



COST EFFECTIVE, SINGLE POINT OR MULTI-DROP DOWNHOLE PRESSURE AND TEMPERATURE MONITORING

Distributed permanent downhole pressure and temperature gauges

Multiple gauges integrated on a single ¼" control line

Factory made gauge array cable delivered to rig site for quick and easy installation

Rugged surface instrumentation delivers real-time "data to desk" advantage

Downhole electronics eliminated

10 year deployment history with 98% reliability

Able to integrate other optical systems such as DTS and DAS for a full monitoring package

Low CapEx investment and no routine maintenance costs

High return on investment via various data value cases:

Reduced HSE issues and costs through real-time well integrity monitoring

Production optimisation through real-time offtake management

Frac treatment monitoring of unconventional reserves

Real-time data for reservoir modelling

Real-time troubleshooting of reservoir issues

THE DATA YOU NEED

DPTS TECHNOLOGY

Smart Fibres' Distributed Pressure and Temperature Sensing (DPTS) is based on a fiberoptic sensor called the fibre Bragg grating (FBG) which responds to strain and temperature. More information is available at smartfibres.com/technology. For DPTS, we use the strain response to measure fluid pressure via a diaphragm transducer called SmartPort, a permanent downhole gauge (PDHG). Multiple SmartPorts are connected on a 1/4" control line and send pressure / temperature data to a surface readout unit called an interrogator.



SmartPort Downhole PT Gauge

DPTS TECHNOLOGY BENEFITS

Why use fiberoptic for permanent downhole measurements?

Fiberoptic technology is immune to EMI, allowing operation near noisy electrical apparatus such as ESPs.

Downhole electronics eliminated, enabling measurement for the life of the completion.

Fiberoptic downhole equipment is small in size and easy to deploy.

Why choose to measure pressure ?

It is the most important downhole measurand and flow can be directly calculated from pressure with high confidence, so giving direct production data. These data can be used not only to ensure production but also to optimise it.

Why choose FBG technology to measure pressure ?

High resolution FBG data provide instant, actionable information without the need for averaging or post-processing.

Data are frequency encoded, so attenuation due to fibre or connector degradation would not impact measurement.

It allows many PT gauges to be multiplexed on a single cable, lowering deployment complexity, cost and risk.

Why choose Smart Fibres' DPTS technology

Our low cost opens DPTS to assets where even a single point measurement was previously too expensive.

Our deployment string has gauges pre-assembled at factory, so is easy to deploy and reduces rig cost.

We can integrate partners' DTS and DAS onto our fibre, allowing a complete integrated monitoring capability.

SMART FIBRES' DPTS TRACK RECORD (until April 2018)

- First deployment: 2008
- DPTS Systems deployed: 19
- Gauges deployed: 104
- Reliability of latest gauge: >98%
- Places deployed: Middle East, West Africa, North America, Asia Pacific



A DPTS Instrumented Oil Well, Oman



DPTS data are delivered real-time to the Operator's desk

EXAMPLE DPTS TECHNOLOGY USE CASES

IMPROVED RESERVOIR MODELLING

Having multiple PT readings across the reservoir allows engineers to better understand and model reservoir behaviour, which aids improved production efficiency and field development planning.

BETTER OFFTAKE MANAGEMENT

DPTS data can be used as part of an intelligent wells production methodology, where the downhole data enables informed operator control decisions. Such control decisions can involve downhole tools such as ESPs¹, ICD² or SSD³ inflow devices, or surface actions such as when to inject or produce, all intended to ensure optimal recovery.

STACKED RESERVOIR PRODUCTION

In stacked reservoirs where a producer passes through multiple pay zones, DPTS can monitor the relative contribution of each stack to help manage offtake.

FRAC WELL OPTIMISATION

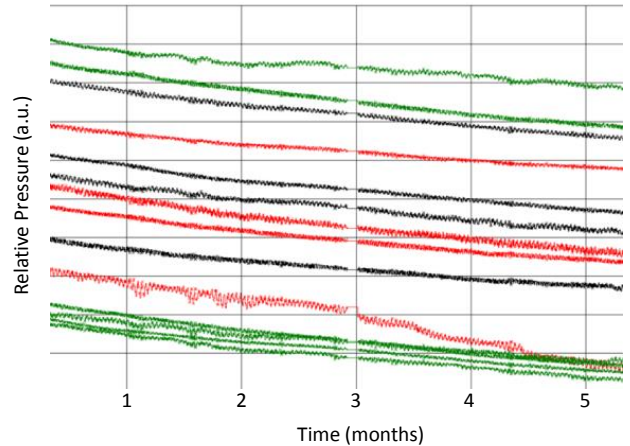
DPTS in the treatment well can provide accurate bottom hole pressure for model calibration. From an offset wellbore, DPTS can identify frac hits and well communication.

FLUID CONTACT MONITORING

DPTS data can provide real-time fluid levels in wells, which is used for oil rim monitoring in highly fractured reservoirs, and level monitoring in storage caverns.

IMPROVED TROUBLESHOOTING

When things do not go to plan, DPTS data can provide asset managers with invaluable insight to support their troubleshooting and remedial action processes.



Highly stable DPTS pressure data
(gauges track within < 0.1psi / 5 months)

DPTS SYSTEM PERFORMANCE

- | | |
|---|---|
| <ul style="list-style-type: none"> ❑ Pressure range: 1, 1.5, 5, 10, 20 kpsi 70, 100, 350, 700, 1400 bar ❑ Pressure accuracy: < 0.1% of full scale ❑ Pressure resolution: < 0.005% of full scale ❑ Pressure stability: < 0.1% of full scale per year ❑ Multiplexing: 15 gauges per fibre pair | <ul style="list-style-type: none"> ❑ Temperature range: -20 to 150 deg C 0 to 300 deg F ❑ Temperature accuracy: 0.1 deg C 0.2 deg F ❑ Temperature resolution: 0.002 deg C 0.004 deg F |
|---|---|

DPTS SYSTEM COMPONENTS

SmartPort P/T Gauge

www.smartfibres.com/products/smartport

An optical permanent downhole gauge using FBG technology.



SmartMandrel

www.smartfibres.com/products/smartmandrel

A SmartPort gauge carrier that allows tubing pressure measurements.



SmartSplit

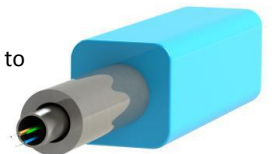
www.smartfibres.com/products/smartsplit

A housing for making downhole spliced connections.



Downhole Cable

A fibre in metal tube optical cable suited to well deployment.



SmartPB Pressure Barrier

www.smartfibres.com/products/smartpb

A backup surface pressure barrier to ensure well integrity.



Wellhead SmartScope

www.smartfibres.com/products/wellhead-smartscope

A surface readout unit for transferring gauge data into client systems.



1. Electric Submersible Pump, 2. Inflow control device, 3. Sliding sleeve door

