

SIPIPE MON FOS

Monitoring of underground pipelines with intelligent fiber sensing

The integrity of underground pipelines represents a particular challenge for pipeline operators. Digging work, seismic faults, and other extraordinary stresses are a major potential threat to these pipelines.

And this is exactly where the SIPIPE MON FOS system developed by Siemens comes in. It monitors pipelines along their entire length using fiber optic cable, detects even the smallest vibrations or stresses in the pipeline, and analyzes them with the help of artificial intelligence. In this way, SIPIPE MON FOS allows for continuous, full-coverage monitoring of this critical infrastructure. The system entails significantly fewer human resources and much lower expenses than current security concepts while at the same time increasing the security standards significantly.

Fiber optic cables monitor pipeline with patented Siemens Virtual Microphone Technology

The patented Siemens Virtual Microphone Technology represents a new generation of distributed acoustic sensing. This technology uses fiber optic cables as virtual vibration and shock detectors. These fiber optic cables are usually already installed along the pipeline for communication and automation purposes. SIPIPE MON FOS uses these existing fiber optic cables as sensors that continuously send measurement data to one of the fiber sensing units, which are placed every 80 kilometers. The reflection of the transmitted light impulses is measured. If the measurement data changes – whether due to temperature, strain, sound, or vibration – a complex algorithm is used to calculate the root cause of the disturbance.

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Artificial intelligence identifies anomalies

The system consists of local fiber sensing signal processing units that contain the hardware, control software, and AI algorithms. Due to their extremely high sensitivity, the fiber optic cables continuously receive signals that do not necessarily represent a threat to the pipeline. Therefore, artificial intelligence is applied to correctly identify the signals that are received: Are they typical disturbances such as street or train track noise or critical incidents that have to be reacted to immediately, such as construction work too close to the pipeline? In order to be able to make this distinction on a reliable basis, the system has to learn. And it does so during ongoing operations every time a new incident is reliably verified - based on the concept of machine learning.

If a relevant disturbance is identified, the operating staff is alerted at an early stage – before the damage even occurs. This can be done in different ways: for example, via e-mail, by text message, or even through the seamless integration of alarms in the pipeline operator's SCADA or IT system.

Low-cost, out-of-the-box solution with low maintenance requirements

With SIPIPE MON FOS, Siemens offers pipeline operators a low-cost, out-ofthe-box solution for monitoring their critical infrastructure. The combination of cutting edge sensor technology and artificial intelligence makes for a solution for effectively increasing the safety and security of pipelines that is highly economical in terms of its operation and maintenance.

Areas of application

- Intrusion detection
- Alerts for digging work
- Identification of seismic anomalies
- Pipeline leaks

The advantages of SIPIPE MON FOS

- Significant increase in safety and security standards through continuous, full-coverage monitoring of pipelines – including over very long distances
- SIPIPE MON FOS uses existing fiber optic cables
- Out-of-the-box solution can be rolled out in a very short period of time
- Low investment and maintenance costs
- Patented Siemens Virtual Microphone Technology
- Localization of threats with a precision of < 10 m
- Early alert before damage has even occurred