

Optiq distributed acoustic sensing interrogator



Compact, low-power unit handles long fiber lengths with high detection sensitivity and low false-alarm rate

Applications

- Permanent reservoir monitoring in oil and gas, geothermal, and carbon capture and sequestration (CCS) wells for
 - production and injection profiling
 - well integrity leak detection and out-of-zone injection (OOZI) identification
 - seismic and microseismic acquisition
- Flow assurance in oil and gas and geothermal wells
- Hydraulic fracture monitoring in oil and gas and enhanced geothermal wells
- Sand ingress monitoring in oil and gas wells
- Pipeline integrity monitoring for leak and threat detection; pig tracking

How it improves performance

A component of SLB Optiq™ fiber-optic solutions, the distributed acoustic sensing (DAS) interrogator features high sensitivity and dynamic range. These characteristics are key enablers of several fiber-optic well monitoring applications.

Multiphase production flow profiling in wells with low gas fraction and in high-rate wells:

Oil or water inflows usually produce less vibration than gas. Consequently, instruments with high DAS sensitivity are essential for quantifying these inflows and differentiating phase fractions from noise.

Conversely, in high-rate wells, especially gas producers with ICDs or wells undergoing hydraulic fracturing, the high noise signal can saturate the DAS response and challenge inflow or outflow profiling. The wide dynamic range of the fiber-optic DAS interrogator ensures acquisition of high-quality data for more accurate interpretation of zonal flows.

Transient analysis requires changing the drawdown, and the interrogator's high sensitivity enables reducing the amplitude of the change to minimize unwelcome production losses while preserving data quality. The small spatial sampling interval enables higher-resolution data interpretation along the wellbore and is critically important for distinguishing flow-related features from other acoustic data.

Injectivity profiling: Injection produces small vibrations (acoustic signals), which are mostly associated with water flowing out to the formation

behind the casing. Even more challenging conditions are encountered postinjection—during warmback—with low wellbore afterflow or crossflow rates, which generate low-amplitude vibrations. High DAS sensitivity and dynamic range address these challenges.

Well and caprock integrity determination: Leak detection to remedy well integrity issues often requires the ability to detect weak vibrations and accurately locate them along the wellbore.

For monitoring caprock integrity and OOZI, the analysis is based on quantitative interpretation of DAS signal variations in the vicinity of the unintended fracture initiation point. High DAS sensitivity is extremely important for improving the accuracy of locating the initiation point and estimating fracture parameters. The interrogator's dynamic range ensures reliable detection of fractures and OOZI, enabling greater injection volumes without risking caprock damage.

Seismic data acquisition: Optiq Seismic™ fiber-optic borehole seismic solution enables acquisition of zero-offset, walkaway, and many more types of vertical seismic profiles (VSPs); 3D seismic surveys; and 4D seismic surveys for reservoir monitoring in minutes rather than the hours or days required using conventional methods.

Additional information

The distributed fiber-optic sensor interrogator unit contains two optical modules, which can simultaneously interrogate sensing fibers, each up to 65 km [40 mi] long, giving the unit a 130-km [81-mi] range. For subsea applications, where the sensing fiber can be longer, a subsea optical amplifier can extend the interrogator's range.



Distributed acoustic sensing interrogator.

DAS Interrogator Specifications

Minimum detectable signal (noise floor)	5 km [†] [3 mi [†]]	-80 dB rad.Hz ^{-½} at 10 Hz (equivalent to an axial strain of about 1.5 pe.Hz ^{-½})
	50 km [‡] [31 mi [‡]]	-60 dB rad.Hz ^{-½} at 10 Hz (equivalent to an axial strain of about 15 pe.Hz ^{-½})
Dynamic range [†]	155 dB at 1 Hz	
	135 dB at 10 Hz	
	115 dB at 100 Hz	
Spatial resolution	1.6 m [5.2 ft]	

All specifications are subject to change without notice.

[†] Measured at the front of a 5-km fiber, using a 20-kHz sample rate and 6.4-m [21-ft] gauge length

[‡] Measured at the front of a 50-km fiber, using a 2-kHz sample rate and 6.4-m gauge length