Tunnel Profile Monitoring System

The RST 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. The closed loop method is analogous to conventional closed end survey techniques, while the open loop must be referenced to a known location.

**APPLICATIONS**

- Monitor underground openings during construction for control and safety.
- Monitor tunnel deformation due to nearby construction activities.
- Monitoring long term deformation and performance of existing tunnels.

**FEATURES**

- Low profile design, with multiple arms that fit close to the tunnel wall and may be bent in the field to accommodate obstructions on the tunnel wall.
- Custom engineered by RST to suit each individual application.
- On board electronics to minimize electrical noise problems, and permit tilt sensor calibration independent of cable length effects. Cable length may be changed without affecting sensor calibration.
- Integral multi stage transient lightning protection.
- Direct measurement of displacement, rather than calculating displacement from a tilt measurement.
- Built in connectors for manual tape extensometer connection to verify operation, and aid in initial installation and commissioning.
- High system accuracy of up to 0.06 mm of deformation.
- Digital Bussed System: single cable per arm to simplify installation and reduce cost.
- Uses RST’s GeoViewer near-real time software which offers full graphics and alarm capabilities. Contact RST for complete details for ordering.
- No tunnel traffic interference.
- Immune to the air density related problems inherent in optical systems.

**BENEFITS**

- Increase Safety
- High Accuracy
- High Reliability
- Custom Options

RST Instruments Ltd. reserves the right to change specifications without notice. EXB009M
Tunnel Profile Monitoring System

SPECIFICATIONS + ORDERING

SPECIFICATIONS

DISPLACEMENT SENSOR

ITEM          SPECIFICATION
Total Mechanical Travel  25 mm
Shock          50 g 11 ms half sine
Vibration      20 g rms 5 Hz to 2 KHz
Life           One billion dither operations
Independent Linearity 0.25%
Operating Temperature -40 to 80°C
Resolution     Infinite
Accuracy       0.06 mm

TILT SENSOR PARAMETER

ITEM          SPECIFICATION
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         MEMS (Micro-Electro-Mechanical Systems) Accelerometer, Uniaxial
Operating Temp. -40 to 85°C (-40 to 185°F)

ORDERING

ITEM                  PART #    Available for CUSTOM OPTIONS
Tunnel Profile Monitoring Sensor Arm 1.0 m   ICTPMS010    Contact RST for Details
Tunnel Profile Monitoring Sensor Arm 1.5 m   ICTPMS015
Tunnel Profile Monitoring Sensor Arm 2.0 m   ICTPMS020
4 conductor, 22 gauge polyurethane jacketed cable   EL380004
Tunnel Profile Monitoring System Open Loop Anchor (Anchor, Spacer x2, Bolt/Nut/Washer)   ICTPMSA

Detailed cross sectional drawing of each instrumented segment.
Plan layout of instrumented segments, and readout location.
Open or closed loop system.

READOUTS & DATA LOGGERS

Ultra-Rugged Field PC   IC32000-AR2-RSTS
flexDAQ Data Logger

SOFTWARE

GeoViewer: Real-Time Monitoring Software (required for analysis - contact RST for details)

SYSTEM COMPONENTS

Tilt/displacement sensor assembly   Manual
Extension tube   Data logger system
Electrical cable sensor to logger   GeoViewer software
Reference pin comes with tape extensometer connector

Typical installation of the RST Tunnel Profile Monitoring System shows the rods linked together and fixed to the tunnel wall. With the addition of GeoViewer Real-Time Monitoring Software, deformation can be closely monitored and data can be graphically presented over an extended period of time.