



Application Note

1



Pipeline rights-of-way may encounter geohazards.

PIPELINE INTEGRITY MONITORING

OMNISENS DITEST AIM

> Leak > Ground Movement > Intrusion Detection

What challenges do pipelines face?

Pipelines are critical assets in the energy supply chain and monitoring their integrity is a major challenge. Laid over long distances, often in remote areas, they are subject to earth movement, extreme climatic conditions and third-party intrusion. All of which threaten the integrity of the pipeline. Pipeline failures result in damage to people, communities and the environment, hence the importance of integrity monitoring.

Pipelines are commonly monitored using a combination of visual inspection, surveys and mass/flow measurements, each with limited ability to detect and locate incipient faults. Small changes, which are not detected, can lead to catastrophic failures.



Application Note



Example of sensing cable deployment during pipeline installation. On the left (orange) is the temperature monitoring cable, on the right (blue) is the strain monitoring cable.



The right-of-way reinforcement is displaced by a landslide. Such events are detected and located remotely by DITEST-AIM.

Omnisens DITEST-AIM for Pipeline Integrity Monitoring

Omnisens DITEST-AIM (Asset Integrity Monitoring) continuously monitors the entire pipeline. It detects and accurately locates pipeline leaks, and disturbances such as ground movement or third-party intrusion, to within a meter along the entire pipeline. The system detects threats by analyzing very small variations in temperature or strain (or both), along a standard telecommunications grade optical fiber integrated within a dedicated fiber optic sensing cable installed along the pipeline.

“ An anomaly can be located to within one meter over a distance of 100 km using a single interrogator. ”

Abnormal conditions and threats are detected and an alarm is triggered showing to within a meter the position of the threat. False alarms are discarded.

Detected events are communicated in real time to SCADA or third-party controls via TCP/IP. The system allows operators to anticipate and respond to failures at a very early stage, reducing the risk of catastrophic pipeline failures. The operators can make timely decisions based on continuous, real time information reflecting actual pipeline conditions. The monitoring is continuous regardless of changes in pipeline operation.

Omnisens pipeline monitoring system, DITEST-AIM offers comprehensive monitoring for protecting pipeline infrastructures against the following threats:

Leak detection

Leaks can have various causes, including deformations caused by ground movement, (earthquakes or landslides), third-party intervention, corrosion, fatigue, material flaws or even intentional damage.

Soil stability monitoring

The earth around the pipeline is subject to seasonal changes in texture and thaw settlements, frost heave, river crossings and other environmental and climate change, which can affect its stability, challenging the pipeline structure. These threats can be identified and located using distributed temperature and strain sensing along the pipeline.

Ground Movement detection

Ground movements are often initiated by heavy rain and water penetration. Unstable geological areas have been appearing with an increased frequency and magnitude as a result of climate change. The Omnisens DITEST-AIM accurately monitors for ground movement. Knowing where the ground is moving, the operator can take action to reduce the risk of failures.

Third party intrusion

Third-party intrusion can be detected as soon as soil above the pipeline is disturbed, and precisely located before the pipeline is damaged.

Omnisens SA

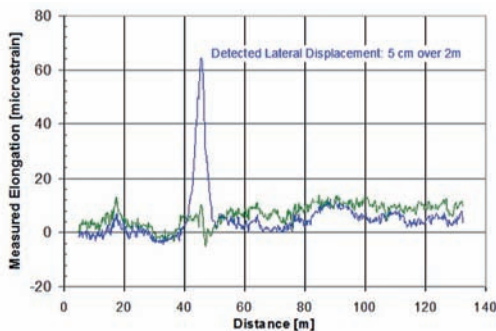
Riond Bosson 3, 1110 Morges – Switzerland
T: +41 21 510 21 21 - F: +41 44 274 20 31
sales@omnisens.com
www.omnisens.com



Application Note

Ground movement Detection - Principal

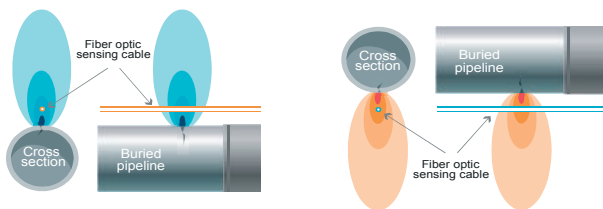
Geotechnical monitoring is based on the measurement of strain along a dedicated fiber optic cable buried in the ground next to the pipeline. Any ground movement, structure deformation or third-party intrusion introduces local strain in the cable and generates an event. A displacement of a few centimeters or inches is detected and located with meter accuracy anywhere along the pipeline. The date/time and precise event location are calculated.



Ground movement detection principal. Green trace shows activity at a given time period. Following an event the blue trace shows the extent of the event, and where it took place.

Leak Detection - Principal

Processing the temperature profiles detects small leaks. Multiple parameters are processed in order to discriminate leaks from normal daily temperature variations. Leaks of brine as small as 50 ml/min are detected, and in the case of chemicals, 10 ml/min, with meter accuracy along 100 km pipeline length.



Liquid leak (oil, brine, water) with fiber optic cable ideally positioned

The Joule-Thomson effect shows that a pressure drop implies a temperature decrease. Typical figures are 0.5 °C/bar x delta p, which indicates that small pressure changes induce significant temperature variations in a few minutes. The size and the speed of temperature change are in direct relation to the type of fluid or gas transported and the leak size. If the pipeline carries compressed gas, the temperature surrounding the pipe decreases. In the case of pipeline transporting heated fluids such as oil, brine, chemicals, water, etc., a leak leads to a local temperature increase, which will then spread laterally as the pipe continues to leak. Typically temperature increases at a few °C/min.

Omnisens SA

Riond Bosson 3, 1110 Morges – Switzerland
T: +41 21 510 21 21 - F: +41 44 274 20 31
sales@omnisens.com
www.omnisens.com

Fiber Optic Cable Selection is key

Leakage Detection Cable - TMC Series

Distributed temperature is measured using telecommunication grade fiber optic cables. Omnisens can provide recommendations for standard cables and customized versions of armored telecommunication fiber optic cable.

Strain sensitive cables - SMC Series

Strain Sensing Fiber Optic Cables (SMC Series) combine robust strain sensing with maximum strain sensitivity. This ensures the detection of a small displacement, which can be localized with meter accuracy anywhere along the cable. Their low loss characteristics are perfect for long distance monitoring, and their robust design makes them ideal for the harsh environments often found in remote pipeline routes.

Mechanical and optical characteristics of the cable are in compliance with IEC 794-1 Optical Fiber Cables.

DITEST-AIM Distributed Sensing Technique

Omnisens distributed sensing system (DITEST) is based on the analysis of stimulated Brillouin backscattered light emitted when a light pulse is transmitted down an optical fiber. Using the latest developments in fiber optic distributed sensing it gives unrivalled temperature and strain monitoring performance and reliability.

“ Detection limits as small as 10 ml/min have been achieved all along the pipeline. ”

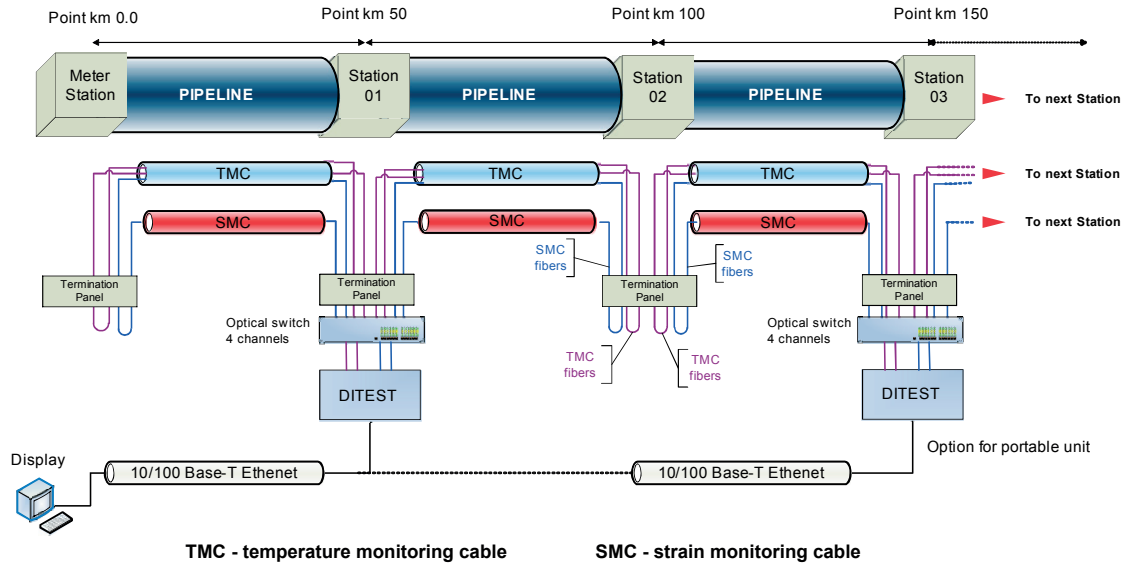
Omnisens DITEST-AIM is adaptable to project specifications and can meet the pipeline operator’s needs in terms of integrity, communication and alarm configuration. Every project has its specific requirements, and the best system performance is ensured by careful selection of the sensing instrumentation, optical fiber cable and the appropriate system configuration.

Omnisens provides customer assistance throughout the project and supports all applications both directly and through its network of certified distributors and solution providers.



Application Note

Schematic installation of Omnisens DITEST-AIM™ system



REF: AN-004 (DITEST Pipeline Integrity Monitoring) en-04

DITEST-AIM Pipeline monitoring system offers the pipeline operator:

- > Fully distributed monitoring capabilities with no dead zone, over the whole pipeline distance.
 - > High sensitivity to ground movement and intrusion detection with meter localization.
 - > Unrivalled pipeline leak detection based on temperature change.
 - > Not affected by pipeline operational changes, transient condition, pigging, shut-in, standstill, etc.
- > No false alarms.
 - > Robust and easy to install sensing cables with full rodent protection.
 - > 100% availability - automatic unattended operation.
 - > Interface with SCADA systems.

Applications	Benefits
Pipeline Leak detection	Leak detection Soil erosion, permafrost thaw settlements Seabed migration, river crossings threatening pipeline integrity and eventually leading to leaks.
Ground movement monitoring	Ground movements, landslides Pipeline deformation Harsh environment with seasonal soil texture changes. Third-party intrusion, hot tapping Soil erosion, seabed migration
Geotechnical	Most ground movements are caused by rain and water penetration. Ground movements are likely to continue in the future with increased frequency and magnitude, as a result of climate change.
Seismic areas	In potentially seismically active areas, DITEST-AIM offers solutions that significantly improve the safety assessment of the infrastructure after earthquake occurrence.

DITEST is a trademark of Omnisens

This document does not constitute an offer or contractual guarantee. We reserve the right to modify this data sheet without notice. OMNISSENS would be pleased to provide a detailed specification of performance tailored to your needs or application. Our continual improvement policy is your guarantee of the highest quality, reliability and value for money.

Omnisens SA

Riond Bosson 3, 1110 Morges – Switzerland
 T: +41 21 510 21 21 - F: +41 44 274 20 31
 sales@omnisens.com
 www.omnisens.com

