

Intelligent DTS Solutions for Improving Oil & Gas Production

Overview

Efficient reservoir and well management requires a good working knowledge of the environment around the wellbore and completion. In today's production operations, operators are putting an emphasis on use of downhole instrumentation that provides a clear picture of these conditions to help reduce uncertainty and accelerate operational decisions. They have found that improving the speed and accuracy of these instruments, as well as collecting data continuously over longer downhole intervals, makes a distinct improvement in their optimization process.

A distributed temperature sensing (DTS) system, is a real-time technology that enables operators and service companies to better visualize downhole conditions and the events that affect production efficiency. While it is well known that temperature data is extremely useful for characterizing and troubleshooting production operations, traditional tools for measuring wellbore temperature provide only limited information. For instance, a production logging tool will measure over the entire length of the well but only provides only short-term data. Permanently installed bottom-hole sensors provide long term monitoring but only measure at a single point in the well.

However, a DTS system with an optical fiber deployed in a cable with the completion can measure temperature over the entire length of the well, detecting conditions at thousands of points in the well. It also permanently monitors conditions over time, capturing critical events as they occur, while helping to eliminate the risk and cost of a well intervention for logging. The DTS can also be integrated with fiber optic point sensors for BHP/BHT single-point measurements, reducing the cost and need for multiple systems and cables in the wellbore.



Robust Solutions for Harsh Conditions

SensorTran wellbore and reservoir monitoring solutions are engineered to work effectively in a variety of environments. From SAGD to chemical stimulation wells to offshore and subsea applications, SensorTran is able to effectively design and implement optimized solutions that meet customer's demanding requirements. Complete solutions include:

- ⇒ Design support services
- ⇒ One or more DTS systems
- ⇒ Data collection, storage, and visualization software
- ⇒ Fiber optic cables, matched to well conditions
- ⇒ System installation and deployment

Fiber optic sensing cables employed by DTS systems are non-corrosive and immune to EMI. DTS technology has been proven to be capable of providing sub-surface measurements at temperatures up to +300°C.

Better Decisions from Better Data

- provides real-time temperature measurements for up to 40,000 discrete points along the length of a fiber optic probe, providing comprehensive thermal profiling
- high optical budgets and fast measurement times allow SensorTran units to be specified, configured, and tuned to optimize the balance between speed and temperature resolution
- improves the accuracy of reservoir models and helps eliminate uncertainty

System Features and Benefits

SensorTran offers intelligent well monitoring solutions that provide a wealth of features and benefits:

- ⇒ up to 50 fiber-optic channels available, providing monitoring for multiple wells from one DTS unit
- ⇒ PerfectVision™ multi-laser technology available, enabling accurate temperature reads even on darkened/attenuated fiber or complex deployments with numerous splices/connectors
- ⇒ open-communications architecture provides reliable and easy interfacing with 3rd party systems and networks (Ethernet, OPC, SCADA, etc.) together with flexible remote control and data output/input capabilities
- ⇒ intelligent and multiple alarm types and configurations can be readily tailored to each specific project to alert the operator to anomalous temperature events or abnormal conditions
- ⇒ each well configuration can be defined into unlimited zones with individual alarm types and set-points for each zone, allowing alarms to fully reflect the changing characteristics in the wellbore
- ⇒ Asset-specific visualizations via the SensorTran AssetViewer™ present the data to the operator in a meaningful, representative and intuitive graphical form with tailored report creation facilities
- ⇒ wide range of hardware implementation packages available to meet exacting project requirements
- ⇒ on-board and expandable data storage provides for historical data archiving
- ⇒ extensive self diagnostics and autonomous operation with safe shut-down and auto-startup
- ⇒ robust optical fiber cable design
- ⇒ suitable for use in hazardous areas and unaffected by electro-magnetic interference

SensorTran also offers a fully integrated DTS/FBG system featuring FBG technology from industry leader Micron Optics. This system combines distributed temperature sensing with pressure, strain, and/or vibration measurements via a single interface and is compatible with a range of 3rd party point sensors.

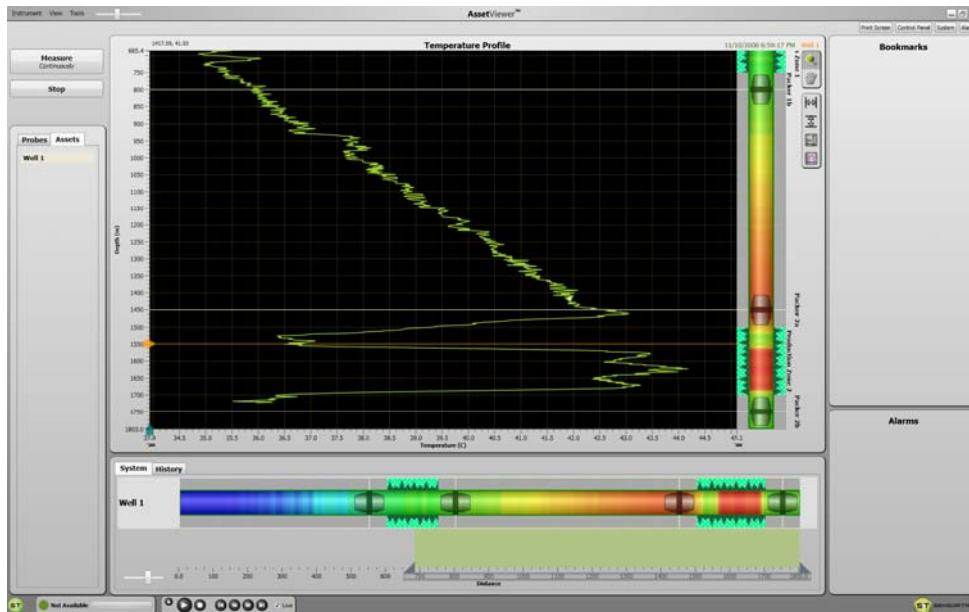
System Configuration

Single or multiple DTS units can be provided within a single control room or field-deployed enclosure. A typical single-DTS unit configuration within a control room cabinet is shown at right. DTS networks can also be readily implemented, providing expanded coverage for multiple wells or site-wide installations that combine monitoring of surface and sub-surface systems. Portable units are available for mobile deployment and monitoring of retrievable or temporary completions.

- ◆ Data and alarm output: Ethernet, OPC, SCADA, relay contacts, RS232, RS485, etc.
- ◆ Remote control and data input: Ethernet, OPC, SCADA, RS232, RS485, etc.
- ◆ Peripheral equipment: printers, remote displays & keyboards, data back-up, etc.
- ◆ Extensive historian capability able to replay/revisit alarm events and asset performance



SensorTran's AssetViewer™ is an optional software product that provides a graphical visualization of the temperature data. The AssetViewer™ is automatically configured from the settings within SensorTran DTS Commander™ software and requires no additional setup. The software simultaneously displays multiple temperature profiles, summary temperature data, and alarm status information for each zone. Recorded data can also be replayed using the powerful data control facility to view historical events at various speeds.

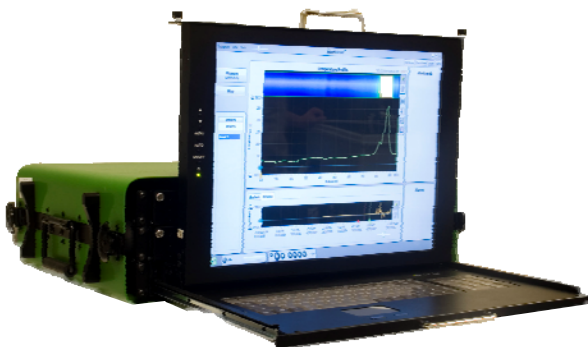


SensorTran AssetViewer™

PerfectVision™ Plug & Play

SensorTran's Gemini™ platform features PerfectVision™ multi-laser technology that simplifies initial set up and calibration and continually maintains that calibration over time - even as the well and fiber conditions change.

PerfectVision™ is able to automatically correct for the effects of fiber damage over time as well as damage that occurs during installation. Gemini™ systems account for splice and connector losses and induced strain effects. DTS systems equipped with PerfectVision™ have demonstrated their ability to read hydrogen-darkened fiber that competitive systems could not. The technology also eliminates the need for double-ended measurements.



Portable Field Armor™ Package

Downhole Applications

DTS systems can provide monitoring for a wide variety of applications. Following are some of the ways that operators and service companies use DTS data to visualize downhole conditions.

Troubleshooting

- Locate tubing and equipment leaks
- Detect flow behind casing
- Identify cross-flow between zones

Optimize Production Over the Life of a Well

- Identify water or gas breakthrough
- Provide enhanced understanding of zonal contributions or flow profiles
- Identify differential depletion in stacked reservoirs as early as possible

Optimize Injection Wells

- Establish injection profiles across multi-zone water flood completions

Intelligent or Smart Completions Monitoring

- Ensure downhole flow-control function or valve position in smart completions

Monitor Steam Flood and SAGD Efficiency

- Verify steam chamber growth and placement
- Monitor observation wells for steam breakthrough into weaker formations

Verify Effectiveness of Downhole Operations in Real Time

- Confirm injection profiles
- Monitor cementing jobs; verify cement tops
- Verify gas-lift valve operation and injection points
- Determine fluid levels and operating temperature in electrical submersible pump (ESP) completions
- Identify potential flow assurance problems from hydrate, scale, or asphaltine build-up

Improve Reservoir Stimulation and Remedial Operations

- Observe fracture-height growth during fracturing treatments in real time
- Monitor multi-stage acid stimulation treatments



The SensorTran Advantage



SensorTran is
ISO 9001 Certified

SensorTran is committed to supplying its customers with smart distributed monitoring solutions. SensorTran's systems are conceived to have a low lifetime cost of ownership (LCO) by way of efficient design, superior engineering and reliable construction. SensorTran's team is dedicated to providing "best-in-industry" customer care from project conception to the development of specifications, through installation, training, and beyond.

SensorTran has made every effort to ensure information contained in this document is accurate at the time of printing, however, product specifications and features are subject to change without notice.

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