



Pipeline Monitoring Systems

- Distributed Fiber Optic Sensors
 - Temperature Profiling
- Axial and Bending Strain Measurement
 - Leakage Detection
- Third-party Intrusion Detection
 - Long Range: up to 250 km
 - High Resolution
- Excellent Long-term Stability
- Multiple Sensing Cable Designs
 - Intrinsically Explosion Safe
- Insensitive to EM-fields and Corrosion

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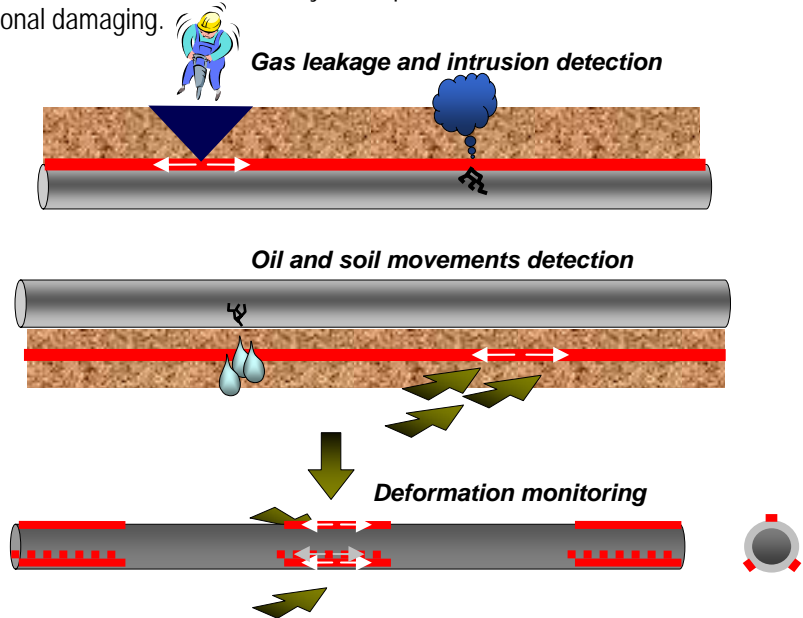
Description

The management of pipelines presents challenges that are quite unique. Their long length, high value, high risk and often difficult access conditions, require continuous monitoring and an optimization of the maintenance interventions. The main concern for pipeline owners comes from possible leakages that can have a severe impact on the environment and put the pipeline out of service for repair. Leakages can have different causes, including excessive deformations caused by earthquakes, landslides or collisions with ship anchors, corrosion, wear, material flaws or even intentional damaging.

Leakages can be detected and localized using distributed fiber optic temperature sensors. Fluid pipelines generate an hot-spot at the location of the leak, while gas pipelines generate a cold-spot due to the gas pressure relaxation. These localized thermal anomalies can be detected by a distributed measurement with good spatial, time and temperature resolution such as the DiTeSt system.

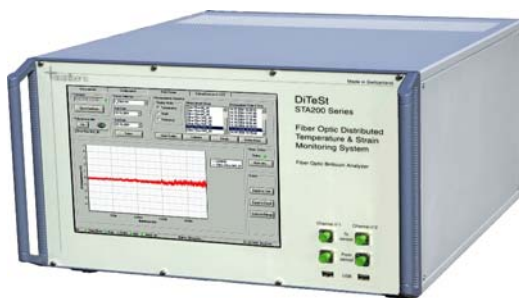
Furthermore, it is often possible to detect damage before a critical state is reached. SMARTEC systems are ideally suited for these tasks. Measuring distributed strain it is possible to determine the increased stresses due to external actions such as landslides and earthquakes or to internal causes such as a reduction of cross-section due to corrosion and wear. Finally, distributed temperature and strain monitoring can detect third party intrusion before any damage is done to the pipeline

The DiTeSt system can be used for distributed measurements of both strain and temperature over extremely long distances, limiting the number of instruments that are necessary to monitor a long pipeline.



System components

SMARTEC's pipeline monitoring systems are based on a combination of sensing cables, measurement instruments and data processing software. Different cables are available for temperature sensing (normal and high temperatures), strain sensing and combined strain and temperature sensing. The cables are designed to be installed on the pipeline surface or in its proximity, as depicted in the figure. The DiTeSt measurement instruments can measure sensors with a length of up to 2 x 30 km (upstream and downstream). Using the DiTeSt Range Extension modules it is possible to monitor up to 250 km from a single instrument. Specialized software packages are available for detecting leakages from gas, fluids and multiphase pipelines, to display and publish the measurement results in an user-friendly interface and to generate warnings when abnormal conditions are detected.



DiTeSt reading unit



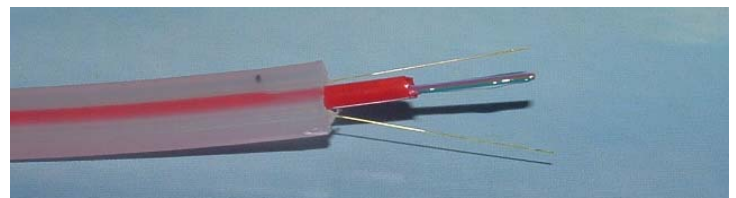
DiTeSt Range Extender



DiTeSt distributed temperature sensor



DiTeSt SMARTape distributed strain sensor



DiTeSt SMARTProfile distributed strain and temperature sensor