SMART FIBRES
SENSE THE FUTURE

Fluid Contact Monitoring System

Using Optical Distributed Pressure Sensing

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- For observation wells and fluid storage vessels
- Provides accurate, real-time measurement of fluid contacts
- Automated data processing and visualisation of results
- Reduces HSE risk by removing the need for well interventions

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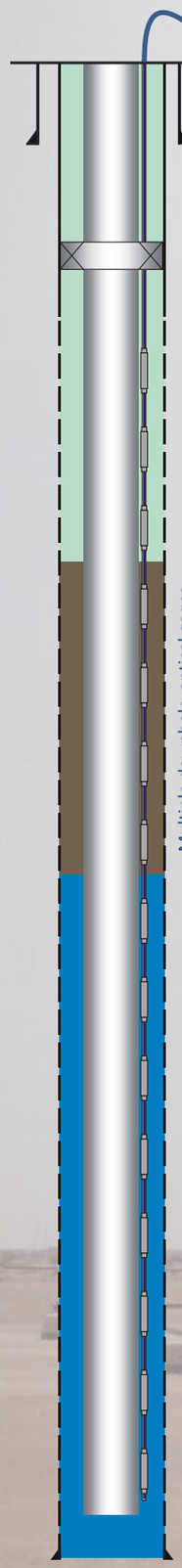
Fluid Contact Monitoring System

Wellhead instrument

Visualisation in office



System Overview

Smart Fibres' distributed pressure sensing system for fluid contact monitoring (FCM) comprises an array of optical pressure gauges permanently or temporarily installed inside fluid storage vessels or downhole observation wells. By deploying the gauges across different fluid layers the system measures the density of the media between adjacent gauges from which, with intelligent data processing, the fluid contacts are derived.

For example, in highly permeable or highly fractured geological formations there is often good fluid communication between the oil reservoir and the observation well. Under these conditions the fluid-contacts measured in the observation well by the system will give the Operator valuable information about the location and the dynamic behaviour of the oil rim to optimise oil production.

The system provides advantage over the conventional method of running periodic gradio surveys through real-time data availability, lower total system cost and reduced HSE risk by avoiding multiple well interventions.

The system was developed by Smart Fibres under a joint project with Shell and Petroleum Development Oman (PDO). The FCM system has been optimized and demonstrated in field trials since 2009, resulting in first commercial deployments in 2015 with PDO.

Sensor installation

Key System Features

- Data output: P/T at each gauge, fluid contact levels, system health
- Data rate: continuous, scheduled or on demand
- Typical contact level accuracy*: <1m (gas/liquid), <3m (liquid/liquid)
- Additional option:
  - all-in FCM system including FCM, surface tubing & casing P/T
- Other applications of the system components:
  - production monitoring: single or multi-point downhole gauges, incl. dual-gauge assemblies for tubing/annulus P/T
  - fluid offtake monitoring in pumped wells

*depends on number of gauges, gauge spacing and fluid densities

System Components

SmartPort Downhole Pressure/Temperature Gauge

SmartPort is Smart Fibres' in-house, low profile (¾") fibre optic P/T gauge. Pressure is communicated via a small pressure port on the gauge body to SmartPort's novel internal optical sensing mechanism where pressure and temperature measurements are made using two fibre Bragg grating sensors. Key features are below. Further details and specifications at smartfibres.com/docs/SmartPort.pdf

- Standard working pressure ranges of 1, 5, 10 or 15 kpsi
- Working temperature range up to 400 °F / 200 °C
- Accuracy 0.1 % of full scale
- Tubing and/or annulus pressure measurement
- Multiplexing of up to 24 gauges per 2 fibres

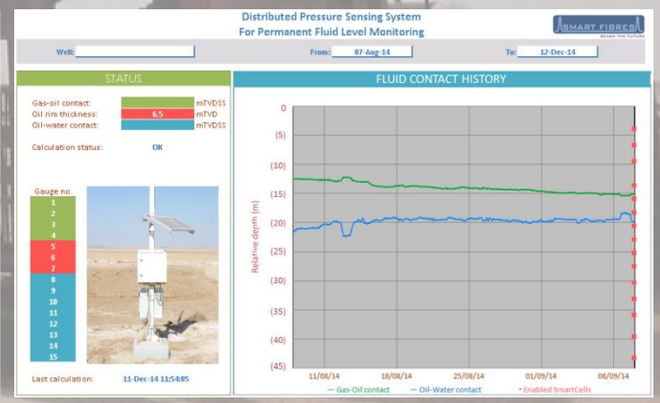
SmartScope Wellhead Data Logger

SmartScope is Smart Fibres' in-house tuneable laser interrogator for FBG sensors. Its high accuracy, broad temperature range, polarisation insensitivity and low power consumption makes it the ideal surface instrument for the fluid contact monitoring system. Data is typically transmitted wirelessly to the client server. Key features are below. Further details at smartfibres.com/docs/SmartScope.pdf

- 40nm or 80nm wavelength range
- 4 to 16 optical channels
- High accuracy and resolution
- No polarisation sensitivity
- Low power
- Hazardous area certified (ATEX)

SmartSoft Software

The SmartSoft software resides on the Operator's data server and picks up the pressure and temperature data transmitted from the SmartScope wellhead data logger. It uses Smart Fibres' proprietary algorithms to process the measured pressures into fluid contacts. Other SmartSoft features include visualisation of fluid contact, pressure and temperature histories, system health and system self-diagnostic information.



Example SmartSoft visualisation of reducing oil level in wellbore