Monitoring Instrumentation for Dams, Hydropower, Irrigation and Energy Projects

Concrete Dams | Concrete Face Rockfill Dams | Earthfill Dams | Pipelines

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. RST engineers worldwide have installed RST’s casing and used the Digital MEMS Inclinometer System for accurate slope stability monitoring.

Technologies
“Turn-key” data logger systems offering real-time data logging & analysis of vibrating wire, thermistor, MEMS (analog and digital), Tensameg, linear potentiometer, strain gauge, LVDT, TDR 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 RedIQ data logger or THREED Gateway. 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 & inclination monitoring instruments using digital MEMS (Micro-Electro-Mechanical Systems) sensors.

Measures any lateral movement down in the earth, via inclinometer casing. Since 2003, RST’s Digital MEMS Inclinometer has traversed a smaller radius bend than all other inclinometer probes available in the industry.

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.
The La Yesca Dam, completed in 2012, is a 220 m (722 ft) tall and 628 m (2,060 ft) long concrete-face rock-fill dam on the Santiago River in Mexico. The power station produces an estimated annual generation of 1,210 GWh.
**Inclinometers and Tilt Sensors**
- Measure lateral movement down in the earth, lateral deformation of concrete dams, tall structures or embankments, and tilt of structures in either one or two plane axes.
- Provide long term/short term observation with maximum resolution and sensitivity.
- Manual or remote monitoring can be read with these products including vibrating wire, thermistor, TENSMEG, linear potentiometer, strain gauge and MEMS.

**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 dissipates 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, thermistor, TENSMEG, linear potentiometer, strain gauge and MEMS.

**KEY PRODUCTS:**
- DT Series Data Loggers
- DT Link Wireless
- RST Link Data Loggers
- V52106 Vibrating Wire Readout
- Ultra Rugged Field PCT
- Custom Data Logger Enclosures

**Piezometers and Pressure Transducers**
- Measure pore water pressure during fill or excavation. Instructible in slope stability investigations and for assessing the stability of earth fills, dams and embankments.
- Compatible with DT Series Data Loggers for remote data acquisition.
- Alarm triggering can also be utilized.
- The V52106 Vibrating Wire Readout and the C509 Pneumatic Readout are the main readers used for reading piezometers.

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

**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 Lupid Settlement Array
- Vibrating Wire Lupid Settlement Systems
- Horizontal In-place Inclinometers
- Magnetic Settlement Systems
- Vibrating Wire Deep Settlement Systems

**Environmental and Pipe Products**
- Measure elevation of groundwater in boreholes, standpipes and wells.
- Complete, custom weather stations.
- PVC wellscreen and pipe products for monitoring groundwater hydrology, drainage, and water wells.
- HCGS pipe is used for various industrial applications for levees, waste sites and mining applications.

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

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

**KEY PRODUCTS:**
- Borehole Packers
- Borehole Packer Accessories

**Tunnel Monitors**
- Key tunnel monitoring technologies for application to coal mining, tunnels, bridges, mines and large structures.
- Internal displacement and deformation in rock and concrete.

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

**Thermists and Temperature Systems**
- Temperature measurement with simple thermistor integration into certain instruments.
- Custom thermistor/temperature systems, such as the Digital Thermarray System.

**KEY PRODUCTS:**
- Digital Thermarray System Thermistor Strings/Systems
- TH2016B Thermistor Readout
- Subgrade Temperature Probe

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- TH2016B Thermistor Readout
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**KEY PRODUCTS:**
- Borehole Packers
- Borehole Packer Accessories

**In-place Inclinometers**
- Inclinometers are used in mine and civil engineering projects, where displacement of structures, tunnels, 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

**Load, Stress and Pressure Sensors**
- Measure load, stress and pressure as it relates to rock, soil, concrete and plugging-type applications.
- Equipped with sensors that are vibrating wire, pneumatic or strain gauge.
- Manual or remote data acquisition configurations are available for many instruments in this category.

**KEY PRODUCTS:**
- Load Cells
- Pressure Cells
- TENDSAM Tension Measuring Gauge
- RockStrain Meter/Sister Bar
- Vibrating Wire Strain Gauge

**Key Products:**
- Precision Lupid Settlement Array
- Vibrating Wire Lupid Settlement Systems
- Horizontal In-place Inclinometers
- Magnetic Settlement Systems
- Vibrating Wire Deep Settlement Systems

**Permeation Grout Monitor**
- 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 smart device/data logger.

**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
- Inclinogy™ 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 MA-7 Readout and ReadEye Data Loggers.

**KEY PRODUCTS:**
- Carlson Joint + Foundation Meters
- Carlson MI-9 Readout
- Carlson Thermometer
- Carlson Reinforced Concrete Meter
- Carlson Resistance Thermometer
- Carlson Strain Meters
- Carlson Stress Cells

**View the product page for videos and downloadable brochure:**
http://www.rsfinstruments.com/PRODUCTS/html
2 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 gauge (full bridge) sensors, digitally bussed 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).
3D Submersible Crack Meter installed on perimeter joint of a concrete rock-fill dam. Inset photo shows protective cover being placed over the sensors.
DT2011B - Single Channel Vibrating Wire Data Logger
Battery powered, radio enabled, unattended monitoring of a single vibrating wire sensor and thermistor.

Pressure Transducer
For uplift measurement in the foundation of concrete dams, overflow settlement measurement in earthfill and rockfill dams, and all other applications for measuring fluid pressure in closed circuits. Available in vibrating wire or strain gauge.

ThermArray
Provides precision thermal gradient information in geotechnical, geothermal, and marine applications. Can be used to detect seepage.

Pendulums
Monitor internal lateral deformations of concrete dams, dam foundations and abutments, tall industrial buildings and bridge piers. Available as both direct and inverted systems.

DT4205 - 5/10 Channel 4-20mA Transmitter Data Logger/Thermistor Data Logger
Battery powered, radio enabled, unattended monitoring of up to 10 channels which may be any mix of 4-20mA sensors or thermistors.

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

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).

Load Cell
Measures loads in tie-backs, struts, ground anchors and rock bolts. Also for measuring loads during the testing of piles. Typical sensors include strain gauge and vibrating wire.

In-Line Extensometer
Determine extension or compression behavior of soil, rock, and concrete structures. The sensor housing is waterproof and can be installed flush with the borehole collar so it does not protrude.

Secondary Enclosure
A secondary enclosure used to house select “DT Series” Data Loggers. The cover can be removed to allow easy access to the internally housed data logger.

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).

FLEXDAQ Data Logger Systems
Ideal 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, TOR, etc. Ideal for remote data logging of various types of geotechnical instrumentation used in dams, tunnels, bridges, mines, and natural slopes.
Submersible Crack Meter
Measure movement across surface cracks and joints, including underwater locations. Ideal for installation on the upstream perimeter joint of CFRD dams.

1-D, 2-D and 3-D versions available.

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

In-Place Inclinometer
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).

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 mass rockfill monitoring. Available with pneumatic, strain gauge, or vibrating wire transducers.

Soil Extensometers
Monitor lateral and longitudinal deformation of soil and different types of embankments and embankment dams. Can be chained together in a series to monitor incremental deformation across structures.

Liquid Settlement System
Monitor settlement of heavy in-situ soils and different types of man-made structures such as embankments, and earth and rockfill dams. Also ideal for preloading consolidation monitoring and subsidence monitoring.

Seepage Weir
Precision system for accurately monitoring water levels through dam seepage channels. Can be chained together in a series to monitor incremental deformation across structures.

Submersible Tilt Meter
Monitoring of tilt of submerged structures, such as inclination of concrete-face rockfill dam slabs and concrete dams. Ideal for retaining walls, piles, bridge piers, offshore structures, and submerged pipelines.

Embedment Joint Meter
Monitor joints in concrete structures. Ideal for joints of concrete arch, gravity and buttress dams; concrete-faced, rockfill dams; concrete retaining walls and slabs.

Embedment Strain Gauge
Designed to be embedded in concrete structures for monitoring strain of concrete.

FLEXDAQ Data Logger Systems
Able to process & reliable data acquisition from various sensor types and gauges including vibrating wire, strainmeter, MEMS (analog and digital), Tensiometer, 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.

**DRAWINGS NOT TO SCALE**
FLEXDAQ Data Logger Systems
Allows for precise & reliable data acquisition from various sensor types and gauges including vibrating wire, thermistor, MEMS (analog and digital), Tensile wire, linear potentiometer, strain gauge, LVDT, TR, etc. Ideal for remote data logging of various types of geotechnical instrumentation used in dams, tunnels, bridges, mines, and natural slopes.

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

Thermistor String
For accurate and reliable long-term temperature measurements under demanding geotechnical conditions. Can be used to monitor seepage.

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

In-Line Extensometer
Determine extension or compression behavior of soil, rock, and concrete structures. The sensor housing is waterproof and can be installed flush with the borehole collar so it does not protrude.

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Pipeline Slope Monitoring

1. Low Profile Spot Weldable Strain Gauge
   Designed to be spot welded to various steel structures, such as tieback anchors, rebar and pipelines. Effectively monitors strain.

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

3. 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 thermostats, typically 3 vibrating wire sensors with their associated thermistors.

4. 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).

5. Secondary Enclosure
   A secondary enclosure used to house select “DT Series” Data Loggers. The cover can be removed to allow easy access to the internally housed data logger.

6. FLEXDAQ Data Logger System
   Allows for precise & reliable data acquisition from various sensor types and gauges including vibrating wire, thermometer, 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.

7. DT2455 Data Logger for DT-BUS Sensors
   Battery powered, radio enabled, unattended monitoring of In-Place Inclinometer Strings and other digital bus (DT-BUS) sensors.

8. Low Profile Spot Weldable Strain Gauge shown installed on a pipeline prior to being covered for protection.
We make monitoring instruments. 
You make sound decisions.

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