



PRODUCTION

# OmniWell™

## SUBSEA PERMANENT RESERVOIR MONITORING SYSTEM

Acquire real-time data for more informed reservoir decisions and enhanced production



**Weatherford®**

# Get real-time data on demand for the life of your subsea wells.

Monitoring subsea wellbores and reservoirs is a complex job. As more production moves offshore and into deeper waters, your data needs in these difficult conditions are growing. You need a permanent solution—one designed for subsea environments and multiple-well fields, refined over more than a decade of testing, and proven to perform without the need for intervention. Through our OmniWell™ system, Weatherford offers a range of in-well optical and quartz sensors with diverse, real-time measurement capabilities.

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Consistent and accurate downhole data enables you to make better reservoir decisions and to increase recovery, profitability, and the life of your well. Subsea conditions that cause vibrations and extreme pressures and temperatures significantly raise your risk of equipment failure—which causes complex repairs and delays while preventing you from getting the critical information you need. In subsea wells, mistakes can be especially costly, and there is no margin for error.

The OmniWell subsea permanent reservoir monitoring system eliminates the need for intervention and reduces your risks while helping you optimize production. Our devices are vetted through a comprehensive series of environmental stress tests to ensure they meet strict criteria for thermal and mechanical shock, pressure and temperature cycling, vibration, drop, and drift. As a result, these tools perform reliably for periods of time that exceed industry standards.





## The Subsea Permanent Reservoir Monitoring Advantage

### Reduced Operating Costs and Risks

- Eliminate interventions
- 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 to determine the cause of unplanned shutdowns
- Accelerate production and realize revenues sooner

### Improved Reservoir Management

- Expand your understanding of your reservoir
- Acquire real-time data based on actual performance, rather than relying on predicted performance
- Quantify contributions from independent reservoir zones and commingled wells
- Monitor independent reservoirs in multilateral wells
- Monitor reservoir drainage and bypassed hydrocarbons
- Predict future production and recovery for various development strategies

Our subsea sensors undergo more rigorous and extensive testing than any other comparable technology in the industry—so you can be assured of their reliability.

# Sophistication meets simplicity in our monitoring technology.

By offering both optical and quartz sensors, we can accommodate the full spectrum of your needs. Our OmniWell sensors gather pressure and temperature (P/T), single-phase and multiphase flow, and distributed and array temperature measurements—all delivered via a single cable. You can select the types and combinations of sensors run in each well for a completely custom monitoring solution. Our sensors can be deployed in any type of subsea tree configuration. These technology advances are leading to greater operator understanding about subsea reservoir behavior and optimization.

## OmniWell Subsea Production and Reservoir Monitoring



### nGAUGE™

Fiber Bragg Grating

- CanePT™ Quartz Gauge
- xQuartzPT



### nTHERMAL™

Multipoint Bragg Grating Thermal

- CaneATS Distributed Temperature Sensing
- DTSPi™



### nPHASE™

Optical Flow Monitoring

- Rheos 1P
- Rheos 2P
- Rheos 3P

## Proven Subsea Performance

No longer a new, unproven technology, optical sensors have evolved into the premier life-of-well monitoring solution for hostile subsea wellbores. Our quartz sensors represent the next generation of hybrid electronic technology. With fewer electronic components placed downhole, our quartz system mitigates opportunities for failure and helps to extend the life of the equipment.

Because we keep our quartz instrumentation within the subsea tree and our optical instrumentation either at the surface or within the tree, these critical components are not exposed to extreme subsea conditions and are accessible for maintenance. We place the more durable sensors, which can withstand severe vibration, shock, and high temperatures and pressures, into the well. Additionally, our optical sensors are resistant to interference from radio or electrical transmissions, and their performance is unhindered by limited power or bandwidth constraints.

## Efficient and Streamlined Conveyance

Our cables go beyond simply providing a reliable pathway between the in-well sensors and data acquisition units. Multiple sensors can gather data simultaneously when they are delivered downhole via our electrical cable or nLINK™ optical cable. By using a single 1/4-in. cable to carry these sensors, you can minimize the collective downhole footprint and avoid flow obstruction. Both cables can easily pass through packers, safety valves, and other in-well equipment, which results in less complex and lower-cost installations. Designed for maximum durability and longevity, our electrical cable incorporates design elements that provide additional mechanical and chemical protection. The nLINK optical cable protects against aging mechanisms, such as hydrogen darkening.

## Real-Time Data Acquisition

Our sensors receive data updates each second for the life of your well. This enables instant information gathering, data visualization, and analysis. You can also quickly perform advanced functions, such as validating reservoir models and multistage and multizone quantitative inflow distribution models. Multiparameter P/T, flow, and seismic measurements can be linked in real time and viewed simultaneously by your personnel for a more timely and enhanced flow of communication.

## Surface

Our topside nFORM™ data acquisition unit contains interface cards to support the deployed sensors. It can operate as a standalone, data acquisition, management, display, and communication system. This unit can also interface seamlessly with legacy SCADA, secure intranets, Internet, or other communications systems.

## Subsurface

Our optical subsea data acquisition unit, the Bragg Grating Interrogator (BGI), is deployed in a third-party canister and integrated into the subsea wellhead. The unit supports IWIS, RS422, RS485, and ethernet communication interfaces.

The quartz interface card in our reservoir monitoring system subsea (RMSs) can communicate with multiple quartz gauges in each well. The card is available with interface connectors to suit the specific subsea electronics module (SEM) or subsea tree vendor. The card is fully compliant with IWIS and supports connectivity with dual SEMs when required. Operators can access this card directly from a surface computer for configuration and diagnostics.

We work with our industry partners to provide in-well wet-mate connector solutions—a key enabling component for optical subsea monitoring systems.

**We offer single-pin optical connections for both vertical and horizontal trees, and three-pin connections for horizontal trees.**

## Sensor Configurations

### 1. Optical Instrumentation Topside (Fiber in Umbilical)

We install optical fiber in the umbilicals and cabling to connect the in-well sensors to the subsea wellhead and topside equipment. This option is available for our full suite of OmniWell optical sensors.

### 2. Optical Instrumentation Within Subsea Infrastructure

We deploy the BGI in a canister and integrate it into the subsea control module on the tree. This option is available only for P/T gauges and array temperature sensors.

### 3. Quartz Instrumentation Within Subsea Infrastructure

We install the downhole electronics interface card within the subsea control module on the tree.



# Deploy the most effective monitoring solution for your specific needs.

Operate with more flexibility by selecting and combining in-well tools that cover virtually all life-of-asset measurements in real time.

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## Subsea Applications

### High Temperatures and Pressures

With only the most durable components installed downhole and critical instrumentation kept at the surface or on the seabed, OmniWell tools can operate in the most demanding environments with exceptional accuracy and resolution. Optical sensors can monitor in-well pressures and temperatures in conditions up to 572°F (300°C) and 30,000 psi (268 MPa), and quartz sensors are rated for conditions up to 392°F (200°C) and 25,000 psi (172 MPa).

### Pressure/Temperature Applications

P/T gauges define production efficiency. When used with flow-control valves or inflow control devices, these gauges help to enable uniform production and to eliminate wireline intervention resulting in production downtime.

### Well Startup Monitoring

P/T sensors measure real-time reservoir pressure and manage initial drawdown. Our supporting software, including the PanSystem and PanMesh programs, creates interference tests and conducts pressure transient analysis to provide reservoir boundary information.

### Downhole Flow Measurement

Real-time flow measurement is critical for optimizing production in complex subsea wells, including multizone and multilateral completions. This data can reduce or eliminate the need for surface well testing and the associated operational, safety, and environmental risks. Configured to measure single-phase and multiphase flow rate, our optical in-well flowmeters are bidirectional, scalable to any pipe size, and do not restrict the flow path. Our optical flowmeters can be used with our Red Eye® subsea water-cut meter for sensitive water-onset detection and tracking water production throughout the life of the well.

# Maximum Reliability

**Optical sensors** operate in conditions up to **572°F (300°C)** and **30,000 psi (206 MPa)**

**Quartz gauges** operate in conditions up to **392°F (200°C)** and **25,000 psi (172 MPa)**

## Artificial Lift

Quartz gauges monitor P/T data to help analyze and automate all forms of artificial lift. With permanent monitoring, you can help to reduce production downtime or losses while extending the operational life of artificial-lift equipment.

## Zonal Isolation Monitoring and Pressure Transient Analysis

Our quartz gauges help you monitor your ever-changing well dynamics. With their high resolution, these sensors can detect even the slightest variations in pressure and temperature.

## Distributed Temperature Sensing

Distributed temperature sensing (DTS) creates a thermal profile of the entire well by logging a time-lapse record of temperature changes—typically per meter—across a production zone. This data can be used to monitor the performance of water, steam, and gas injections; to optimize gas-lift operations; and to identify flow anomalies, including tubing or casing leaks, flow obstructions, and thief zones.

## Array/Multipoint Temperature Sensing

We space multiple optical array/multipoint temperature sensing (ATS) devices throughout an area of interest in the wellbore to provide reliable, accurate, and stable temperature data that is used to measure subtle production-induced thermal changes. ATS devices, which achieve real-time measurements up to 100 times the resolution and 25 times the accuracy of DTS, can also provide reference points for DTS measurements.

## Production and Injection Profiling

Optical DTS and ATS systems help to establish production and injection profiles across the reservoir sections of horizontal, multilateral, and multizone wells.

## Water, Steam, and Gas Breakthrough

Optical DTS and ATS systems detect wellbore intrusions.

## Sand Control

Placed inside or outside sand screens, optical systems are adept at gathering data across perforated intervals and openhole sections.

## Multizone Completions

In multilateral completions and wells with commingled production from stacked reservoirs, optical flowmeter data can help resolve issues with production allocation. This data can also help to determine the productivity index for individual zones or the entire well.



The OmniWell subsea permanent reservoir monitoring system gathers real-time data that helps to optimize subsea oil and gas production even in the toughest conditions and within complex, multiple-well fields. This technology eliminates intervention and reduces your costs and operational risks. However, the OmniWell system is just one part of our comprehensive portfolio of solutions for maximizing recovery in onshore, offshore, and subsea wells. For more information, email [omniwell@weatherford.com](mailto:omniwell@weatherford.com).

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