Monitoring Instrumentation for Mines and Underground Excavations

Open-Pit Mines | Underground Mines | Tailings Dams

We make monitoring instruments. You make sound decisions.
History
Since 1977, RST’s geotechnical monitoring instruments have been integral components for major dams, mines, tunnels, pipelines, and structures around the world that require monitoring, measuring and data collection. As a world leader in the design, manufacturing and sale of innovative geotechnical, environmental and structural monitoring instruments, our customers rely on our reliability & accuracy to:
- Improve Decision Making
- Manage Risks
- Improve Safety
- Optimize Design
- Increase Productivity
- Reduce Costs

Experience
With years of geotechnical instrumentation experience, RST is capable of providing custom engineered solutions to site-specific problems. When requested, in-depth technical support is provided and all related staff members are always available to work with clients until a solution is found to meet the project requirements.

Quality
The RST Instruments management system is certified to ISO 9001:2015. It is based on evidence of corporate commitment to quality in management responsibility, design control, inspection & testing, internal quality audit procedures, training & servicing.

Products
More than half of all instruments manufactured at RST Instruments are specifically engineered to meet site-specific requirements and are designed in conjunction with client input. RST also specializes in custom, complex data acquisition systems and holds a number of patents such as “Snap-Seal” ABS inclinometer casing and the Digital MEMS Inclinometer System.

Technologies
"Turn-key" data logger systems offering real-time data logging & analysis of vibrating wire, thermometer, MEMS (analog and digital), Tensmeg, linear potentiometer, strain gauge, LVDT, TOP and other sensor types. Ideal for remote data logging of dams, tunnels, bridges, mines, and natural slopes.

Fully automated wireless data collection using "DT Series" Data Loggers at the sensor level, deployed in a star topology from an active RSTAR Hub with flexDAQ data logger. Users can access collected data remotely, either on-site or off-site.

A semi-automated wireless data collection system that is an on-site wireless connection to "DT Series" Data Loggers for quick data collection. Ideal for hard to access areas where the data logger is within line of sight.

A series of rugged data loggers that provide reliable, unattended monitoring of various sensor types: Vibrating Wire, MEMS, 4-20mA Transmitters & Thermistors, Potentiometers and Load Cells. DT Series Data Loggers can be used to collect data wirelessly or as non-wireless stand-alone data loggers.

DT-BUS instruments use a series of digitally bussed sensors, all addressable, along one cable. It simplifies installation and minimizes costs by eliminating the need of a separate cable for each sensor and also reduces the amount of cable to be managed during installation.

A precision line of tilt and inclination monitoring instruments using digital MEMS (Micro-Electro-Mechanical Systems) sensors.

RST Inclinalysis™ Software quickly reduces large volumes of data from the RST Digital MEMS Inclinometer System for analysis and presentation.

GeoViewer is a data viewer that provides flexible console viewing of large data sets from ADAS (automatic data acquisition systems). It features alarm functions and remote, real time data access.
A series of Paste Backfill Monitoring Cages being installed in an underground mine.
**Product Categories**

**Inclinometers and Tilt Sensors**
- Measure lateral or settlement movement in the earth, lateral deformation of concrete dams, tail structures and embankments, and tilt of structures in either one or two planar axes.
- Provide long term short term observation with maximum resolution and sensitivity.
- Manual monitoring or remote data acquisition options available.

**KEY PRODUCTS:**
- Inclinometer Systems
- Tilt Loggers & Meters
- Inclinometer Casing
- Tunnel Monitors
- Track Monitors

**Readouts and Data Loggers**
- Collect data from sensors in dams, tunnels, bridges, mines, natural slopes and other geotechnical applications.
- Manual monitoring or remote, wireless data acquisition with alarm triggering.
- Many sensor types and gauges can be read with these products including vibrating wire, TENSMEG, linear potentiometer, strain gauge and MEMS.

**KEY PRODUCTS:**
- DT Series Data Loggers
- DT LMK Wireless
- flexDAQ Data Loggers
- VW2106 Vibrating Wire Readout
- Ultra-Rugged Field PCs
- Custom Data Logger Enclosures

**Piezometers and Pressure Transducers**
- Measure pore water pressure during fill or excavation. Installs in slope stability investigations and for assessing the stability of earth fill dams and embankments.
- Compatible with "DT Series" Data Loggers for remote data acquisition. Alarm triggering can also be utilized. The VW2106 Vibrating Wire Readout and the CH109 Pressure Transducer are the main readouts used for reading piezometers.

**KEY PRODUCTS:**
- Vibrating Wire Piezometer
- Pneumatic Piezometer
- Strain Gauge Piezometer
- Strain Gauge and Vibrating Wire Pressure Transducers

**Extensometers and Compressometers**
- Measure ground deformation in mining and civil engineering projects, linear displacement of structures, tunnel displacement, and deformation in rock faces or underground workings.
- Manual monitoring or remote, wireless data acquisition with alarm triggering.

**KEY PRODUCTS:**
- Convergence Monitors
- Borehole Extensometers
- In-Line Extensometers
- Crack Meters
- Pivot Laser Extensometer
- Tunnel/Profile Monitors

**Settlement Systems**
- Accurately monitor settlement or heave in soils and man-made structures such as buildings, tunnels, embankments, and earth and rockfill dams.

**KEY PRODUCTS:**
- Precision-Liquid Settlement Array
- Vibrating Wire-Liquid Settlement Systems
- Horizontal In-place Inclinometers
- Magnetic Settlement Systems
- Vibrating Wire Deep Settlement Systems

**Borehole Packers**
- Suitable for a wide variety of applications in open or cased holes and for monitor well sampling, zone testing & monitoring, permeability testing, hydro-geological testing, formations, pressure grouting, and sampling of artesian flows.
- Alternate sizes and materials are available for custom applications.

**KEY PRODUCTS:**
- Borehole Packers
- Borehole Accessory

**Environmental and Pipe Products**
- Measure elevation of groundwater in boreholes, sump pits and wells.
- Complete, custom weather stations.
- PVC well screen and pipe products for monitoring groundwater hydrology, drainage, and water wells. HCGP pipe is used for various industrial applications for landfill, waste sites and mining applications.

**KEY PRODUCTS:**
- PVC Well screen, Casing and Pipe
- Water Level Meters

**Grout Monitors**
- Grout Monitors offer a permanent record of key grouting parameters for quality assurance, quantity documentation, and pressure & flow readings.
- Real-time data viewing available via Wi-Fi communication with on-site monitor data loggers.

**KEY PRODUCTS:**
- Compaction Grout Monitor
- Permeation Grout Monitor

**Analysis Software**
- Leading edge software for seamless integration with RST’s instruments.
- 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.

**KEY PRODUCTS:**
- GeoViewer Real-time Monitoring
- Inclinalysis™ - Inclinometer Analysis Software
- Host Software for RST’s Readouts & Data Loggers

**Carlson Instruments**
- Used where concrete or similar type structures require geotechnical investigation. Readings can only be accessed by the Carlson MA7 Readout and flexDAQ Data Loggers.

**KEY PRODUCTS:**
- Carlson Joint / Foundation Meters
- Carlson MI7 / Readout
- Carlson Packer
- Carlson Reinforced Concrete Meter
- Carlson Resistance Thermometer
- Carlson Strain Meters
- Carlson Stress Cells

[View the product page for videos and downloadable brochure: http://www.rstinstruments.com/PRODUCTS.html]
WIRELESS DATA COLLECTION OPTIONS:

Whether collecting geotechnical instrument data on-site or remotely, RST Instruments offers two wireless data collection systems: RSTAR and DT LINK.

Compatible sensor types for both systems are identical and use the “DT Series” Data Loggers from RST Instruments which provide reliable, unattended monitoring of various sensor types: vibrating wire sensors, potentiometers, MEMS tilt sensors, strain-gage (full bridge) sensors, digitally buised sensors (“DT-BUS”), 4-20 mA sensors, and thermistors. These data loggers at the NODE (data logger & sensor) level require a single lithium “D” cell and provide years of battery life. Both systems provide extensive open-country range through use of a simple dipole or directional antenna.

OPTION 1: RSTAR

The RSTAR Array Radio Series uses wireless technology to provide automated data acquisition. A complete RSTAR L900 System uses RSTAR NODES at the sensor level, deployed in a star topology from a continuously active RSTAR HUB, which consists of an L900 RTU interfaced to an RST FLEXDAQ Data Logger.

The RSTAR system is intended for fully automated scheduled collection and provides remote data access. It uses a fixed central hub with its own data logger, antenna, and power. The range from the sensor node to the hub is up to 14 km and is based on the 900 MHZ, 868 MHZ, and 2.4 GHz spread spectrum band (country dependent).

OPTION 2: DT LINK

The DT LINK system is a wireless connection to RST data loggers for quick semi-automated data collection performed on-site. The DT LINK system uses a portable hub with laptop connection and host software. The ranges from the sensor node to the hub can be up to 500 m and 800 m and is based on the 900 MHZ, 868 MHZ, and 2.4 GHz spread spectrum band (country dependent).
**Open-Pit Mine**

**Total Earth Pressure Cell**
Measure stress acting on plane surfaces, ideal for earth embankments, dams, foundations, retaining walls, pits, pipelines & culverts, railroad bases, embankment foundations, tunnel linings, and mine backfill monitoring. Available with pneumatic, strain gauge, or vibrating wire transducers.

**In-Place Inclinometer and Inclinometer Casing**
Installed in a borehole to monitor horizontal displacement of the slope casing. Compatible with all commercially available inclinometer probes including RST’s Digital MEMS inclinometer Probe/System (manual readings) and In-Place Inclinometers (automated readings).

**Piezometer**
Monitor pore water pressures in the ground in slopes, dams, foundations, or embankments.

**TDR (Time Domain Reflectometry)**
Detect and interpret rock and soil mass response to underground and surface mining using coaxial cables grouted in boreholes. Ideal for monitoring subsidence above abandoned underground mines and high wall slope monitoring in open pit mines.

**FLEXDAQ Data Logger Systems**
Allows for precise & reliable data acquisition from various sensor types and gauges including vibrating wire, MEMS (analog and digital), Tensile, linear potentiometer, strain gauge, LVDT, TDR, etc. Ideal for remote data logging of various types of geotechnical instrumentation used in dams, tunnels, bridges, mines, and natural slopes.

**DTL201B / DTL202B Uniaxial / Biaxial Digital Tilt Loggers**
Battery powered, radio-enabled, unattended monitoring of tilt in either uniaxial or biaxial planes.

**Borehole Packer**
Ideal for permeability testing, sealing or leach flows in open or cased boreholes, monitor well sampling, and pressure grouting.

**Panoramic view of an open-pit mine.**
Seepage Weir
Study water levels through dam seepage channels.

Tailings Dam

Precision system for accurately monitoring water levels through dam seepage channels.

Seepage Weir

Precision system for accurately monitoring water levels through dam seepage channels.

DT Series Data Loggers:
- DT2011B - Single Channel Vibrating Wire Data Logger
- DT2055B - 5/10 Channel, Vibrating Wire/Thermistor Data Logger
- DT2485 - Data Logger for DT-BUS Sensors
- DTL201B - Uniaxial Digital Tilt Logger
- DTL202B - Biaxial Digital Tilt Logger

*Contact RST for details on additional “DT Series” data loggers.

FLEXDAQ Data Logger Systems
Allows for precise & reliable data acquisition from various sensor types and gauges including vibrating wire, thermistor, MEMS (analog and digital), Tensig, linear potentiometer, strain gauge, LVDT, Tor, etc. Ideal for remote data logging of various types of geotechnical instrumentation used in dams, tunnels, bridges, mines, and natural slopes.

Magnetic Settlement System
Magnetic Settlement Systems are available in 3 main configurations which monitor either heave or settlement in soil and rock.

Piezometer
Monitor pore water pressures in the ground in slopes, dams, foundations, or embankments.

In-Place Inclinometer and Inclinometer Casing
Installed in a borehole to monitor horizontal displacement of the slope casing. Compatible with all commercially available inclinometer probes, including RST’s Digital MEMS Inclinometer Probe/System (manual readings) and In-Place Inclinometers (automated readings).

Pictured Left: In-Place Inclinometer (F) and Inclinometer Casing (G)

Total Earth Pressure Cell
Meets stress acting on plane surfaces. Ideal for earth embankments, dams, foundations, retaining walls, piles, pipelines & culverts, railroad bases, beneath raft foundations, tunnel linings, and mine/fill monitoring. Available with pneumatic, strain gauge, or vibrating wire transducers.

Liquid Settlement System
Monitor settlement or heave in soils and different types of man-made structures such as embankments, and earth and rockfill dams. Also ideal for preload consolidation monitoring and subside monitoring.

Thermistor String
For accurate and reliable long-term temperature measurements under demanding geotechnical conditions.

In-Place Inclinometer and Inclinometer Casing
Installed in a borehole to monitor horizontal displacement of the slope casing. Compatible with all commercially available inclinometer probes, including RST’s Digital MEMS Inclinometer Probe/System (manual readings) and In-Place Inclinometers (automated readings).

Piezometer
Monitor pore water pressures in the ground in slopes, dams, foundations, or embankments.

In-Place Inclinometer and Inclinometer Casing
Installed in a borehole to monitor horizontal displacement of the slope casing. Compatible with all commercially available inclinometer probes, including RST’s Digital MEMS Inclinometer Probe/System (manual readings) and In-Place Inclinometers (automated readings).

Pictured Left: In-Place Inclinometer (F) and Inclinometer Casing (G)

Total Earth Pressure Cell
Meets stress acting on plane surfaces. Ideal for earth embankments, dams, foundations, retaining walls, piles, pipelines & culverts, railroad bases, beneath raft foundations, tunnel linings, and mine/fill monitoring. Available with pneumatic, strain gauge, or vibrating wire transducers.

Liquid Settlement System
Monitor settlement or heave in soils and different types of man-made structures such as embankments, and earth and rockfill dams. Also ideal for preload consolidation monitoring and subside monitoring.

Thermistor String
For accurate and reliable long-term temperature measurements under demanding geotechnical conditions.
DT2055B - 5/10 Channel Vibrating Wire/Thermistor Data Logger
Battery powered, radio enabled, 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 and/or thermistor strings.

DT2040 - 20/40 Channel Vibrating Wire/Thermistor Data Logger
Battery powered, radio enabled, unattended monitoring of up to 40 sensors - can be any mix of vibrating wire sensors and thermistors, typically 20 vibrating wire sensors with their associated thermistors.

Auto-Warning Telltale
Visual monitoring of movement in a tunnel roof, typically for use in underground mines. Installed in vertical boreholes where access may become restricted or would constitute a high risk for direct or close-up viewing. Flashing LED for indicating movement above a set threshold.

Borehole Extensometer
Determine the stability and movement behavior of soil and rock masses. Two or more anchors at various depths assist to distinguish between potentially dangerous deep seated movements and more trivial surface spalling.

FLEXDAQ Data Logger Systems
Allows for precise & 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. Ideal for remote data logging of various types of geotechnical instrumentation used in dams, tunnels, bridges, mines, and natural slopes.

Total Earth Pressure Cell
Measure stress acting on plane surfaces. Ideal for earth embankments, dams, foundations, retaining walls, piles, pipelines & culverts, railroad bases, beneath raft foundations, tunnel linings, and mine backfill monitoring. Available with pneumatic, strain gauge, or vibrating wire transducers.

Paste Backfill Monitor
Used in mine paste backfill to achieve improved extraction and to increase safety. Provides useful engineering feedback to allow paste and slope design to be optimized. Monitors pressures in 3 planes, fluid pressure and other optional parameters.

NATM Stress Cells
Measure stresses in concrete (shotcrete) linings in tunnels and other underground workings.
We make monitoring instruments.
You make sound decisions.

HEAD OFFICE:
RST Instruments Ltd.
11545 Kingston St.,
Maple Ridge, BC
V2X 0Z5   Canada

CANADA & USA: Sales + Service + Manufacturing
EMAIL | sales@rstinstruments.com
TELEPHONE | 604 540 1100
TOLL FREE | 1 800 665 5599

EUROPE / MIDDLE EAST / AFRICA: Sales
TELEPHONE | +44 1449 613677

www.rstinstruments.com

www.youtube.com/user/RSTgeotechnical
www.linkedin.com/company/rst-instruments-ltd-

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