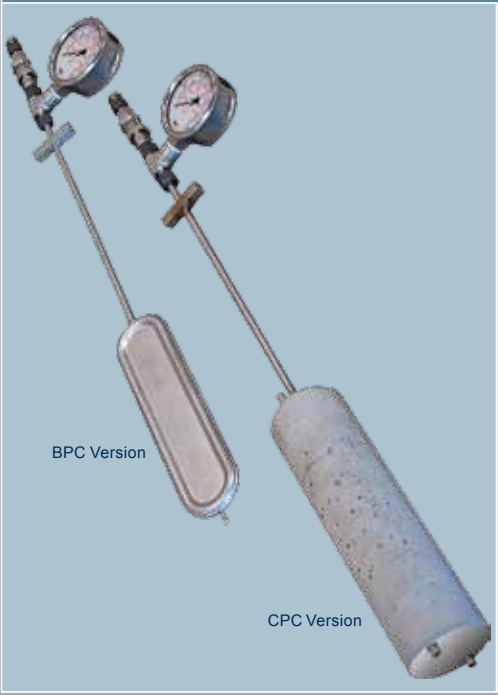
WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

did you KNOW?

Since RST is capable of providing custom engineered solutions, well over half of all the geotechnical instruments manufactured at RST Instruments are specifically designed to meet invidual project requirements as requested by our customers.

CUSTOM

Borehole Pressure Cells



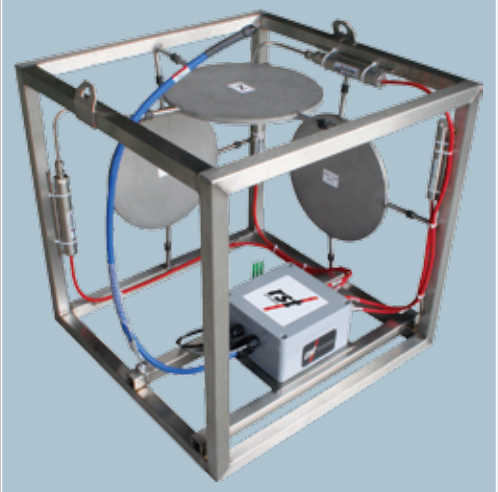
Borehole Pressure Cells are used for stress monitoring in both elastic and viscoelastic rock and are available in two basic configurations: (1) miniature flatjack version (BPC), and (2) cylindrical pressure cell (CPC). Due to the flat design, the BPC responds primarily to the stress in the plane perpendicular to the cell, and is only slightly affected by stress in the same plane. Two BPC's mounted at right angles to each other in the same borehole will monitor the principal stresses in the plane perpendicular to the borehole. Biaxial stress measurement will require three BPC's in the same borehole.

While not appropriate for anisotropic stress conditions, the CPC will measure the average change in the principal stresses in the plane perpendicular to the borehole.

SPECS

Material	*Copper or stainless steel*
Range	*0 – 70 Mpa*
Sensitivity with Gauge Readout	*300 kPa*
Accuracy with Gauge Readout	*1%*
BPC Dimensions	*Contact RST for sizes*
CPC Dimensions	*Contact RST for sizes*
Options	*Vibrating Wire Transducer may be used in place of Bourdon tube gauge.*

Paste Backfill Monitor



RST's Paste Backfill Monitors are used in mine paste backfill to achieve improved extraction and to increase safety. They provide useful engineering feedback to allow paste and stope design to be optimized.

A typical Paste Backfill Monitor consists of 3 or more vibrating wire total stress sensors (orthogonal), 1 vibrating wire piezometer to measure pore water pressure, a biaxial tilt meter and optional magnetic compass to measure "as-placed" orientation, matric suction and volumetric water content sensors, and conductivity sensors. A compact and sturdy stainless steel frame surrounds the unit and is designed to withstand the rigors of installation.

Because stope geometries vary depending on the mining situation, Paste Backfill Monitors are typically customized for the situation. All sensors are connected to a single, *Kevlar® reinforced, multi-conductor cable that can be extended outside the mining area for remote data acquisition.

SPECS

Total Stress	*0.7-3 MPa FS*
Piezometer	*0.7-3 MPa FS*
Matric Suction	*0.01-2.5 MPa*
Power Source	*1 'D' lithium primary battery*
Water Content	*1-100%*
Conductivity	*0-2.3 S/m*
Temperature	*-25°C to 65°C*

** Kevlar® is a registered trademark of E.I. du Pont de Nemours and Company.*

Pile Tip Load Cells

Pile Tip Load Cells measure load at the tips of driven piles, cast-in place piles, and drilled shafts. Custom manufactured to suit site specific requirements, cells can be any shape to suit different pile types and operate on principles similar to total earth pressure cells. Transducer types are available as Pneumatic, Strain Gauge or Vibrating Wire.

Strain Gauge Load Cells

Strain Gauge Load Cells provide measurement of loads in tie-backs, struts, ground anchors and rock bolts. They incorporate from 8 to 16 high output electrical resistance strain gauges in a full bridge configuration that are bonded to a high strength steel or stainless steel spool. This arrangement compensates for both temperature effects and off center loading.

Strain Gauge Load Cells are available in virtually any size in both annular and solid styles. Gauge waterproofing utilizes the latest application techniques and protective materials. The rugged design includes heavy duty protective cover, sealed construction, and low deflection under load.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

- Capacity | *22.5 kN to 10675 kN (5,000 lbs to 2,400,000 lbs)*
- Hole Size | *16 to 356 mm, as required.*
- Material | *High strength steel or stainless elements.*
- Temperature Compensation | *-40°C to 40°C*
- Over Range | *100% F.S.*
- Sensitivity | *±2.0 mV/V*

Due to the extensive specifications for each variety of strain gauge load cell, please contact RST Instruments for complete information or visit www.rstinstruments.com

Push-in Pressure Cell

Push-in Pressure Cells can be pushed into the ground where it can measure total earth pressure and pore water pressure within the soil. They can be used as a site investigation tool to determine the in situ stress state, both vertical and horizontal, depending on the direction of installation. They can also monitor the change in active and passive pressure around retaining structures (diaphragm walls,...) as well as in tunneling, and other earthworks. Typical installations are in fine grained cohesive soils, including very soft to stiff clays.

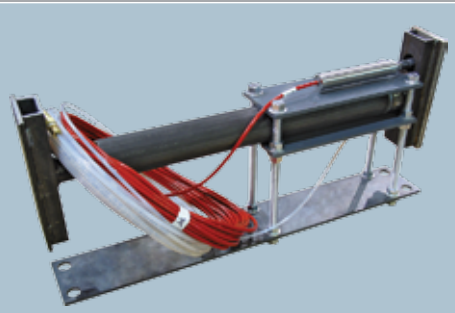
Construction consists of two longitudinal stainless steel plates welded together around their periphery. The annular space between these plates is filled with de aired glycol. A port and filter for pore water pressure measurement are located on one of the flat sides of the support plate behind the pressure sensitive section of the cell.

SPECS

- Capacity | *350, 700 kPa 1, 2, 3, 5 MPa*
- Over Range | *150% F.S.* *(maximum)*
- Resolution | *0.025% F.S.* *(minimum)*
- Accuracy | *±0.1% F.S.*
- Sensor Type *(earth and pore water pressure)* | *Vibrating Wire*
- Temperature Range | *-20°C to 80°C*
- Filter | *50 micron sintered filter* *(high air entry alumina filter 1, 3, 5 Bar available)*
- Length x Diameter x Thickness *(pressure sensitive section)* | *200 x 57 x 6.3 mm*
- Total Length | *524 mm*

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"



Jackout Earth Pressure Cell

Jackout Earth Pressure Cells measure active and passive pressures on diaphragm walls. They also verify design assumptions, assuring soil pressures are not larger than those the structure was designed to withstand. RST Jack Out Earth Pressure Cells can be combined with an integral piezometer to allow effective stress readings to be made. Standard cell size is 22.9 cm (9 in.) and others sizes are available upon request.

Hydraulic Load Cells

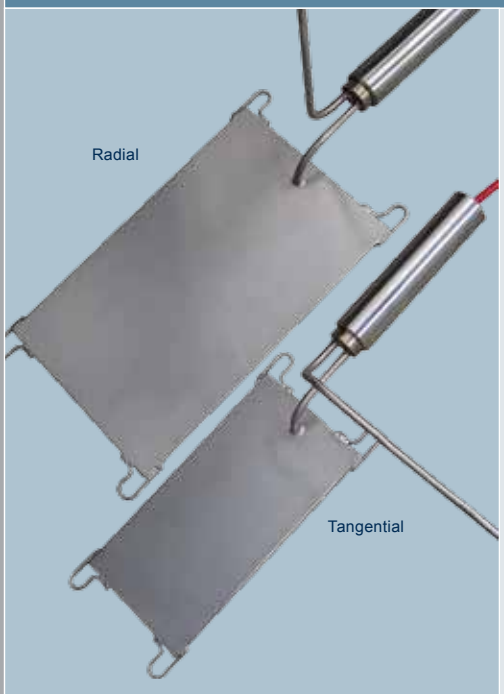
Hydraulic Load Cells are available as an annular cell or a solid cell for the measurement of compressive force typically between structural members. They may also be used for applications involving rock and soil anchors.

Hydraulic Load Cells equally distribute load over the loading area of the cell by a thick, machined steel distribution plate. The load, when applied to the cell, causes a pressure increase in the hydraulic fluid; thus, this change in pressure may be measured via a Bourdon Tube Gauge or a variety of electrical transducers. Remote readout and data acquisition configurations are available.

SPECS

- *Annular cells are available to suit all load ranges for both cable bolts and continuously threaded rock bolts. Please contact RST Instruments for more information.*
- *Custom cells, either solid or annular, can be fabricated to suit any specialized application or ranges.*
- *For highest accuracy and temperature compensation, RST recommends either Strain Gauge or Vibrating Wire type cells.*

Vibrating Wire NATM Stress Cells



Vibrating Wire NATM Stress Cells measure stresses in concrete (shotcrete) linings in tunnels and other underground workings. They feature a higher stiffness than Earth Pressure Cells, and are therefore more suitable for stress measurement in concrete.

The instrument name is associated with New Austrian Tunneling Method (NATM), which is also known as Sprayed Concrete Lining (SCL) and Sequential Excavation Method (SEM). Monitoring of radial and tangential stresses within and on shotcrete lining, along with measurement of tunnel convergence and deformation is an integral, very important part of the method and its successful implementation.

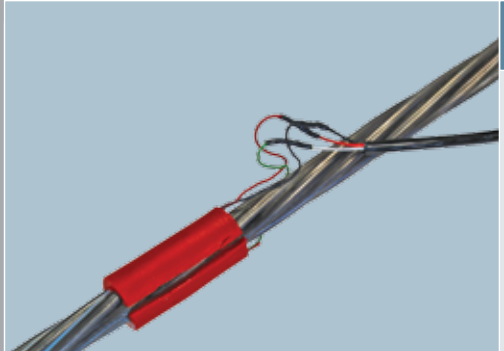
NATM cells are constructed of two rectangular steel plates welded around their periphery. The annular space between the plates is filled with fluid. The cell is connected via a stainless steel tube to a vibrating wire pressure transducer. The stress on the cell is then converted to a signal which is read either with a vibrating wire readout, such as the VW2106 from RST, or a data logger.

SPECS

- Sensor Type | *Vibrating Wire*
- Over Range | *200% F.S.*
- Accuracy | *± to 0.1% F.S.*
- Resolution | *±0.025% F.S. minimum*
- Pressure Ranges *(model dependent)* | *2, 3, 5, 7, 20, 35 Mpa*
- Cell Dimensions (2, 3, 5 Mpa models) | *150 x 250 mm*
- Cell Dimensions (7, 20, 35 Mpa models) | *100 x 200 mm*

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"



Tension Measuring Gauge (TENSMEG)

The TENSMEG is an accurate and cost-effective means to examine load and strain in rock and soil anchors, and also in cable bolts used for rock support. Pre-stressed and post-tensioned concrete load and strain may also be effectively measured.

extensometers and convergence monitors

fast facts: extensometers + convergence monitors

RST Instruments Ltd. manufactures various types of extensometers and convergence monitors that are used to measure ground closure in mining and civil engineering projects; linear displacement of structures; tunnel displacement; and deformation in rock faces or underground workings. Manual monitoring or remote data acquisition configurations (with alarm triggering) are available for many instruments in this category.

Rod Type Multiple Point Borehole Extensometer (MPBX)

Stability and movement behavior of soil and rock masses can be determined by the use of borehole extensometers. A typical rod extensometer consists of a reference head, usually installed at the collar of a drill hole, and one or more in-hole anchors, each of which is fixed in place at a known depth in the borehole. As the soil or rock deforms, the distances between adjacent in-hole anchors change, as do the distances between the individual in-hole anchors and the reference head. This allows an accurate determination of distribution, magnitude, rate and acceleration of deformation in the rock or soil mass intersected by the drill hole.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

EXPANDING SHELL ROCK BOLT ANCHOR

Preferred for single and double point extensometers. Wide expansion and positive mechanical set make it useful in rough, uneven boreholes within fractured rock.

GROUTABLE ANCHOR

Simple to install and the preferred anchor for downward directed holes. Not suitable for use in soft ground or soil. Up to six can be placed in a single 3 in. (NX) borehole.

SNAP RING ANCHOR

For use in hard, competent rock, where smooth, uniform boreholes can be drilled. It offers the optimum in speed and simplicity of installation, and up to eight can be placed in a single 3 in. (NX) borehole.

HYDRAULIC ANCHOR

For use in soft ground and soil, especially where hole squeezing is anticipated. Three types are available: standard expanding tube type, single acting borros prong type, and double acting borros prong type. Up to six can be placed in a single 3 in. (NX) borehole.

Contact RST for complete ordering information.

Vibrating Wire Crack Meters

Vibrating Wire Crack Meters are designed to be fixed to various structures for monitoring linear displacement.

They are easily installed by grouting, bolting or bonding the two threaded anchors (with ball joints) on either side of the crack/joint, and then reattaching the anchors to the sensor.

When separation or convergence of two reference points reaches a preset critical rate, or value, an alarm may be triggered based on the type of data logger configuration being implemented.

Submersible (up to 200 m) versions are available for installation on the upstream perimeter joint of CFRD dams. 2D and 3D versions are also available.

SPECS

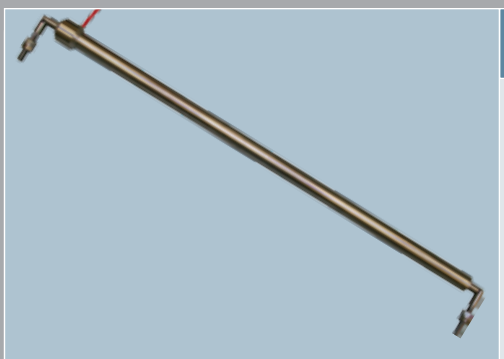
Ranges | *12, 25 , 50, 75, 100, 150, 200 mm*

Standard Range | *1.0 in. (2.0 & 4.0 in. optional)*

Accuracy | *0.2% F.S. (0.1% F.S. optional)*

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"



Submersible Crack Meter

Submersible (up to 200 m) Crack Meters are made for installation on the upstream perimeter joint of Concrete Rock Fill Dams (CFRD). Both 2-D and 3-D versions are available. Contact RST for complete details.

Vibrating Wire Joint Meter

The Vibrating Wire Joint Meter monitors joints of mass concrete structures. The instrument consists of two parts, a socket and the main body with a waterproof vibrating wire sensing gauge.

During construction of the structure, the socket is secured to the form and embedded into a lift of the block to be constructed. After removal of the form, and prior to the concreting of the adjacent block, the gauge is screwed into the socket, set at the desired range and then embedded into concrete. Opening and closing of the joint is then measured by the gauge, which is firmly anchored in both blocks.

Measurements from the Vibrating Wire Joint Meter are read with the VW2106 Vibrating Wire Readout, or a data logger (flexDAQ) if remote continuous monitoring of the joints is required.

SPECS

- Ranges | *15, 25, 50 mm (other ranges available)*
- Over Range | *1.25 X range*
- Resolution | *0.02% F.S.*
- Accuracy | *0.2% F.S. (0.1% F.S. optional)*
- Operating Temperature | *-20°C to 80°C*
- Diameter | *51 mm*
- Lengths |
  15 and 25 mm range: 340 mm
  50 mm range: 430 mm

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

Flexible Rod Extensometer

Flexible Rod Extensometers monitor ground displacements and are designed to withstand severe field conditions and accommodate transverse shear. The unit is supplied completely assembled and sealed for grouting into the borehole. Rod displacement readings may be taken manually using a dial gauge or monitored continuously with a remote readout head.

The extensometer consists of a maximum of 6 or 10 carbon fiber, fiberglass, or spring steel rods, each sheathed in a neat fitting plastic tube. One end of each rod is connected to a ribbed steel anchor grouted into the borehole. The other end is fitted with a brass cap which is the displacement surface with reference to the collar tube. The multiple rods are sheathed in a polyethylene tube and sealed at each anchor point. Before coiling of the extensometer, the ends of the rods are locked in position at the collar and released only after the grout has hardened in the borehole.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

- ROD ASSEMBLY TYPE: B
- Anchor Diameter | *35 mm*
- Maximum Number of Rods | *4*
- ROD ASSEMBLY TYPE: C
- Anchor Diameter | *41 mm*
- Maximum Number of Rods | *6*
- ROD ASSEMBLY TYPE: D
- Anchor Diameter | *47 mm*
- Maximum Number of Rods | *10*
- NOMINAL BOREHOLE DIAMETERS
- UPHOLE |
  With external air bleed tube 10 mm I.D.
  ROD TYPES: B: 54, C: 60, D: 85 mm
- DOWNHOLE |
  With external grout tube 15 mm I.D.
  ROD TYPES: B: 57, C: 65, D: 90 mm
- UPHOLE |
  With internal air bleed tube 12 mm I.D.
  ROD TYPES: B: 39, C: 45, D: 75 mm

Convergence Monitor

The Convergence Monitor is an economical, robust instrument for the continuous or random monitoring of ground closure in mining and civil engineering projects such as: mine development in squeezing ground, tunneling, remnant mining, roadway intersections, regional subsidence and closure surveys.

Consisting of a sensor unit coupled to a lower spring loaded leg and an upper adjustable leg, the sensor itself has a digital indicator that displays movement in inches or millimeters.

Optionally, the Convergence Monitor can be modified to include the ability to be remotely read by a datalogger. This is especially useful in applications where continuous monitoring is essential.

SPECS

- Standard Range | *150 mm* *(other ranges available upon request)*
- Resolution | *0.01 mm*
- Span *(custom sizes also available)* | *3.7 m fully extended 2.06 m retracted*

Tape Extensometer

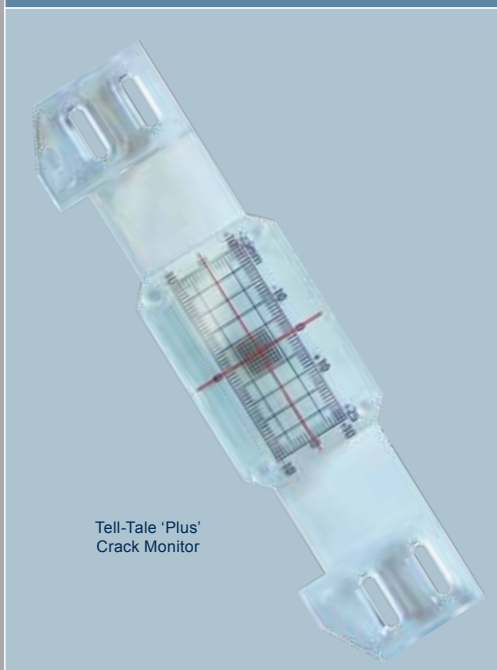
The Tape Extensometer is a portable device designed to measure the relative distance between reference anchors fixed to the excavation or structure.

It consists of a precision punched steel tape incorporating a repeatable tensioning system and dial gauge readout. To obtain a reading, the swivel hook on the fixed end of the extensometer is connected to the stainless steel eye on the anchor. The tape is unwound, allowing the tape swivel hook to be attached to the opposing anchor eye. Coarse tension adjustment is accomplished by positioning the pin of the extensometer in one of the precision punched tape holes. Fine tension adjustment is achieved by rotating a knurled sleeve until two index marks align. A precision dial gauge measures this fine adjustment with the tape held under a consistent repeatable spring force. The instrument is then read by noting the tape position and subtracting the dial gauge reading.

SPECS

- Tape Lengths in Meters | *10, 15, 20, 30 m*
- Tape Lengths in Feet | *30, 50, 100 ft.*
- Dial Indicator Resolution | *0.01 mm*
- Repeatability | *± 0.25 mm*
- Weight with 20 m Tape | *2.2 kg*

Tell-Tale Crack Monitors



Tell-Tale 'Plus'
Crack Monitor

Tell-Tales consist of two plates which overlap for part of their length. One plate is calibrated in millimeters and the overlapping plate is transparent and marked with a hairline cursor. As the crack width opens or closes, one plate moves relative to the other. The relationship of the cursor to the scale represents the amount of movement occurring. Range ±20 mm – Resolution 1 mm. The tell-tales are fixed with screws and adhesive across the crack to be monitored.

SPECS

STANDARD TELL-TALE

Produced in durable acrylic plastic and used for monitoring movement across cracks in vertical and horizontal directions on flat surfaces.
Coefficient of thermal expansion: 7x10-5cm/cm/°C.

CORNER TELL-TALE PLUS

Made of polycarbonate and used for monitoring movement across cracks in internal and external corners. *Coefficient of thermal expansion: 7x10-5cm/cm/°C.*

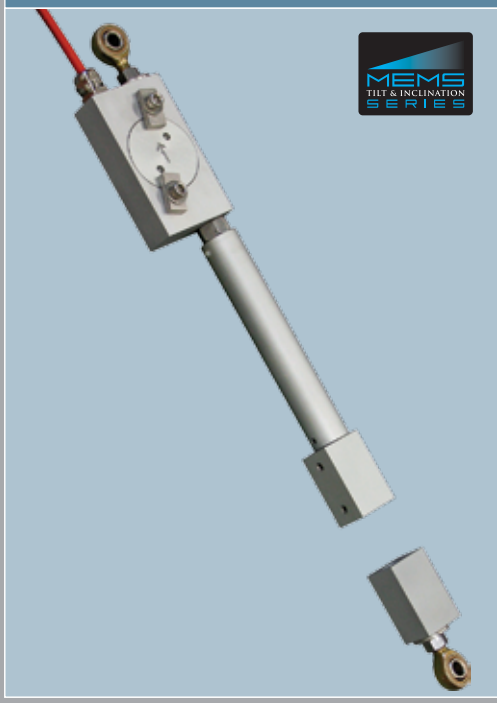
DISPLACEMENT TELL-TALE PLUS

Made of PVC rigid sheet and is used for monitoring movement across cracks when one surface moves out of plane with the other. The TELL-TALE monitors out of plane movement.
Coefficient of thermal expansion: 7.3x10-5cm/cm/°C.

TELL-TALE 'PLUS'

A weather resistant design that monitors cracks to an accuracy of 1.0 mm, or to an accuracy of ±0.1 mm with calipers. Monitors vertical and horizontal movement and also offers increased horizontal monitoring range to ±25 mm. Manufactured in vandal resistant polycarbonate.

Tunnel Profile Monitoring System



The Tunnel Profile Monitoring System is a series of linked rods, fixed to the tunnel wall, to monitor deformation. A data logging system and related software is available to provide near real time displacement and generate a graphical representation of tunnel performance.

A system of linked arms is affixed to the tunnel wall. Each arm is fitted with a high accuracy displacement sensor and precision tilt meter. Spatial displacement of the pins and arms results in changed tilt and displacement readings. The data logger system automatically collects the data and transmits it to a computer. The computer then analyzes the data, and calculates the displacement profile for presentation.

The system is available in either open or closed loop configurations.

WORKS WITH
flexDAQ DATALOGGERS
custom, turn-key datalogger systems shipped "ready to run"

SPECS

DISPLACEMENT SENSOR

Total Mechanical Travel	*25 mm*
Independent Linearity	*0.25%*
Operating Temperature	*-40°C to 80°C*
Resolution	*Infinite*
Accuracy	*0.06 mm*

TILT SENSOR

Range	*±15°* *(other ranges upon request)*
Resolution	*±2 arc sec. (±0.0006°) (0.01 mm/m)*
Non-linearity	*±0.0125% F.S. (±0.002°) (0.03 mm/m)*
Repeatability	*±0.0125% F.S. (±0.002°) (0.03 mm/m)*
Sensor Type	*Accelerometer*
Operating Temperature	*-40°C to 85°C*

Rod Extensometer Single-Double Point

The Single Point Model EX-1 is an inexpensive, simple, rugged, and reliable device to monitor deformation in under ground workings such as chambers, tunnels, mine galleries and mine excavations. The entire instrument is recessed in the borehole, providing maximum protection against mechanical damage. The extensometer consists of modified expanding shell rockbolt anchors set with a standard socket wrench. A rod extends from the borehole anchor to the collar anchor, which is set in the mouth of the borehole.

Deformation measurement is accomplished by using either an analog or digital depth indicator to measure the position of the rod tip relative to the collar anchor reference surface.

The Double Point Model EX-2 is similar to the Single Point EX-1 although two anchors are employed. The use of two points allows the engineer to distinguish between dangerous deep seated movements and more trivial surficial spalling.

SPECS

SINGLE POINT
Measurement Points | *1*
Range | *100 mm*
Resolution | *0.02 mm*
Borehole Diameter | *35, 44, 50, 64 mm*
Maximum Borehole Diameter Deviation | *-0, +10 mm*
Maximum Length | *30 m*
Weight | *0.90 kg/m*
DOUBLE POINT
Measurement Points | *2*
Range | *150 mm*
Resolution | *0.02 mm*
Borehole Diameter | *41-44, 50-57 mm*
Maximum Borehole Diameter Deviation | *-0, +6.4 mm*
Maximum Length | *15 m*
Weight | *0.90 kg/m*

Vibrating Wire Soil Extensometer

The Vibrating Wire Soil Extensometer monitors lateral and longitudinal deformation of soil and different types of embankments and embankment dams.

It consists of a vibrating wire displacement sensor encased in a sealed body. The body contains a telescopic outer PVC pipe fitted with two flanges and an inner stainless steel rod. One end of the rod is attached to the flange, while its other end is connected to a displacement sensor attached to the other flange.

As deformation occurs, the telescopic pipe moves with the soil causing the rod to operate the displacement sensor. Displacement is measured by a readout like the RST VW2106 Vibrating Wire Readout or a data logger. The initial reading of the instrument is used as a datum. Subsequent readings are compared to the datum to calculate the magnitude, rate, and acceleration of movement.

SPECS

Gauge Length | *1m, with 0.5, 1, 2 and 3 m long extension kits*
Sensor Range | *25, 50, 75, 100, 150, 200, 300 mm (other ranges available)*
Accuracy | *±0.25% F.S.R.*
Resolution | *0.02% F.S.R.*
Linearity | *0.25% F.S.R.*
Thermal Zero Shift | *<0.05% F.S.R./°C*
Operating Temperature | *-20°C to 80°C*
Instrument Body / Flange Diameter | *28 mm / 280 mm*
Signal Cable | *Two twisted pair cable with polyurethane jacket.*

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

settlement systems

fast facts: settlement systems

RST Instruments Ltd. produces Settlement Systems that accurately monitor settlement or heave in soils and man-made structures such as embankments, and earth and rockfill dams.

Vibrating Wire Liquid Settlement System

The Vibrating Wire Liquid Settlement System monitors settlement or heave in soils and man-made structures such as embankments, and earth and rockfill dams. The system consists of a fluid body, reservoir, flexible tubing, and sensor and readout unit.

A vibrating wire pressure sensor is attached to a settlement plate located at the point to be monitored, and connected via two liquid-filled tubes extending laterally to a reservoir located on stable ground. The sensor measures the hydraulic head of liquid between the sensor and reservoir locations. The liquid filled tubes can also be flushed.

Standard configuration includes one reservoir for each cell. In applications where settlement of two or more points along the same monitoring profile is of interest, RST provides systems with multi-position reservoirs.

SPECS

- Standard Ranges | *7, 17 m*
- Optional Range | *2 m (with digital output sensor)*
- Resolution/Sensitivity | *0.05% F.S.*
- System Accuracy | *0.1% F.S.*
- Temperature Range | *-20°C to 80°C*

WORKS WITH VW 2106 vibrating wire readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

Magnetic Settlement System

The portable Magnetic Settlement System monitors either heave or settlement in soil and rock. Installation may be either as a single purpose device to monitor settlement/heave only, or in conjunction with RST flush-coupled inclinometer casing to obtain both vertical and horizontal deformation data from a single installation.

Magnetic targets are anchored to the ground around either a PVC pipe, Standpipe Piezometer, or Inclinometer Casing. The anchors are not coupled to the access pipe, and are free to move with the soil. Magnets are available for attachment to inclinometer casing to monitor closure of casing telescopic sections. The probe is a normally open simple reed switch that closes upon entering the magnetic field of the target anchor. Operation is analogous to a water level meter in that when the switch closes, the electrical circuit is completed, causing a buzzer/light in the readout to operate. A two-conductor tape serves to both lower the probe and connect the probe to the circuit board. The switch closes upon entering magnetic field, the signal amplified, and fed to the light/buzzer. Anchor elevation is then read directly from the tape. A Combination Reed Switch/Water Level Meter is also available.

SPECS

- MAGNETS *(contact RST for details)*
- *Datum Magnets*
- *Spider Magnets*
- *Plate Magnets*
- *Inclinometer Casing: Telescopic Section Magnets*
- REED SWITCH PROBE (READOUT)
- Resolution | *1 mm*
- Tape | *Polyethylene coated (* Teflon® coated optional) 10 mm flat style. Stainless steel conductors.*
- Probe | *Two reed switches standard. 16 mm O.D. x 200 mm long.*
- Reed Switch Precision | *±0.03 to 0.3 mm*
- System Precision | *Vertical installations typically ±3 to 5 mm. Vertical installations with micrometer head typically ±0.5mm.*
- Battery | *Standard 9 V*
- ACCESS PIPES *(contact RST for details)*

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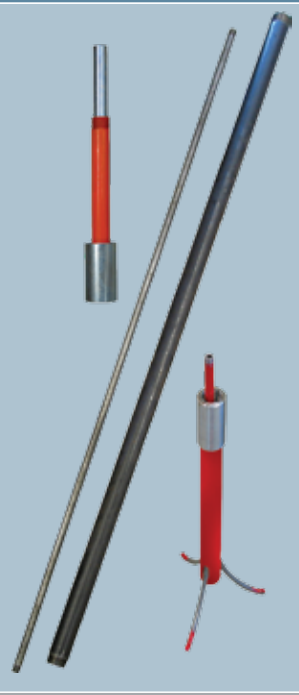
Multi Cell Liquid Settlement System

The Multi Cell Liquid Settlement System is an automated, multi-cell, settlement monitoring system. It monitors structures that may be exposed to heave and/or settlement as a result of nearby construction, tunneling, or natural phenomena.

It is a closed system consisting of a volume of de-aired fluid that is distributed throughout an arrangement of settlement cells, one of the cells being the reference cell which is installed in a stable location unaffected by the area of concern. As a cell experiences settlement or heave, the cell body moves up or down with respect to the level of fluid, which remains constant throughout the system. The amount of movement is measured by the LVDT linear transducer housed within the settlement cell and the datalogger records the readings.

SPECS	
SETTLEMENT CELLS	
Width	*150 mm*
Height	*550 mm*
System Accuracy	*±0.3 mm*
Transducer	*LVDT*
Measuring Ranges	*50 and 100 mm*
Water Height	*<100 mm*

Subsurface Settlement / Heave Points (Borros Anchors)



Settlement points with Borros type anchors are mechanical, single point devices used to monitor subsurface settlement or heave of ground. The system consists of a three pronged anchor, a 6 mm (¼ in.) steel inner pipe and a 25 mm (1 in.) steel outer pipe. Pipes are assembled using standard couplings. After installation, the outer pipe serves as a friction reducer, allowing the inner pipe to move freely. Measurement of the elevation of the top of the inner pipe is conducted using standard optical survey methods. Changes in surveyed elevation are equal to the movement of the anchor.

Anchors are most commonly deployed by pushing on the inner rod to extend the anchor prongs. Hydraulically actuated anchors are also available.

Standard Borros anchor systems are prone to binding of the rods, or downdrag on the anchors caused by the rods binding where the riser pipe exits the friction reducer pipe at the anchor. RST Borros systems avoid this problem by incorporating a bearing/bushing at this critical location.

SPECS	
STEEL PIPE SIZES	
1 in. x 5 ft.	
0.25 in. x 5 ft.	
COUPLING SIZES	
1 in. Pipe Coupling	
0.25 in. Pipe Coupling	

Paste Backfill Cages – Kidd Creek Mine – Timmins, Ontario Canada – Photo taken by Ryan Veenstra courtesy of University of Toronto.

environmental products, pipe and accessories

fast facts: environmental products + accessories

RST Instruments Ltd. manufactures and supplies environmental products that are mainly related to geotechnical applications, such as measuring the elevation of groundwater in boreholes, standpipes and wells. Complete custom weather stations are built to required site specifications. PVC wellscreen and pipe products provide top-quality monitoring for groundwater hydrology, drainage, and water wells. HDPE pipe is used for various industrial applications for landfills, waste sites and mining applications.

Accu-Seal PVC Wellscreen & Pipe

Accu-Seal PVC Wellscreen and Pipe is a system of top-quality monitoring pipe products for groundwater hydrology, environmental, drainage, water wells, and geotechnical applications.

This line of slotted PVC material is manufactured using the latest NC machining techniques. The thread/sealing system, conforming to ASTM F480, uses precision threads, an "O"-ring seal and a wedge locking mechanical seal to obtain a quick, strong, water-tight connection. Fully automated NC lathe threading and proprietary NC slotting equipment ensure superb precision and consistency, as well as competitive pricing.

SPECS

Pipe Sizes | *Threaded 0.5 to 8.0 in. and custom slotting 0.5 to 12.0 in. is available.*
Slot Sizes | *0.010 - 0.125 in.* *(alternate slot sizes available)*
PVC Schedules | *40 & 80*
Schedule 40 & 80 O.D.'s | *0.840 - 12.750 in.*
Schedule 40 I.D.'s | *0.622 - 11.938 in.*
Schedule 80 I.D.'s | *0.546 up to 11.376 in.*
Packaging | *Decontaminated/protective*
Lengths | *Contact RST for details*

Flush Threaded PVC Well Casing

Flush Threaded PVC Well Casing is engineered to be assembled quickly and accurately for use in water wells and similar applications. PVC construction provides durability and effectiveness in the most adverse field conditions, and protection against most chemicals and corrosive agents.

RST manufactures Flush Threaded PVC Casing with precision CNC technology, resulting in a product which meets ASTM F480 standards. Slotted PVC Well Screens are also available.

SPECS

114 MM CASING O.D.
Casing I.D. | 102 mm
Casing Length | 6 m
SDR | *21*
Thread | *8 round right hand, 3° taper*
Crate Quantities | *30 each x 20 ft.*
125 MM CASING O.D.
Casing I.D. | *113 mm*
Casing Length | *6 m*
SDR | *21*
Thread | *8 round right hand, 3° taper*
Crate Quantities | *27 each x 20 ft.*
152 MM CASING O.D.
Casing I.D. | *133 mm*
Casing Length | *6 m*
SDR | *17*
Thread | *8 round right hand, 3° taper or left hand buttress*
Crate Quantities | *21 each x 20 ft.*

High Density Polyethylene Pipe (HDPE)

HDPE pipe is used for various industrial applications including landfills, waste sites and mining applications.

This high density pipe is resistant to corrosive chemicals, and provides durability due to it's high strength and flexibility; it can be bent to a minimum radius of 10-20 times it's own diameter.

HDPE pipe is UV resistant and lightweight weighing 75% to 90% less than cast iron, steel or concrete pipe. As well, this pipe is unaffected by temperatures ranging from -82°C to 87°C.

HDPE pipe can be custom slotted or perforated to your specifications.

SPECS

- Slot Options | *Standard slot widths from .010 to .125 inches with alternate slot sizes available, as required. Minimum slot size for HDPE is 1 mm or 0.040 in. Alternate slot sizes available, including angle slotting.*
- Pipe Sizes | *Slotting or perforating up to 12 in.*
- Pipe Joints | *Bell end, plain end, flush thread (ASTM F480, 4TPI, NPT). HDPE is only available in plain end.*
- Perforating Options | *Various options are available, please contact RST for details.*
- Pipe Preparation | *Unwashed, washed & bagged, and bagged.*

Well Sounder

Well Sounders are designed to measure the depth of boreholes, standpipes and wells. RST Well Sounders employ a high accuracy, non-stretch, stainless steel wire marked in standard 10 ft. graduations that are clearly stamped on to sturdy brass crimps. Alternate graduations are available upon request.

Depths are quickly measured by simply lowering the stainless steel weight, which is attached to the marked wire, until it reaches the bottom of the well or borehole. The onset of any slack in the wire will indicate when the bottom has been reached, at which point the depth can be recorded from the crimp on the wire nearest the top of the opening.

The RST Well Sounder is supplied on a sturdy hand-winding reel complete with a convenient carrying handle and quick access storage area for the detachable stainless steel weight.

SPECS

- Cable Length | *As requested*
- Crimped Markings | *Every 10 or 5 ft.* *(alternate graduations available)*
- Weight Material | *Stainless steel*
- Cable Material | *Stainless steel*
- Crimp Material | *Brass* *(stamped markings for measuring)*
- Reel Material | *ABS plastic and winding handle with carbon steel tubing for base and carrying handle.*
- Weight of Complete Unit | *4.44 kg*
- Weight of Stainless Steel Weight | *1.96 kg*

Portable Water Level Logger

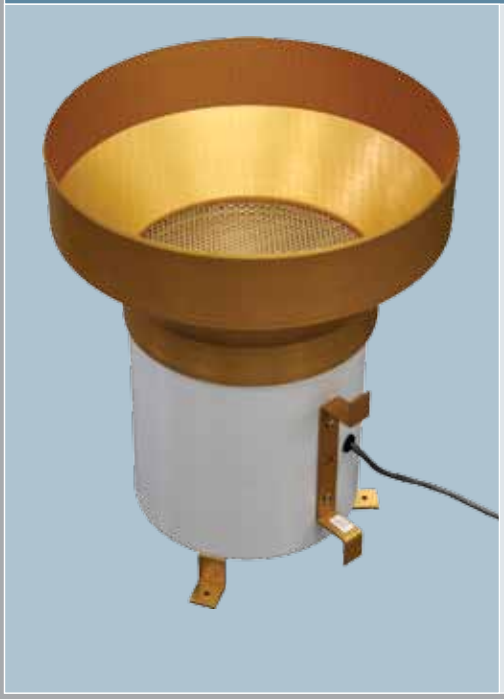
The RST Portable Water Level Logger combines the excellent long-term accuracy and stability of our Vibrating Wire Piezometers with the easy to use Single Channel Vibrating Wire Data Logger. This versatile unit utilizes a strong and light weight reel with *Kevlar® reinforced cable marked at customer specified intervals allowing it to be used at varying depths from hole to hole and site to site.

SPECS

VIBRATING WIRE PIEZOMETER
Over Range | *2 X F.S.*
Resolution | *0.025% F.S. minimum*
Accuracy | *0.1% F.S.*
Operating Temperature | *-20°C to 80°C*
Housing | *Hermetically sealed stainless steel*
Thermistor Resolution | *0.1°C*
Filter | *50 micron sintered filter*
SINGLE CHANNEL VIBRATING WIRE DATALOGGER
Frequency Accuracy | *0.01% F.S.*
Resolution | *1 part in 65,000*
Memory | *Over 30,000 records including time, frequency², temperature*
Power Source | *2 'AA' batteries*
Battery Life | *Over 5 years / 20 memory fills dependending on temperature and use*
Communication | *RS232*
Dimensions | *150 x 65 x 40 mm*
Temperature Range | *-40°C to 60°C*

** Kevlar® is a registered trademark of E.I. du Pont de Nemours and Company or its affiliates.*

Tipping Bucket Rain Gauge



The Tipping Bucket Rain Gauge (Model TR-525) collects rainfall in an accurate and economical method. The rugged and reliable exterior of the unit allows it to be installed in the harshest of weather conditions and adverse climates. Being a completely automatic system, the unit is extremely easy to implement and use.

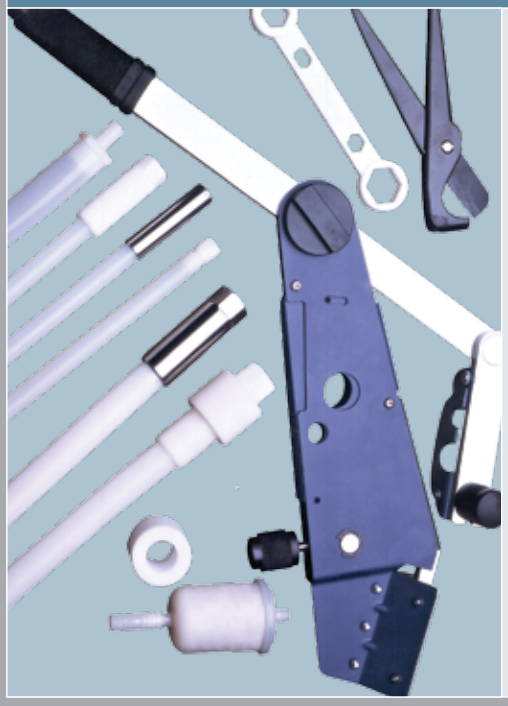
Methods of collecting rainfall data is simple as connecting the Tipping Bucket Rain Gauge to a data logger, event logger or a digital display and take the readings.

The rainfall sensor is dynamically calibrated in the factory and should not require re-calibration upon installation. Field maintenance should include occasional cleaning of the collector screen and inspection of the internal mechanism to make sure it is free from insects and debris. In some applications, user may need to occasionally verify and document sensor accuracy.

SPECS

Resolution | *0.1 mm (0.01")*
Accuracy | *1% at 25.4 mm/hour using dynamic calibration method.* *1% at 1 ft./hour using dynamic calibration method.*
Switch Type | *Magnetic Reed Switch*
Switch Closure | *135 ms average*
Switch Rating | *Maximum of 30 VDC @ 2A, 115 VAC @ 1A*
Temperature | *1°C to 60°C*
Humidity | *0 - 100%*
Height *(with Mounting Feet)* | *25.4 cm (10.0 in.) (TR-525I - Imperial)* *30.48 cm (12.00 in.) (TR-525M - Metric)* *28.58 cm (11.25 in.) (TR-525USW - Imperial)*
Receiving Orifice Diameter | *16.8 cm (6.60 in.) (TR-525I - Imperial)* *24.5 cm (9.66 in.) (TR-525M - Metric)* *20.3 cm (8.00 in.) (TR-525USW - Imperial)*
Funnel Depth | *13.5 cm (5.3 in.) (TR-525I - Imperial)* *18.3 cm (7.2 in.) (TR-525M - Metric)* *16.3 cm (6.4 in.) (TR-525USW - Imperial)*

Waterra Equipment & Accessories



Waterra Equipment & Accessories are the industry standard for environmental monitoring, sampling and purging with regard to groundwater applications.

The most common system employs the use of 5/8" O.D. high density polyethylene (HDPE) or low density polyethylene (LDPE) tubing and a 1" foot valve. Tubing is also available in other sizes ranging from 1" O.D. to 3/8". The appropriate foot valves are also available for each size of tubing either in acetal thermoplastic or in stainless steel. A stainless steel foot valve must be used for 3/8" O.D. tubing.

Once the foot valve has been attached via a self taping thread onto the tubing and inserted into the well; water can be extracted using a simple up/down motion. For deep wells, or where large volumes of water need to be extracted, a lever pump or mechanical pump can be used as an aid to water removal.

SPECS

Due to the extensive variety of products in this category, please contact RST for complete details.

Water Level Meter

For convenient and accurate measurement of elevation of groundwater in boreholes, stand-pipes and wells, the latest rugged Water Level Meters from RST Instruments showcase an improved set of features over previous models:

- An ultra-wide conductivity range allows for use in different liquids ranging from pure water to neat cement grout.
- Multi-functional, single button control interface.
- Frontal battery compartment needs no tools.
- Auto buzzer and battery level check at start up.
- Auto OFF.
- Thermistor option also available.

Other features include a shrouded stainless steel probe, light, buzzer, and sensitivity control as standard.

SPECS

Probe Size | *13 mm / 0.5 in. O.D.*	
Resolution | *1 mm or 1/100 ft.*	
Materials | *NIST traceable, non-stretch steel tape, Tefzel® or polyethylene coated.*	
Power | *9 V (easily removed from front compartment)*	
Conductors | *7 strand, 24 gauge stainless steel*	
POLY TAPE AND TEFZEL® TAPE LENGTHS *(alternate tape lengths available upon request - contact rst for info)*	
Metric: 15, 30, 50, 75, 100, 150*, 200*, 250*, 300** m	
Imperial: 50, 100, 150, 200, 250, 300, 400*, 500*, 1000** ft.	
CARRYING CASES/SHIPPING CASES	
Aluminum | *for 300 m / 1000 ft.*	
Aluminum | *for 150 m, 200 m, 250 m, 400 ft. and 500 ft.*	
Soft vinyl carrying case	

** Mounted on a medium sized reel.*
*** Mounted on a large sized reel.*
Tefzel® is a registered trademark of E.I. du Pont de Nemours and Company or its affiliates.

Disposable and Reusable Bailers

Bailers provide a simple way of collecting samples from monitoring wells.

There are 3 types of Disposable Bailers:

1) PVC

2) Polyethylene

3) Teflon®

There are 3 types of Reusable Bailers:

1) Standard PVC Bailer: The most economical version of the reusable bailer is constructed of opaque PVC pipe.

2) Transparent PVC Bailer: Constructed of transparent PVC pipe, and is ideal for use in hydrocarbon detection wells. Floating hydrocarbons are easily seen as the entire sample is visible.

3) Stainless Steel Barrier: Constructed of stainless steel, this bailer provides the most accurate sample retrieval and is also the most durable and long lasting.

SPECS	
	DISPOSABLE
	Available Bailer Materials | *PVC, polyethylene and *Teflon®*
	O.D. | 1.6 inches
	Polyethylene Lengths | 0.30, 0.45, 0.91, 1.06, 1.21, 1.52, 1.82 m
	PVC Lengths | 0.30, 0.45, 0.91, 1.06, 1.21 m
	*Teflon® Lengths | 0.30, 0.45, 0.91 m
	REUSABLE
	Available Bailer Materials | *Standard PVC, transparent PVC and stainless steel barrier.*
	Overall Assembled Length | *72 cm*
	Wall | *3.6 mm*
	I.D. | *35 cm*
	PVC Ball | *20 mm*
	Capacity | *Approximately 293 mm/ft*
	A double check valve version of all bailers is also available by attaching a second check valve to the standard bailer.

** Teflon® is a registered trademark of E.I. du Pont de Nemours and Company or its affiliates.*

Locking Well Caps & Covers

Lockable Above Grade Well Covers offer the ultimate in surface protection. Square design eliminates rotational removal while sturdy tabs allow security locks to be placed. The raised, angled lid allows casing to rise above the edge of the cover for increased access.

Flush Locking Well Plugs provide an air and water tight seal. The use of a padlock insures a tamper resistant plug, while printed warnings help prevent the possibility of contamination. Standard Locking Well Plugs are available to fit 2 in. and 4 in. I.D. monitoring wells.

Bolt Down Welded Well Covers offer an economical way to provide traffic protection and help protect against water infiltration for monitor wells completed at grade.

SPECS	
	WELL COVER SIZES & TYPES
	2, 3 and 4 in. | *J-plug, flush type lockable*
	4 in. | *Steel, square, powder coated*
	4 in. | *Square, grey paint*
	6 in. | *Round tamper resistant, painted*
	6 in. | *Square, lockable*
	8 in. | *Steel bolted, powder coated*
	8 in. | *Steel bolted, painted*
	8 in. | *Round tamper resistant, painted*

Medium Bentonite Chips

Medium Bentonite Chips are made of high swelling natural Wyoming sodium bentonite. These chips form a flexible, permanent, non-toxic seal where water flows and hydrostatic pressures are involved.

They seal all types of piezometers and surface casing for water wells and well pits. The Medium Bentonite Chips provide an intermediate seal preventing inter-aquifer transfer and offer a seal at the upper most aquifer and prevent entrance of surace water into aquifer. Abandoned wells, maintaining aquifer yield and artesian head, can also be sealed with these chips.

Chip sizes are available in 6 - 10 mm (1/4 to 3/8 in.) and are packed in 22.7 kg (50 lb.) bags, 48 per pallet. All pallets are plastic-wrapped.

SPECS

- Sizes | *6 - 10 mm*
- Composition | *Natural Wyoming sodium bentonite - a hydrous silicate of alumina comprised essentially of the clay mineral montmorillonite.*
- Purity | *Montmorillonite content 90% minimum.*
- pH | *8.5 to 10.5*
- Dry Bulk Density | *1109 kg/m³*

Monitoring Well & Cable Route Warning Markers

Monitoring Well & Cable Route Warning Markers are the ideal way to notify and warn others about the location of monitoring wells and underground cables. They are invaluable in providing safety and greatly assist in the reduction of accidental digging and costly service interruptions.

Constructed of a special fibreglass reinforced composite, the markers are lightweight, extremely durable and can handle vehicle impact, harsh weather, contact with wild animals and vandalism. This material is also able to endure small grass fires and controlled ditch burns; it will not soften and melt like plastic markers. The Monitoring Well & Cable Route Warning Markers are produced in an industry standard colour (bright orange) that will never fade, and the marker itself will never crack, rust, or rot like wood and metal markers.

An optional Post Driver for the marker offers quick and easy installation. This simple, two-handed tool, has an opening at the bottom where the marker is inserted and then driven into the ground with successive taps.

SPECS

- Material | *Glass Reinforced Polyester Composite*
- Weight | 0.62 lbs. per foot
- Length | 1.83 m
- Width | 0.10 m
- Colour | Orange

Thermistor installation for determining concrete curing temperature – Kaplan Turbine Scroll Case, Brilliant Dam – British Columbia, Canada

thermistors and temperature systems

fast facts: thermistors

For temperature measurement, RST Instruments Ltd. provides simple thermistor integration into certain instruments. More complex thermistor/temperature systems, such as the Digital Thermarray System, can be custom made to fit the exact requirements of your project.

Thermistor Strings

Thermistor String assemblies are environmentally hardened to provide accurate and reliable long-term measurements under demanding geotechnical conditions. The strings incorporate interchangeable, curve tracking, negative temperature coefficient (NTC) thermistors. Since the thermistors are curve matched to desired temperature tolerance over selected temperature ranges, they allow the use of multiple sensors with a single readout or data logger; thereby, eliminating costly calibration procedures.

RST Thermistor Strings are custom manufactured to user specifications: cable length, thermistor number, accuracy, and location on the string. Resistance to the ingress of water is insured by a triple encapsulation procedure. Standard cable employed is a heavy duty, direct burial rated 22 gauge water blocked instrumentation cable.

Other cable types are available to suit site-specific requirements. Readout instruments are available, ranging from hand held devices to complete data logger systems.

SPECS

Interchangeability Tolerance	*±0.1°C*
Interchangeability Temp. Range	*0°C to 75°C*
Operating Temp. Range	*-80°C to 75°C*
Stability	*0.01°C or better/100 months at 0°C*
Resistance at 25°	*2252, 3k, 5k, 10k ohms*
OTHER VERSIONS	
Bussed digital version also available. (see Digital ThermArray System below)	

WORKS WITH TH 2016B thermistor readout

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

Digital ThermArray System

RST's Digital ThermArray System provides precision thermal gradient information for geotechnical, geothermal, and marine applications. The main component of the system consists of digital thermal data acquisition nodes distributed along a single cable, typically spaced at uniform intervals. This digital technology allows for many nodes to be placed on one string without greatly increasing the overall cost; furthermore, every node can be individually addressed and simultaneously read through the Ultra Rugged Field PC via a single connection.

Data setup and collection is performed by a stationary datalogger system (typically an RST flexDAQ Datalogger System), a laptop or an Ultra-Rugged Field PC for portable readings.

WORKS WITH flexDAQ DATALOGGERS custom, turn-key datalogger systems shipped "ready to run"

SPECS

THERMARRAY NODE	
Temperature Range	*-20°C to 50°C*
Resolution	*0.01°C*
Accuracy	*0.07°C*
Time Constant	*20 seconds*
Address Range	*0 - 255*
Power Supply Voltage	*4 - 6 V*
Current per Node	*0.8 mA*
Acquisition Time	*0.2 seconds*
Node Length	*140 mm*
Node Diameter	*19 mm*
THERMARRAY CABLE	
Conductors	*4*
Diameter	*7 mm*
Maximum Segment Length	*500 m*
Minimum Node Spacing	*300 mm*
Breaking Strength	*5 kN*
THERMARRAY TERMINAL	
Maximum Nodes	*256*
Input Power	*6 VDC*

Thermistor Readout TH2016B

The TH2016B Thermistor Readout reads, displays, and logs up to 16 thermistor string points at the push of a button. Accuracy, flexible memory options and ease of use make the TH2016B invaluable for projects requiring temperature monitoring involving thermistor strings. Operation requires only 3 "AA" batteries, and the unit is well-equipped with a large graphics display with backlight. See page 17 for more info.

analysis software

fast facts: analysis software

RST Instruments Ltd. continuously strives to develop leading-edge software for seamless integration with many of our instruments. In addition to our two key software applications that are used as analysis tools for specific geotechnical projects, Inclinalysis™ and GeoViewer, we have also developed host software for many of our readouts:

C108 - Pneumatic Readout

Carlson MA7 Readout - Host Software

DIGITAL INCLINOMETER - Inclinometer Readout Software

DT2055 - Ten Channel Data Logger - Host Software

INCLINALYSIS™ - Inclinometer Analysis Software

DT2011 - Single Channel Vibrating Wire Datalogger

MEMS Tilt Meter - Host Software

Multi-Readout - Host Software for
QB120, SG350, IR420, TH2016B, LP100

SPIRAL - Spiral File Format Converter

ThermArray - Host Software

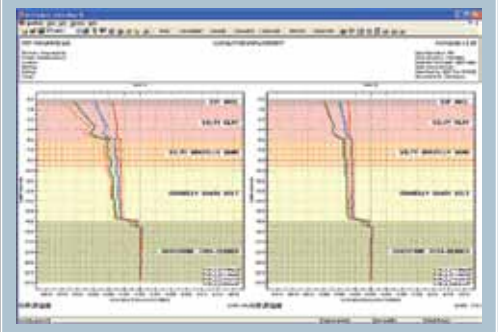
VW0420 - Vibrating Wire Isolated Analog Interface

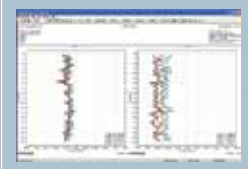
VW2106 - Vibrating Wire Readout

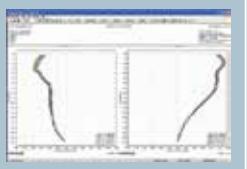
All software offered by RST is fully backed by a support team of software engineers who are ready to assist you with any questions, and to provide on-going software updates for improved product performance.

Inclinalysis™ Digital Inclinometer Software

inclinalysis™
digital inclinometer analysis software







RST Inclinalysis™ Software is a powerful companion to the RST Digital MEMS Inclinometer System and the MEMS Horizontal Inclinometer System. It allows the user to quickly and efficiently reduce large volumes of inclinometer data into a variety of formats suitable for analysis and presentation.

Using a multi-document interface, the user is able to view several data plots simultaneously on the screen at one time. Intuitive single-click buttons allow the creation of plots within seconds. Plots can be saved as individual reports allowing the flexibility to load multiple specialized plots for a single borehole data set.

Designed to complement the RST Digital MEMS Inclinometer System, data is organized in a standard file structure which makes importing data seamless between Inclinalysis™ and the Ultra-Rugged Field PC.

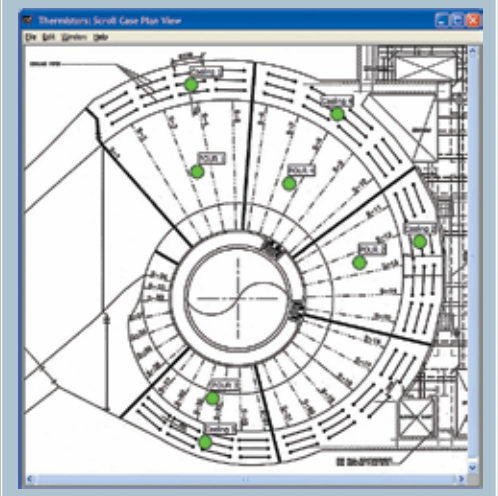
WORKS WITH
DIGITAL MEMS INCLINOMETER SYSTEM

SPECS

- *Create custom graph views, text views, vector or time plots.*
- *Single click views for mean deviation, incremental displacement, absolute position, cumulative displacement, checksum, time plot and vector plot.*
- *User defined settings for X and Y-axis properties such as scale, units, labels, ticks and gridlines.*
- *Ability to read a variety of inclinometer survey file types: *.csv, *.rpp, *.bch*
- *Spiral file support for other spiral formats: *.rpp; *.txt; *.prn, *.twi*
- *Reading Units conversion between millimeters, meters, inches or feet.*
- *Movement Zone selection for Time Plot & Vector Plot*

GeoViewer Real-Time Monitoring

GeoViewer
REAL-TIME MONITORING



GeoViewer is a data viewer that provides flexible console viewing of large data sets from ADAS (automatic data acquisition systems). The program runs on *Microsoft Windows®, with full functionality under *Microsoft Windows Server®. GeoViewer operates on a LabVIEW® platform, which has facilitated the evolution of the product, to support multiple loggers, on-web serving of data, numerous devices, web events, mobile access etc. The robust, fast, feature-rich, ever-improving LabVIEW platform permits new functionality to be added readily.

WORKS WITH
flexDAQ DATALOGGERS
custom, turn-key datalogger systems shipped "ready to run"

SPECS

- *Near-real time data logger retrieval.*
- *Graphical representation of data in a variety of forms.*
- *Superimposition of original images over post deformation data.*
- *Automated collection and processing of data updating in near-real time.*
- *Multiple alarm functions with user programmable rate/magnitude thresholds provisions.*
- *View data by remote computer or mobile devices and receive alarms by e-mail and text messages.*

**Microsoft Windows® is a registered trademark of Microsoft Corporation in the United States and/or other countries.*

vibration and overpressure monitors

fast facts: vibration / overpressure monitors

Instantel Blastware® software offers powerful, easy-to-use features, for event management, compliance reporting and data analysis from most Instantel vibration and overpressure monitors.

Blastware®

Instantel®

The World's Most Trusted Vibration Monitors

Minimate Blaster shown in typical field set-up.

Blastmate III

Since 1982, Instantel monitors have earned their position as the world's most trusted monitors for regulated vibration control. Used in over 110 countries, Instantel seismographs monitor ground vibration, air and water over pressure created by blasting, demolition, mining, quarrying, and construction activities.

Innovative features, specialized sensors, and a variety of recording formats increase the functionality of Instantel monitors and allow for flexibility across applications, from regulatory blast monitoring to remote data collection. Renowned for their ease of use and reliability, Instantel vibration and overpressure monitors are the instruments of choice for various mining, construction, and geotechnical applications.

As part of Instantel's independent dealer network, and official representative for Western Canada, RST Instruments Ltd. provides equipment sales and rentals, as well as professional consulting and monitoring services for any project. Contact RST for more information.

Instantel Series IV Minimate Pro4™ and Series IV Minimate Pro6™ monitors are among the most versatile and capable monitors available. Featuring a rugged design, innovative enhancements, and advanced monitoring technology, the Minimate Pro systems will give you the results you need in a wide variety of applications.

The Instantel Series III Minimate Plus™ vibration monitor offers unrivalled features and versatility in a small, rugged and easy-to-use package. The system is portable so it is ideal for short term monitoring applications. It is also flexible enough to be easily integrated into permanent remote monitor stations using auxiliary power and wired or wireless telemetry.

The Series III Blastmate III™ vibration and overpressure monitor provides the user with unprecedented flexibility and reliability for almost any vibration or overpressure monitoring application. A variety of sensors are available including a triaxial velocity sensor, which satisfies the amplitude, frequency and phase response requirements of the DIN 45669-1 standard.

Instantel Blastware® software, the Windows® software companion to your Instantel seismographs, offers powerful, easy-to-use features, for event management, compliance reporting and advanced data analysis – including Signature Hole Analysis.

InstaLink™ Web Based Vibration Monitoring is a complete solution to satisfy the most demanding reporting requirements, effortlessly and cost effectively. Combining the reliability of Instantel instruments with the power of the Internet, InstaLink provides an 'end to end' monitoring solution with safe and secure 24/7 access to your vibration data immediately after it is recorded.

SPECS

MINIMATE PRO 6 & 4
Ethernet® interface
Auto Call Home™ remote monitoring function
Water resistant to IPC67 - submerse to 30 cm (1 ft.) for 24 hours
Sensor Check for automatic error checking
Minimate Pro6 | *6 Channels: Microphone and Triaxial Geophone or two Triaxial Geophones*
Minimate Pro4 | *4 Channels: Microphone and Triaxial Geophone*
Minimate Pro6 | *Available Memory: 7,100 plus events*
Minimate Pro4 | *Available Memory: 8,000 plus events*
Minimate Pro6 | *Available Sample Rates: 512 to 4,096 S/s per channel*
Minimate Pro4 | *Available Sample Rates: 1,024 to 4,096 S/s per channel*
Record Modes | *Manual, Continuous, Histogram, Instantel Histogram Combo, and VDV - Vibration Dose Value (optional)*
Unit Dimensions | *254 x 117 x 108 mm*

MINIMATE PLUS
Sensors | *Microphones, geophones, accelerometers, and hydrophones*
4 Channels | *Microphone and Triaxial Geophone*
8 Channels | *Two Microphones and two Triaxial Geophones or 8 independent channels*
Available Memory | *300 events*
Record Modes | *Manual, Continuous, Histogram, Single-shot, and Instantel® Histogram Combo*
Available Sample Rates | *1,024 S/s to 16,384 S/s per channel, selectable up to 65,536 S/s for 8 channels*
Unit Dimensions | *81 x 91 x 160 mm*

MINIMATE BLASTER
4 Channels | *Microphone and Triaxial Geophone*
Available Memory | *300 events*
Record Modes | *Manual and Continuous*
Available Sample Rates | *1,024 to 4,096 S/s per channel*
Unit Dimensions | *81 x 91 x 160 mm*

BLASTMATE III
Onsite/In-field printing
Auto Call Home™ remote monitoring function
4 Channels | *Microphone and Triaxial Geophone*
8 Channels | *Two Microphones and two Triaxial Geophones or 8 independent channels*
Available Memory | *300 events*
Record Modes | *Manual, Continuous, Histogram, Single-shot, and Instantel® Histogram Combo*
Available Sample Rates | *1,024 S/s to 16,384 S/s per channel, selectable up to 65,536 S/s for 8 channels*
Unit Dimensions | *269 x 355 x 165 mm*

carlson concrete instruments

fast facts: carlson concrete instruments

RST Instruments Ltd. is the sole manufacturer of Carlson Concrete Instruments which has been used since the early 1940's. These specialized instruments are specifically designed for use in applications where concrete, or similar, type structures require geotechnical investigation. The readings taken from the six instruments in this category can only be accessed by the Carlson MA7 Readout and flexDAQ Dataloggers.

Carlson Concrete Instruments

Standard Carlson Strain Meter

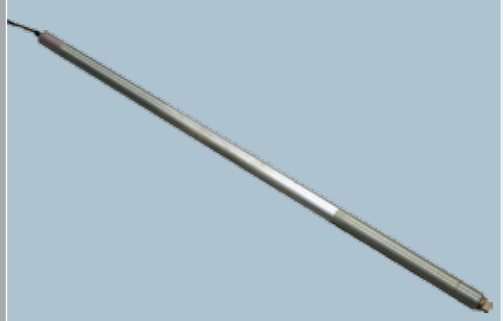
Mini Carlson Strain Meter

Carlson Joint & Foundation Meters

Carlson Resistance Thermometer

Carlson Piezometer

Carlson Concrete Stress Cell Carlson Soil Stress Cell



Carlson Reinforced Concrete Meter

Carlson Concrete Instruments are elastic wire strain meters containing two coils of highly elastic steel wire, one of which increases in length and electrical resistance when a strain occurs, while the other decreases. The ratio of the two resistances is independent of temperature (except for thermal expansion) and therefore the change in resistance ratio is a measure of strain. The total resistance is independent of strain since one coil increases the same amount as the other decreases due to a change in length of the meter. Therefore, the total resistance is a measure of temperature.

The cable most commonly used is heavy duty, neoprene rubber-covered, with either three or four conductors. Alternate cable types are available to suit site specific conditions and we invite your inquiries.

The Carlson MA7 and later series readout instruments, while compatible with both three and four wire systems, require only three conductors to monitor both temperature and resistance. Earlier versions of Carlson readouts require four conductors to monitor both parameters.

Carlson MA7 Readout

SPECS

There are 6 Carlson Instruments to choose from which are used in conjunction with the Carlson MA7 readout.

CARLSON STRAIN METERS

The Strain Meter is a device, which can be embedded in concrete to reveal internal deformations. It responds to any change in dimension of the concrete, due to stress, creep, temperature change, moisture change or chemical growth. The main purpose of the strain meter, however, is to indirectly determine stress.

JOINT & FOUNDATION METERS

Joint Meters and Foundation Meters are similar to Strain Meters except that they offer greater range by having a coil spring in series with each of two loops of elastic wire. The Foundation Meter is the same as the Joint Meter except that it has its range mainly in contraction. The Joint Meter is used mainly to measure the opening to joints and therefore it has most of its range in expansion.

CARLSON PIEZOMETER

With a Carlson Piezometer in soil, water pressure is admitted to an internal diaphragm through a porous disc which holds back the soil or other granular material. The deflection of the internal diaphragm is measured with a sensing element. The Carlson Piezometer permits measurement with a minimum of water movement.

REINFORCED CONCRETE METER

The Reinforced Concrete Meter is a rod-like device which simulates a bar of reinforcing steel. The hollow rod accommodates a miniature strain meter which measures the change in length from which the stress is derived. The change in length of the steel rod is measured regardless of the occurrence of fine cracking which is common to reinforced concrete.

RESISTANCE THERMOMETER

The Resistance Thermometer reads temperature remotely where a quick response is not required. Well sealed against moisture, and its diffusivity is approximately that of concrete, make the Resistance Thermometer especially suited for embedment in concrete to measure internal temperature.

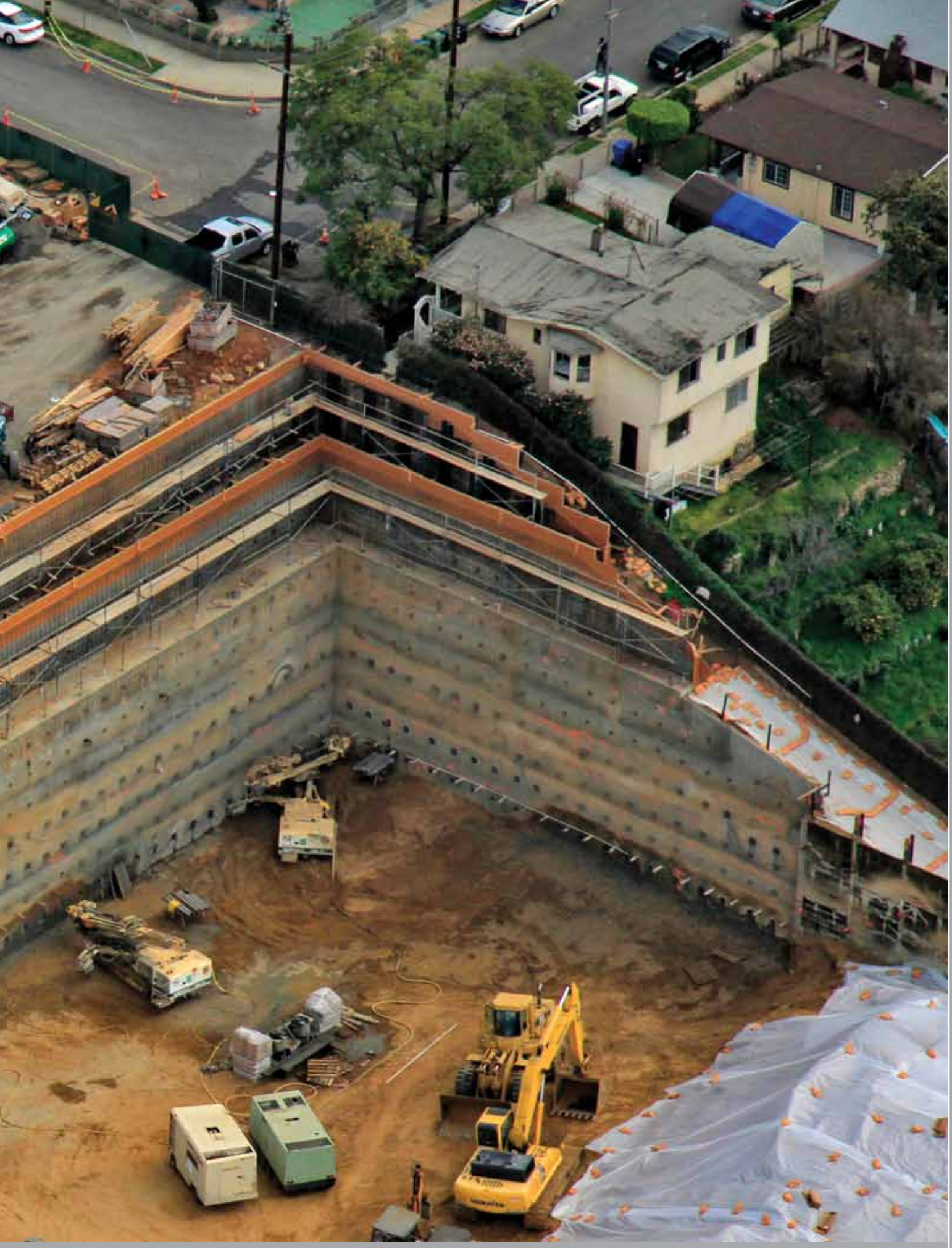
CARLSON STRESS CELLS

Stress Cells are circular plates with a strainmeter sensing element mounted on one face. The plate has a mercury film at its mid-thickness and a flexible rim with the result that any stress through the plate is applied to the mercury film.

CARLSON MA7 READOUT

The Carlson MA7 Readout is the intended readout for all Carlson Instruments. The unit has a maximum of 254 instrument locations and a memory capacity of 11,400 custom labeled points. It offers a large 128 x 64 pixels graphic display with LCD (auto off) backlight.

Soil Nail Instrumentation – Apartment Complex Project – Los Angeles, California, USA



innovation in
geotechnical
instrumentation

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