Instrumentation for measuring and monitoring geotechnical and geomechanical parameters in tunnels, caverns and underground works.

SISGEO design and manufacture a comprehensive range of equipment to suit specific applications and engineering requirements. SISGEO will be pleased to assist and provide further information to select equipment.
Instrumentation
Application

1. Concrete stress cell
   Measurement of concrete stress changes

2. Borehole extensometer
   Rock movements around tunnel

3. Measuring anchor
   Stress distribution of anchors

4. Pressure cell
   Measurements of rock pressure on lining

5. Convergence tape extensometer
   Movements of tunnel lining

6. Increx mobile extensometer
   Strains and deformations around tunnel

7. Anchor load cell
   Monitoring of anchor loads

8. Piezo-settlement column
   Water level and settlement control

9. Embedment strain-gauge
   Concrete strain measurements (shotcrete)

10. Electrical piezometer
    Control of pore-water pressure

14. Smach accelerograph
    Vibration measurement during excavation
Planning a performance monitoring programme in an essential component of successful tunnel construction. Tunnel monitoring is recommended to determine the behaviour of the surrounding soil during excavation, to ensure the stability and the safety of the structure.

Criteria of instrument selection:
- Reliability of measurements (resolution, accuracy and repeatability)
- Long-term stability and instrument longevity
- Easy of automation for real time monitoring
- Efficient data management
**Instrumentation**

**Application**

2. **Borehole extensometer**  
Rock movements around tunnel

5. **Convergence tape extensometer**  
Movements of tunnel lining

6. **Increx mobile extensometer**  
Strains and deformations around tunnel

8. **Piezo-settlement column**  
Water level and settlement control

11. **Settlement system**  
Monitoring of ground settlement

12. **Surface clinometer**  
Structural inclination movement

13. **Settlement column**  
Soil settlement above tunnel

14. **Smach accelerograph**  
Dynamic measurements during excavation
The performance offered by the Automatic Data Acquisition System is:

- On-line management of a network of several hundred instruments
- Collection of a large quantity of data
- Checking of the design hypotheses
- Operating support during the tunnel construction
- Data analysis and evaluation of the tunnel safety

Sisgeo’s ADK-10 is a powerful and versatile multi function datalogger which allows to manage a large instrument network.
PROJECT REFERENCE

TORINO - BARDONECCHIA Motorway - Italy
MOTTARONE Motorway Tunnel - Italy
CELS Motorway Tunnel - Italy
M.T.R. - Metro Naples - Italy
VILLETTA - Motorway Tunnel - Italy
TORINO - SAVONA Motorway - Italy
ELMALIK Motorway Tunnel - Turkey
GILO - Motorway Tunnel - Israel
AOSTA - S. BERNARDO Motorway - Italy
EL SALAAM SYPHON UNDER SUEZ CANAL - Egypt
S. CROCE Railway Tunnel - Italy
FREJUS Motorway Tunnel - Italy
M.R.T. - Metro Rome - Italy
TAIPEI M.R.T. - Taiwan
UNDERGROUND PARKING in Milan - Italy
COZZO della GUARDIA Hydraulic Reservoir - Italy
PORCE II HYDROELECTRIC PROJECT - Colombia
T.A.V. Rome-Naples - Colli Albani Railways tunnel - Italy

PORT FOUAD PROJECT - Egypt
MATEFER Railway Tunnel - Italy
Highway Zagreb - Rejka - Gorsky Kotar Tunnel - Croatia
UNDERGROUND RAILWAYS CROSSING of Genova - Italy
KARUN III - Diversion Tunnel - Iran
O.S.E. Railway Tunnel Ano Liossia - Greece
TEMBI RAILWAY TUNNEL - Greece
T.A.V. MILANO - GENOVA - Italy
UNDERGROUND RAILWAYS Seoul - Korea
ANCONA - BARI - S. Vito Railways Tunnel - Italy
S. PELLEGRINO TERME - Motorway Tunnel - Italy
GIUSTINO - Hydraulic Reservoir - Italy
PETRALIA - Underground mine - Italy
CASECNAN PROJECT - Philippine
REALMONTE - Underground mine - Italy
KALI GANDAKI H.P. - Nepal
MRTA BANGKOK - Thailand
CONTUY MEDIO - Venezuela