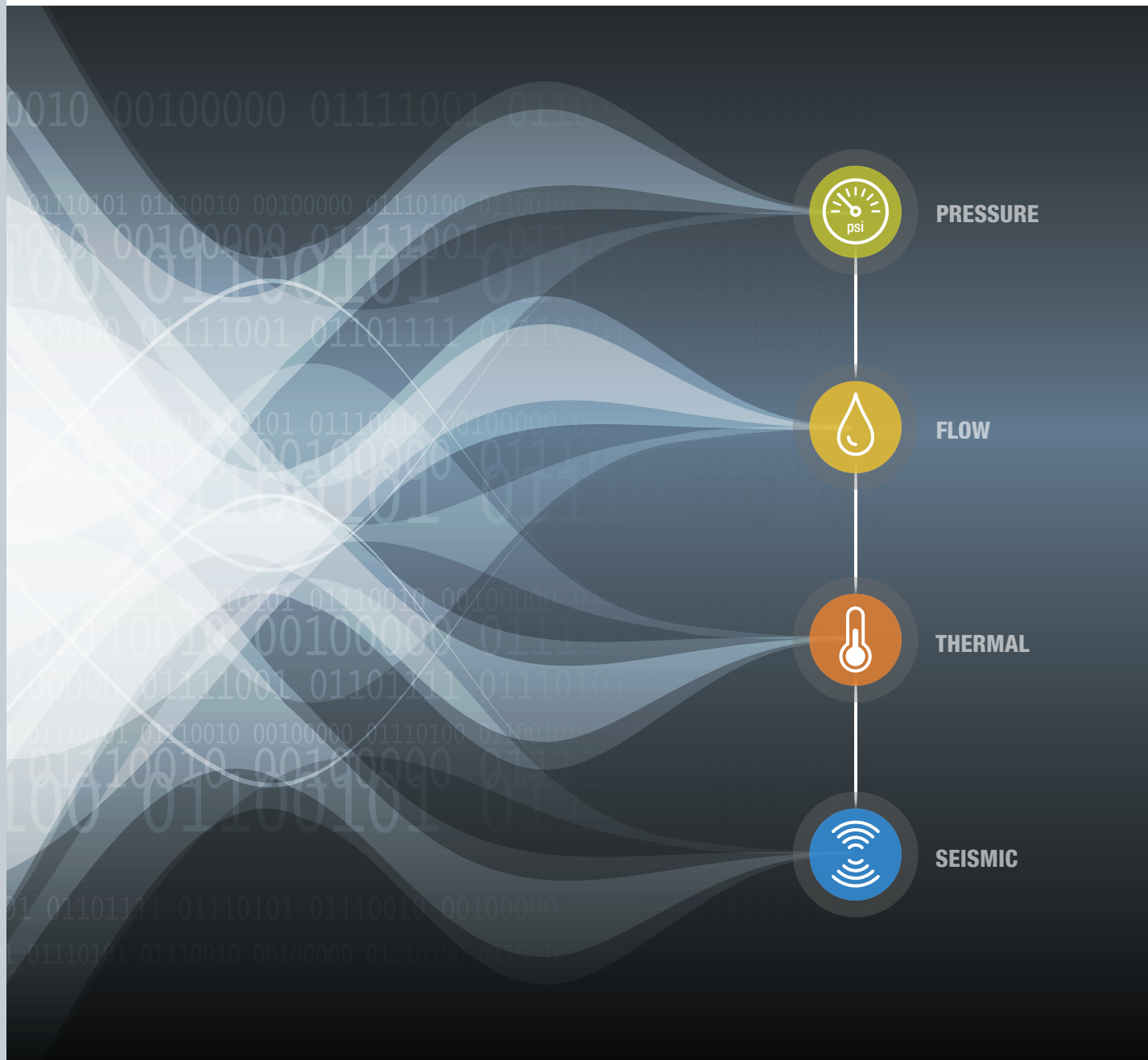




Weatherford®

OmniWell® Production and Reservoir Monitoring

Bringing you actionable data for better decisions

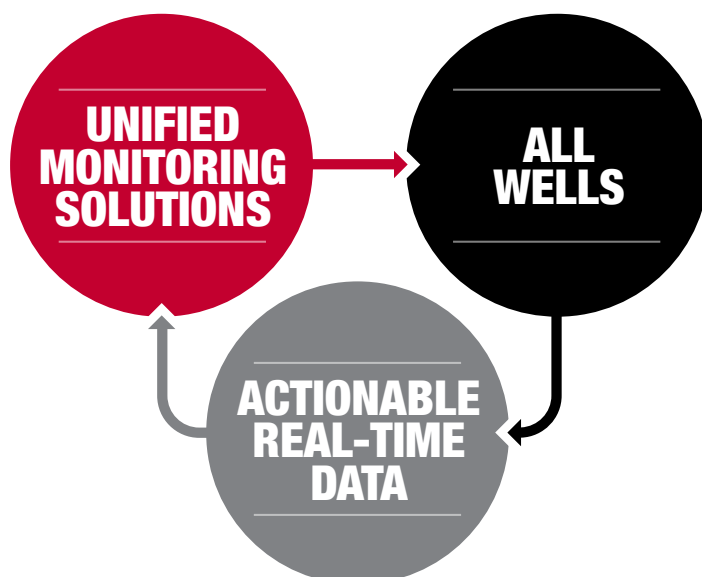


Simplify your decisions with OmniWell® solutions

Today's wells call for actionable data that reduces risks and improves decisions. Hundreds of factors—from costs, to production disruptions, to inefficiencies and uncertainties—can influence your choices. Unleashing the potential of your asset is more than choosing the right tool; it's adopting a systematic approach that combines proven equipment with innovative field-management solutions. Weatherford, the only oilfield services company to offer extensive solutions for production optimization, brings global expertise and an unparalleled depth of products to make your field decisions faster, easier, and more effective.

Nothing tells your well's story like the well itself. In skilled hands and with precision tools, changes in pressure, flow, temperature, acoustics, and seismicity come together to paint a precise picture of your well. OmniWell production and reservoir monitoring solutions use reliable electronic or optical downhole sensors that let you know what's happening inside any well, whether in conventional or extreme operating environments.

The OmniWell solution delivers real-time downhole data, giving you the critical information you need to get the most from your well. Our approach is a shift away from typical tool-based data collection to a more unified well-information solution. It's designed for reliability, flexibility, simplicity, and accessibility. Through data acquisition, visualization, and analysis tools, the OmniWell solution gives you actionable data, enabling more efficient decisions on well optimization.



OmniWell Benefits at a Glance

Provides permanent real-time monitoring solutions for the lifetime of a well

Delivers real-time downhole data for all well conditions, including extreme environments

Offers easy installation with a single-cable approach to downhole data

Relays integrated flow, pressure, temperature, and seismic reservoir monitoring

Provides flexible, fit-for-purpose solutions for any operation

Helps identify production problems before they happen, saving on costly workovers

Delivers data for flow profiling, frac monitoring, production surveillance, thermal profiling, and more on a single cable

A unified, simple approach to downhole monitoring

Our simplified approach to downhole monitoring can help you solve complex challenges. The OmniWell solution is a unified family of pressure, thermal, flow, and seismic products that give you an accurate view into your well. Based on a simplified, single-cable approach to downhole measurement, our system physically integrates multiple measurement solutions and visualizes well performance data in real time. Our permanent downhole systems provide information that helps you accelerate production, reduce operational risk, and maximize reservoir recovery.

Proven Know-How

We have decades of experience in reservoir monitoring. Our permanent electronic gauges have been installed in more than 5,000 wells, while our optical systems have been installed in more than 600 wells. We have installed more than 15 million ft (4,570 km) of optical fiber in wells around the world. With hundreds of millions of hours in cumulative operating time, the OmniWell solution gives you reliable operations for any type of hydrocarbon production.

Best-In-Class Technology

Weatherford is an industry leader in downhole monitoring performance and reliability, and you can count on our tools for dependable operations in every type of production, including oil sands, subsea, and unconventional shale. To ensure that our products perform in the harshest environments, our sensors undergo some of the most rigorous testing available. The OmniWell solution has been field-tested the world over to ensure precise and reliable data from your wells.

Fit-For-Purpose Solutions

From simple, single-gauge installations to complex multizone intelligent-wells, we offer a complete range of production-monitoring solutions. Our systems are scalable and can be part of a well, reservoir, or comprehensive field-optimization solution. By combining downhole measurements with surface-data and control systems, we provide you the means for enhanced, long-term management of your wells.

Conventional To Extreme Environments

OmniWell systems have been installed in all well types around the world:

- Unconventional oil—heavy oil, steam-assisted gravity drainage (SAGD), cyclic steam stimulation (CSS), steam flood, horizontal oil shale wells
- Unconventional gas—including shale gas, tight sands, and coalbed methane
- Offshore oil and gas wells

Real-Time, In-Well Solutions For All Wells

CONVENTIONAL

- Onshore
- Offshore
- Producers
- Monitor Wells
- Vertical, Deviated and Horizontal Wells
- Intelligent Completions

UNCONVENTIONAL

- Gas and Liquid Shale
- Tight Gas Sands
- Coalbed Methane
- Coal-Seam Gas
- Oil Sands
- Heavy Oil
- HPHT

AGING RESERVOIRS

- Artificial Lift
- Injection Wells
- IOR / EOR
- Workovers
- Liquid Unloading
- Water Control
- Infill Wells
- Bypassed Hydrocarbons
- Restimulation
- Reperforation

FRONTIER

- Extended Reach
- Extreme HPHT
- Deep Water
- Sub-Salt
- Arctic

Accurate sensing. Real-time information. Reliable results. Any Well.

OmniWell production and reservoir monitoring solutions provide data acquisition, information management, and analysis for any type of well. The system is your platform for more informed decision making, which can lead to lower operating costs by reducing deferred production, reducing failures and workovers on live wells, and optimizing well production.

Proven Know-How

The OmniWell system helps you manage day-to-day field operations in conventional production.

- Enhances your reservoir knowledge, including permeability, size, boundaries, drive mechanisms, inter-well influences and more
- Analyzes development strategies, improves calculation of reserves, and optimizes production
- Provides data on actual versus predicted performance
- Quantifies contributions from independent reservoir zones or co-mingled wells
- Monitors independent reservoirs in multilateral wells
- Supports material balancing, including fault blocks, independent of the reservoirs
- Provides seismic imaging and monitoring of reservoir drainage and bypassed hydrocarbons

Best-In-Class Technology

Permanent downhole monitoring provides pressure and temperature data for automation and analysis in artificially lifted wells. The OmniWell system facilitates proactive decisions to reduce downtimes in gas-lift wells, progressing cavity pumping (PCP) wells, and more.

- Analyzes pressure losses, including draw down, completion skin, productivity indexing, and tubing pressure losses
- Accelerates production, helping to realize revenues earlier
- Manages sand-face pressure drop
- Minimizes shut-in time for pressure buildup surveys
- Retrieves data from unplanned shutdowns
- Monitors formation damage through well transients
- Optimizes sand control and stimulation
- Confirms or suggests improvements to well design performance

Coalbed Methane (Coal-Seam Gas)

Simple electronic gauges help you recover methane at optimum rates while maintaining positive well economics. The OmniWell system provides the data needed to facilitate proper drawdown of the fluid column while maintaining pump coverage.

Downhole Flow Measurement

Real-time downhole flow measurement is critical for optimizing many complex well designs, including intelligent, multizone and multilateral completions. The OmniWell system collates data from a downhole flowmeter, which helps to reduce or eliminate surface-well testing and the resulting operational, safety and environmental impacts. Our optical flowmeters have no borehole restrictions or intrusions into the flow path. They are bidirectional, scalable to any pipe size, and feature a control-line bypass for use in intelligent-well systems. These flowmeters can be configured for single-, two- or three-phase flow and are applicable to production and injection wells.

Production And Injection Profiling

Optical distributed temperature sensing (DTS) and array temperature sensing (ATS) systems enable you to determine production and injection profiles across the reservoir sections in horizontal, multilateral, and multizone wells.

Well Startup Monitoring

Optical pressure and temperature (P/T) sensors not only measure real-time reservoir pressure, but also manage initial drawdown. Our proprietary software, such as the PanSystem® and PanMesh™ programs, create inference tests and pressure transient analysis that provide you with reservoir boundary information.

Horizontal Completions

P/T gauges define drainhole production efficiency. When coupled with flow-control valves or inflow control devices, the gauges can help you ensure uniform production across long horizontal sections. This technique can prevent excessive flow from the heel of the completion that can kill production from the toe.

Gas Storage

Permanent seismic sensors installed in a gas-storage reservoir wellbore measure gas-bubble expansion or contraction as a function of injection or withdrawal. Our Clarion™ seismic monitoring tools provide the sensitivity and repeatability that seismic surveys demand. The system is a field-proven and reliable tool—many of our Clarion tools still process seismic data after more than a decade of operation in harsh environments.



Subsea Capabilities

Acquiring data from subsea wells and reservoirs is a complex job. And as more production moves offshore, your data needs in these difficult conditions are growing. You need a permanent solution—designed for subsea environments, tested and refined over a decade of trial installations, and proven to perform without the need for intervention.

Consistent and reliable downhole data informs better reservoir decisions and increases recovery, well life expectancy, and profitability. But in subsea environments, environmental conditions that cause vibrations and extreme pressure and temperatures challenge reliable data. The risk for equipment damage or failure is high—which prevents you from getting the information you need while causing delays and costly, complex repairs. Permanent monitoring systems remove the need for intervention, which reduces costs and operational, production, safety, and environmental risks. Through our OmniWell product portfolio, Weatherford offers a range of permanent downhole sensors and data acquisition units suited for diverse subsea applications.

Our devices are vetted through a comprehensive series of environmental stress tests to ensure strict criteria are met for thermal and mechanical shock, pressure and temperature cycling, vibration, drop, and drift. As a result, these tools perform reliably for periods that exceed industry standards—and your onshore well or reservoir.

The Permanent Reservoir Monitoring Advantage

Reduced Operating Costs and Risks

- Eliminate interventions
- Decrease the amount of persons required on board
- Avoid deferred production costs

Optimized Production

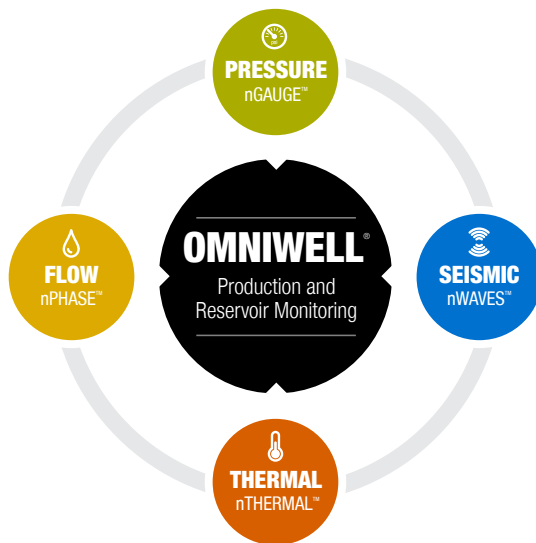
- Improve well design
- Enhance stimulation, artificial lift, and sand control
- Monitor formation damage
- Analyze pressure losses
- Manage sand-face pressure drop
- Minimize shut-in time for pressure buildup surveys
- Help determine the cause of unplanned shutdowns
- Accelerate production and realize revenues sooner

Improved Reservoir Management

- Expand your understanding of a reservoir and its characteristics
- Acquire real-time data based on actual performance, rather than relying on predicted performance
- Establish unchanging reference points and eliminate repeatability errors from reusing temporary sensors
- Quantify contributions from independent reservoir zones and commingled wells
- Monitor independent reservoirs in multilateral wells
- Monitor reservoir drainage and bypassed hydrocarbons
- Capture seismic imaging
- Predict future production and recovery for various development strategies

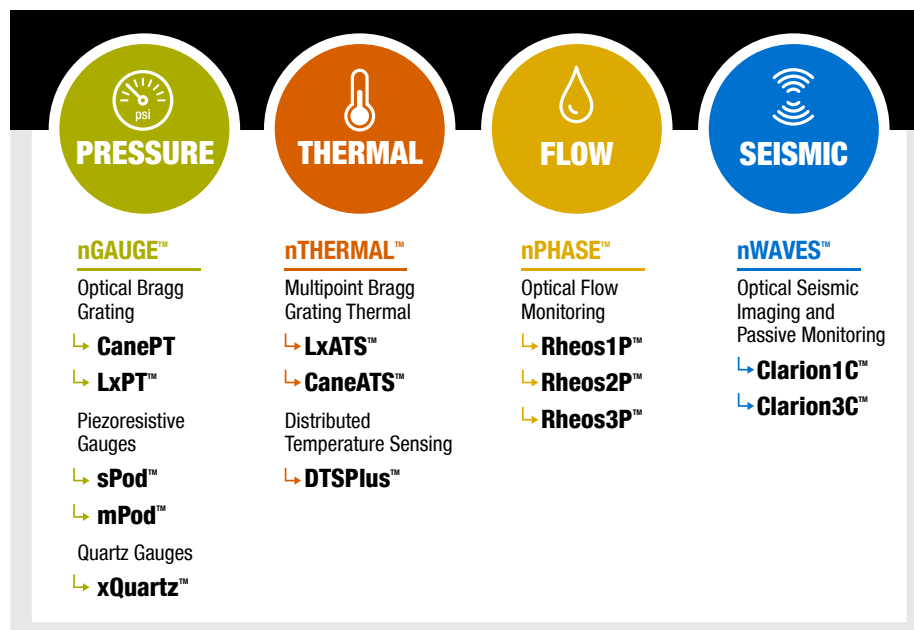
A solution scalable to your well monitoring needs

OmniWell production and reservoir monitoring gives you options for optimizing your wells. We understand that every well is unique, and we can provide a customized solution that matches the needs for your well, for your reservoir, or for your entire asset base.



OMNIWELL

Data Acquisition Platform





PRESSURE AND TEMPERATURE GAUGES

nGAUGE™ TECHNOLOGY—ELECTRONIC SENSORS

Quartz and piezoresistive electronic gauge systems offer cost-efficient and flexible solutions for downhole monitoring. These systems are recommended for applications with moderate to elevated temperatures and pressures, including artificial-lift production, reservoir pressure monitoring, free-flowing wells, multizone applications, and offshore platforms.

Quartz Technology

The capability to permanently acquire real-time pressure and temperature data is critical to long-term well and asset performance. This is especially true in subsea wells and extreme HPHT downhole environments. In these applications, where production optimization and reservoir management decisions depend on reliable, high-performance data, hybrid electronic quartz technology offers a rigorous solution for implementing life-of-well pressure and temperature monitoring systems. Yet, to date, the track record for quartz gauges in subsea and HPHT environments has been less than optimal.

To move the industry forward, Weatherford introduces its new xQuartzPT™ gauge that uses the latest hybrid and downhole communications technology, along with the most comprehensive qualification testing in the industry, to significantly increase continuous operating temperature and achieve low drift and long-term stability in extreme wellbore installation environments. The unique gauge design has fewer electronic components, lower power, and a robust data interface protocol that enhances reliability and service life. As a result, the gauge is able to withstand more severe combined stresses, including pressure, temperature, shock, and vibration. Design mean time to failure (MTTF) is 25 years.

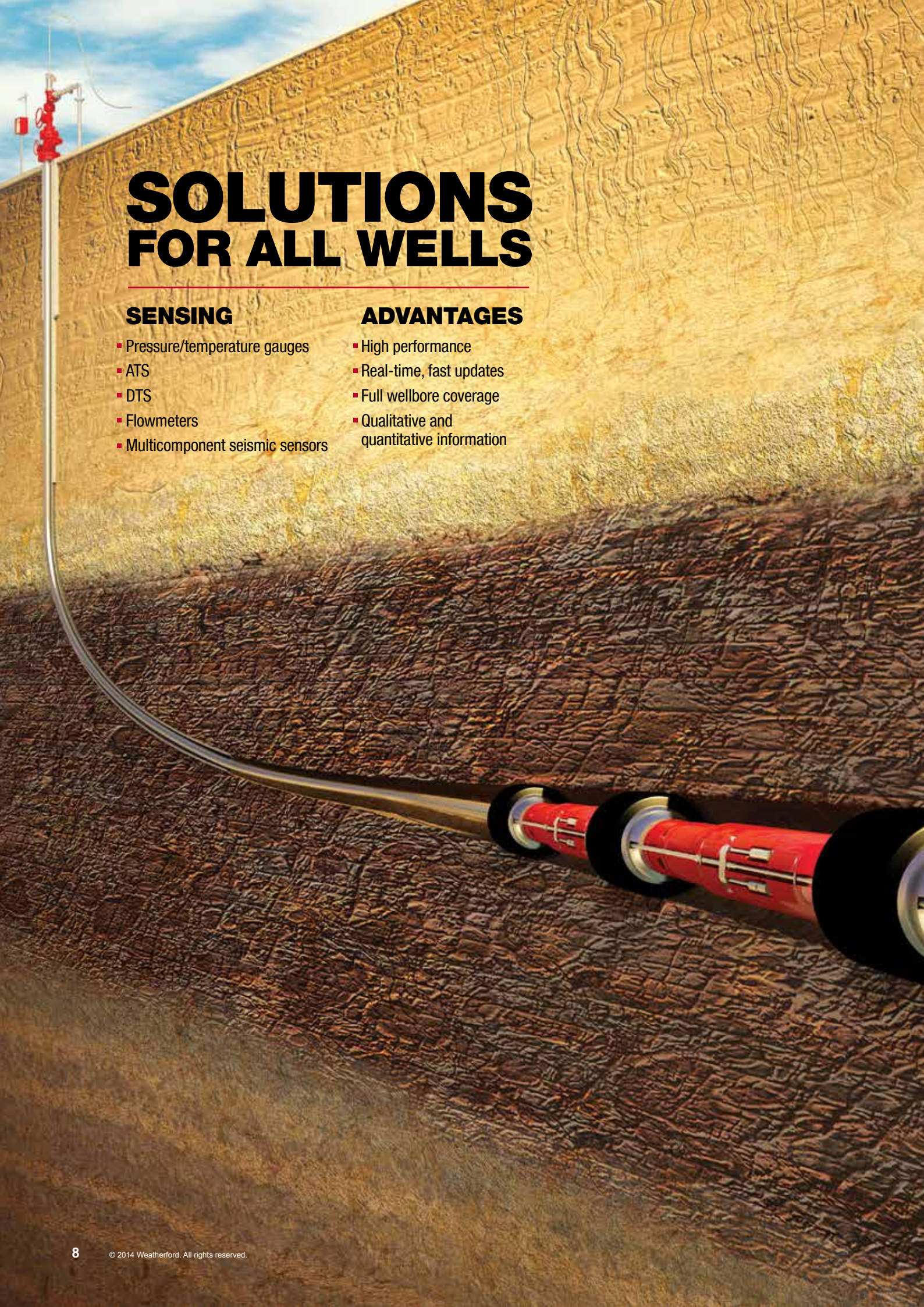
These performance characteristics are an important consideration in HPHT land and offshore wells, and particularly in deepwater plays. The xQuartzPT gauge is the result of Weatherford experience in thousands of wells with both electronic and optical downhole gauges deployed in a wide variety of applications around the world. The new gauge supports permanent monitoring applications up to 392°F (200°C) and 25,000 psi (1,724 bar) while providing a high pressure resolution up to 0.006 psi (0.000414 bar) at one-second intervals for 10,000 psi full scale.

Piezoresistive P/T gauges

Our electronic mPOD™ pressure, temperature, and vibration (P/T/V) gauges add downhole vibration measurements to the standard capabilities of a P/T gauge. This extra data point gives you another tool for diagnosing downhole problems in applications such as artificial lift. For example, monitoring well vibrations can help avoid pump damage. When vibrations reach destructive levels, you can choke back the well to a safer operating level using real-time vibration data.

mPOD P/T gauges provide multiple P/T gauge communication on a single, multidrop conductor cable. The design incorporates a silicon-on-insulator (SOI) transducer that converts pressure into a change in resistance. The strain of the applied pressure is measured across an active four-wire resistive bridge, and the temperature is measured from a secondary part of the main bridge. The gauge is rated for temperatures up to 302°F (150°C). Our dual mPOD P/T gauges will permit simultaneous casing and tubular monitoring.

sPOD™ P/T gauges measure pressure and temperature above and below artificial-lift pumps. The accurate measurements provided enable the operator to diagnose the cause of an under-producing well or challenging reservoir. The gauge is rated for temperatures up to 257°F (125°C).



SOLUTIONS FOR ALL WELLS

SENSING

- Pressure/temperature gauges
- ATS
- DTS
- Flowmeters
- Multicomponent seismic sensors

ADVANTAGES

- High performance
- Real-time, fast updates
- Full wellbore coverage
- Qualitative and quantitative information



MORE THAN
10,000
SENSORS
INSTALLED
WORLDWIDE

nGAUGE™ TECHNOLOGY—OPTICAL SENSORS

Optical monitoring systems provide downhole measurement and control unmatched by any other technology. These systems are extremely durable and suited for HPHT wells, multizone wells, and high-rate gas wells. With zero or negligible drift over time, our optical P/T systems are ideal for high-value wells in the most challenging and hostile well environments.

Glass Cane Bragg Grating P/T gauges provide drift-free production data throughout the lifetime of the well, measuring real-time reservoir pressure and managing initial drawdown. The operational temperature and pressure envelope for the next generation optical P/T gauge is 446°F (230°C) and 1379 bar (20 kpsi).

Our high-density Fiber Bragg Grating (FBG) thermal sensors integrated with slimline P/T gauges offer multipoint monitoring for your heavy-oil projects, including the most challenging SAGD wells. These sensors characterize and monitor steam distribution and chamber growth during startup and production. They also identify potential steam breakthroughs.



Comprehensive Qualification and Testing

We ensure the survivability and reliability of our optical P/T gauges through a rigorous qualification plan. The gauges are first subjected to a burn-in test to stabilize the fully assembled gauge over the desired operational space. We then establish a benchmark measurement for comparison after each qualification test. Next, we subject the gauges to a series of tests, including vibration, shock,

drop, thermal cycling, pressure pulsing, and thermal shock. Finally, the gauges are placed in a long-term endurance test as well as highly accelerated life test (HALT), which includes simultaneous exposure to vibration, pressure cycles, and temperature cycles.



FLOW MONITORING

nPHASE™ TECHNOLOGY

Nonintrusive flowmetering solutions are critical for complex well designs such as intelligent, multizone and multilateral completions. Unlike conventional flowmeters, the Rheos™ optical flowmeter has no borehole restrictions or intrusions into the flow path, such as a Venturi throat, probe, or spinner. The all-optical flowmeter has no active transducers, no electronic or chemical sensors, and no nuclear sources. The passive sonar device is bidirectional, is scalable to any pipe size, and features a control-line bypass for use in intelligent-well systems. This flowmeter can be configured for single-, two- or three-phase flow and is effective in both production and injection wells.





THERMAL SENSORS

nTHERMAL™ TECHNOLOGY

Our nThermal sensor applications are the culmination of our experience in heavy oil production. High density LxATS™, glass Optical Cane™ high-performance ATS, and our Raman-based DTS sensors are advanced methods for monitoring the thermal profile of your well. These sensors give you a production or injection profile across the reservoir that helps you to identify flow anomalies such as tubing or casing leaks, thief zones, and flow obstructions.

Our thermal monitoring solutions go beyond distributed-sensing architecture to a more powerful pad-level architecture. We integrate our capabilities into a single central-interrogation and processing unit that delivers a real-time, pad-level representation of the thermal environment. This creates new possibilities in advanced imaging, reservoir modeling, and ultimately process optimization.

Multipoint Bragg Grating thermal sensors —The LxATS optical technology offers reliable sensing in ultrahigh temperature environments. This solution gives you simplified and cost-efficient instrumentation for in-situ thermal wells. Through a single integrated platform, LxATS sensors gather real-time, synchronized, and correlated pressure and multipoint temperature measurements. This solution uses one data acquisition unit housed within your remote control room or at the wellsite. This unit is connected to a single monitoring system, which is then connected to your distributed control center (DCS). This architecture minimizes downhole space and surface instrumentation requirements; it also reduces overall operational instrumentation costs.

Our high-precision, ultrastable CaneATS™ array can be used to measure fluid changes in low-contrast temperature environments and advanced applications such as sandface monitoring.

DTS thermal sensors —Our DTSPPlus™ sensors provide superior resolution with flexible downhole configurations. DTS systems are available for continuous thermal profiling.





SEISMIC SENSING

nWAVES™ TECHNOLOGY

The multicomponent Clarion™ seismic sensor system enables production optimization and enhanced reservoir management by providing high-resolution, on-demand reservoir imaging and passive monitoring. This permanent, life-of-well system was designed specifically for hostile wellbore environments and can be installed on producer, injector, or dedicated monitor wells. The sensors decrease uncertainty by providing consistent, unchanging reference points in the subsurface, that eliminate repeatability errors. Active, on-demand, timelapse, borehole seismic imaging can be obtained in many cases, while the well is producing or injecting. Permanent microseismic monitoring can track injection or production-induced stress, identify changes in the reservoir, locate bypassed reserves, and monitor cap-rock integrity in gas storage applications.



Instrumentation, Data Interface and Communications

OmniWell Data Acquisition Platform

The OmniWell data acquisition platform integrates your well's temperature, pressure, flow and seismic data for your well. This system is ideally suited for real-time surveillance of high-value assets, which gives you the right data at the right time and empowers you to make the right decision.

The breadth of electronic and optical sensing capabilities gives you a comprehensive, reliable reservoir and production monitoring system. Our basic reservoir monitoring system can operate as a stand-alone data-acquisition, management, display, and communication system. It also can seamlessly interface with legacy SCADA, secure intranets, Internet, or communication systems. With considerable local storage available, our platform can hold an extensive amount of high-frequency data. The system features a single shared network for Modbus, TCP/IP and OPC.

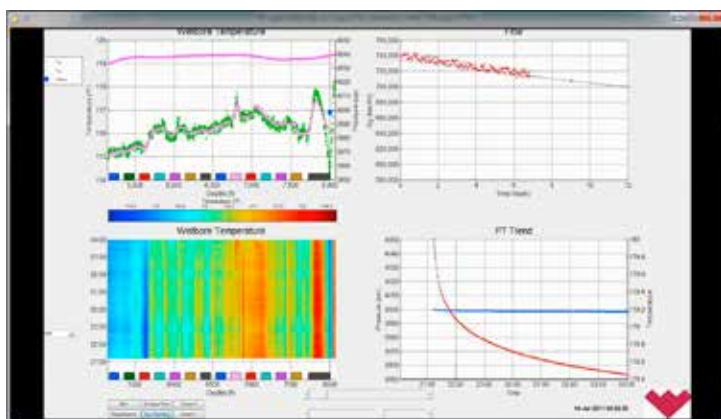


Advanced Visualization Platform

The WellVista® software and data platform provide a powerful visualization and analysis platform for the OmniWell solution. Based on an integrated multi-applications, multimeasure solution, it enables intelligent correlation of downhole temperature and pressure readings and advanced characterization of well environments. The platform has real-time, per-second data acquisition on every sensor. This enables active data gathering, analysis and visualization, as well as advanced functions, including validation of fracture stimulation and reservoir models, multistage and multizone quantitative inflow distribution models, and steam chamber growth characterization.

nLINK™ One-Cable Solution

The one-cable solution is a unified and simplified optical cable system. It can operate at temperatures and pressures ranging from low to extreme, delivering information on pressure, thermal profiles, flow, acoustics, and seismicity—all on a single cable.



Where We Are



Installations

Abu Dhabi	China	Kuwait	Qatar
Algeria	Colombia	Malaysia	Russia
Angola	Congo	Mexico	Saudi Arabia
Argentina	France	Mozambique	Thailand
Australia	Germany	Myanmar	Trinidad &
Bangladesh	Gulf of Mexico	Netherlands	Tobago
Bolivia	India	New Zealand	Uganda
Brazil	Indonesia	Nigeria	UK
Brunei	Iraq	Norway	USA
Chad	Italy	Oman	Venezuela
Canada	Kazakhstan	Peru	Vietnam

Manufacturing/R&D

Montreal
Quebec
Wallingford, CT
Baltimore, MD
Kingwood, TX
Houston, TX

From the unconventional to the conventional, the harsh to the benign, the difficult to the straightforward, Weatherford offers the broadest range of proven electronic and optical sensors in the industry for reliable, real-time data acquisition. To learn more about our production and reservoir monitoring solutions, contact us at omniwell@weatherford.com or visit weatherford.com.



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