

The Roxar Downhole product portfolio
Permanent downhole monitoring system



Make the Right Downhole Choice

From its origins in 1986 right through to the innovative new downhole solutions it is bringing to market today, Roxar Flow Measurement, the business unit of Emerson Process Management, is providing operators with unrivalled downhole insight and control over their production operations.

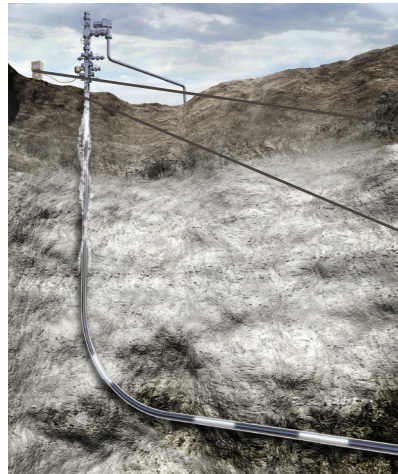
Roxar's downhole solutions are characterised by:

- An unsurpassed track record of more than 25 years of downhole monitoring solutions (by far the longest in the industry!) generating reliable and real-time downhole information from some of the world's most complex wells and remote fields;
- The best availability and reliability in the industry, negating the need for intervention and the high accompanying costs;
- High temperature performance at up to 200°C and beyond;
- A single-cable, intelligent downhole network that acts as a central hub for all downhole instrumentation; and
- A field wide production management system that squeezes maximum value from the data.

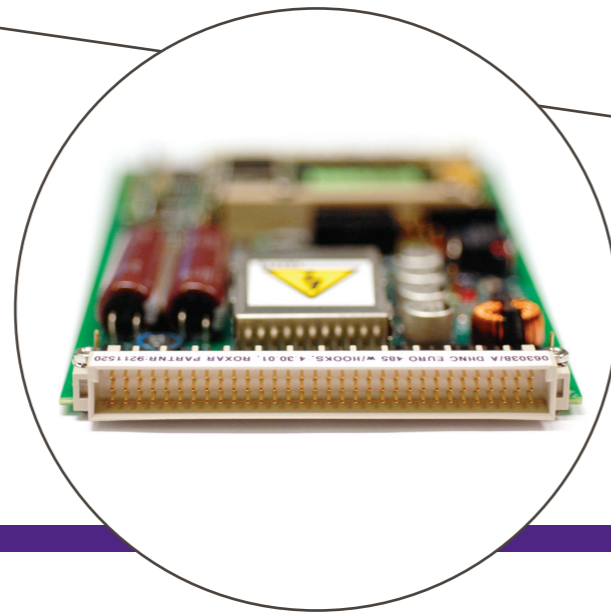
From pressure and temperature information through to downhole flow rates, well casing integrity and offshore safety, all operators want to know what is going on at the bottom of their wells.

At a time of growing complexity and remoteness in fields and well architectures as well as high pressure and temperature environments, Roxar is delivering operators with the insight and control over their reservoir operations that can make the crucial difference between economically unviable reservoirs and the seamless and profitable flow of oil & gas from reservoir to refinery.

Qualified and tested electronics to last more than **30** years at **200 C / 392 F**



The Intelligent Downhole Network



The Intelligent Downhole Network (IDN) is at the core of our downhole monitoring portfolio and the platform on which our downhole solutions successfully operate.

The fully integrated Roxar IDN allows operators to install up to 32 sensors on a single cable, all providing valuable information input in managing a range of wells or separate zones simultaneously. In this way, the intelligent network can act as a hub for downhole choke position indicators, for additional third party sensors, and for the transmission of power and data.

The Roxar Downhole Network Controller (DHNC) card has also been designed to support the IDN by performing the role of a power and communications hub and acting as an interface between the operator and its downhole network and other third party field infrastructure.

Containing an embedded PC and using a single Tubing Encapsulated Cable (TEC) between the DHNC card and downhole instrumentation, the card's main function is to provide an electrical and communications interface between the downhole instrumentation. This might include permanent pressure and temperature gauges, and topside or subsea based field infrastructure.

In this way, all elements of the reservoir's monitoring infrastructure are linked together, providing the operator with complete flexibility and the choice of selecting from a range of different sensors.

32 Sensors
1 Single Cable

At the heart of the Roxar IDN is the Downhole Network Controller (DHNC). The DHNC is the communications hub of the Roxar IDN passing the sensor data onward to the control system. Roxar has an extensive track record of successful integration with all the major EPC's.

Operating in the Harshest of Environments - The Downhole Interface Units and Surface Acquisition Units



For all the benefits of the Roxar Intelligent Downhole Network (IDN), however, challenges remain in regard to being operational in high depths and in some of the world's harshest environments. Step forward the Roxar Downhole Interface Unit (DIU) and the Roxar Surface Acquisition Unit (SAU).

The Roxar DIU enables the Roxar IDN to be positioned and deployed subsea at depths of up to 3,048 meters (10,000 feet). The DIU, which incorporates a standard connector interface to support wet-mate connections, is fully ROV retrievable and utilises a tried and tested funnel design to enable secure subsea installation. In addition, the Roxar DHNC card is fully Intelligent Well Interface Standard (IWIS) compatible, ensuring effective and reliable communications.

The electronic rack within the DIU also allows two DHNC cards to be positioned within one single unit, ensuring improved redundancy and seamless communications and power from the lower depths of the reservoir.

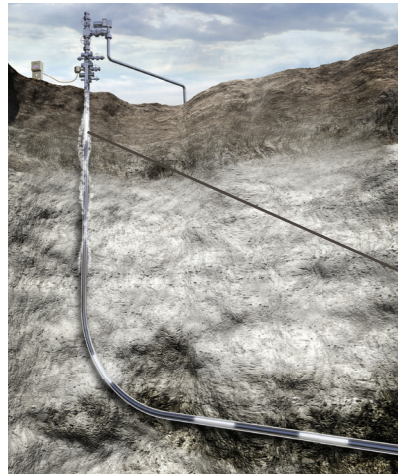
As well as the DIU, Roxar also provides a range of SAUs which allow the intelligent network to be deployed in some of the world's harshest environments.

Single or Multi-Well solutions and explosion proof, weather-proof or safe area enclosures allow the network to be installed safely in any environment, with the Roxar DHNC card also part of the internal SAU. Gauge data can also be remotely stored for later retrieval or sent directly to the Control System.

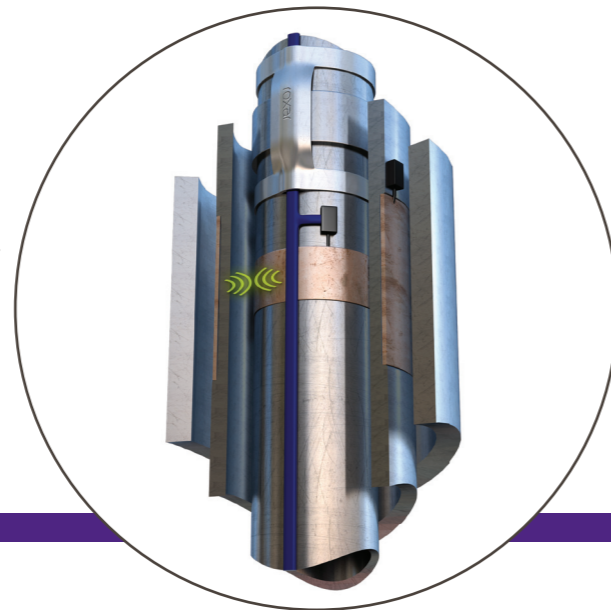
Roxar prides itself on maximum availability and reliability in its downhole operations, irrespective of the environment. The Roxar DIU and SAU are a key means of achieving this.

Any location or any environment

Roxar has the products required to make state of the art downhole measurement possible.



A New Wireless Tool to Measure Well Casing Pressure and Improve Offshore Safety



The growth in innovative wireless technologies is also playing a key role in Roxar's ability to support operators through well integrity monitoring and improved offshore safety. One of the most inaccessible areas in subsea well production systems today is the B annulus of an oil well. A build-up in pressure behind the well casing and the annulus, however, can have significant repercussions for well integrity and offshore safety.

Such pressure build-ups can cause the cement sealing to deteriorate leading to a loss of casing integrity and can result in the vertical migration of oil & gas towards the surface. This creates a potentially hazardous situation especially during workover operations, where uncontrolled gas may escape at the surface, with the worst case scenario being a shallow gas blow out.

Roxar has developed a new wireless instrument that, attached to the same cable as the reservoir monitoring gauges, generates real-time pressure and temperature information from the B annulus within the well casing - an area previously considered off-limits. The instrument is easy and quick to install with no additional cards or modifications required and no disruptions to existing monitoring activities.

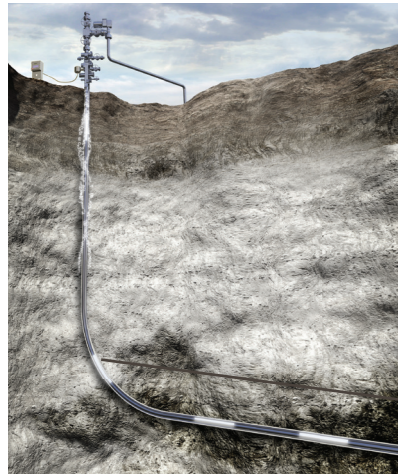
The wireless sensor reader directly measures pressure behind the casing string. The system consists of an Intelligent Downhole Network (IDN) to carry signals from the wellbore to the customer monitoring system with a Downhole Network Controller Card (DHNC) placed in the subsea structure and connected to a Tubing Encapsulated Cable (TEC).

Other key components include a wireless reader, a wireless PT Transponder and antennas to monitor activity in the B annulus, and a transponder carrier. The system is qualified to last for a minimum of 20 years.

The result is a highly effective, easy to install and innovative instrument for improved well integrity, flow assurance and offshore safety, providing early warnings of pressure changes behind the well casing and enabling fast remedial action to be taken. For oil and gas operators planning subsea production or injection wells and looking for improved well integrity and safety, and for government regulatory agencies overseeing safety and environmental protection, the Roxar Downhole Wireless PT Sensor System is an industry first.

"Conventional land wells and offshore wells with a dry wellhead have valves that provide operators with easy access to the B annulus to check the pressure and make any adjustments. This is not an option on subsea wells; so instruments that monitor and detect variations in pressure behind the casing string are **invaluable**," Hart's E&P Production Milestones 2011





Taking Multiphase Metering Downhole



For all the developments in downhole monitoring over the last few years, there has been one missing element – that of multiphase meters and the ability to measure multiphase flow downhole.

This information has become even more difficult to obtain, due to the rise in multilateral wells, with the ability to generate flow rates from different zones and branches off a single wellbore remaining elusive to many operators. More often than not, they have to settle with data on total production flow rather than flow from specific well zones.

Full bore, real downhole Multiphase meter

The Roxar downhole Flow sensor system can, for the first time, generate multiphase measurements, including fluid fractions and flow rates, from either single bore or multilateral well configurations. In this way, the system allows operators to control multiple production wells, measure the individual zone contributions of oil, gas and water, and establish optimum flow rate control.

Key features of the new flow sensor system are accurate and reliable flow rate measurements using technology from Roxar's third generation multiphase meter. The compactness of the tool at 3.5" and 1/4" also enables the system to be fitted in short zones between packers as well as in 7" liner/casing. The Roxar downhole Flow sensor system fully integrates with the Roxar Intelligent Downhole Network and Roxar's production management software, Fieldwatch.

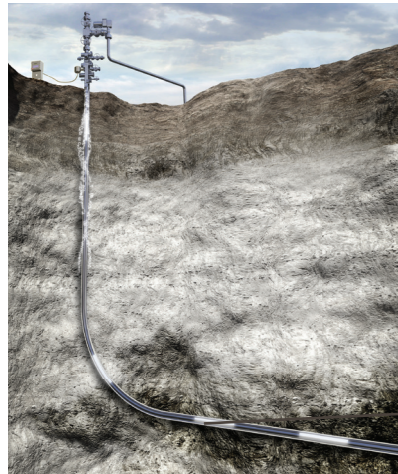
In addition, the sensor system is made out of state-of-the-art electronic components, has been rigorously selected and tested, and is qualified to operate continuously at high pressures and temperatures for a minimum of 20 years.

Finally, the system can be fitted to existing control systems without the need for modification, ensuring unsurpassed flexibility within completions and downhole monitoring almost immediately.

The result is a step-change in downhole reservoir monitoring and flow assurance and the opening of a new window into downhole production operations.

Real downhole multiphase measurement finally made possible!





Temperature & Pressure Gauges – Accurate & Reliable Real-Time Data from Any Reservoir Location



Reliability, Accuracy and Innovation in one solutions portfolio.

Roxar's leading position in downhole monitoring began in 1987 when the Roxar Permanent Downhole Monitoring System (PDMS) was installed on Statoil's Gullfaks A field in the North Sea. Many of these early systems are still in operation in the North Sea to this day!

The series of high pressure and temperature gauges, that form a crucial element of PDMS, provide reliable real-time data from any reservoir location, helping operators make better decisions for the lifetime of the well.

The Roxar downhole HS gauge is designed for the most extreme well conditions with their quartz crystal measurements generating highly accurate low drift readings of downhole temperature and pressure measurements. Its Silicon-On-Insulator (SOI) technology can take gauges as high as **225°C**.

Furthermore, in addition to these industry leading gauges, Roxar also provides a wide variety of completion accessories including:

Robust cable protectors - designed to secure downhole electrical cables and hydraulic control lines when installed in a well.

Roxar Wellhead outlet - serves as a pressure barrier between the well and top side.

Carriers - One piece carrier for up to three gauges.

1990 and Still Counting!

The North Sea's inhospitable climate and depths requires innovative and cost-effective offshore technology. That's why operators look to complete reliability and longevity in their downhole installations.

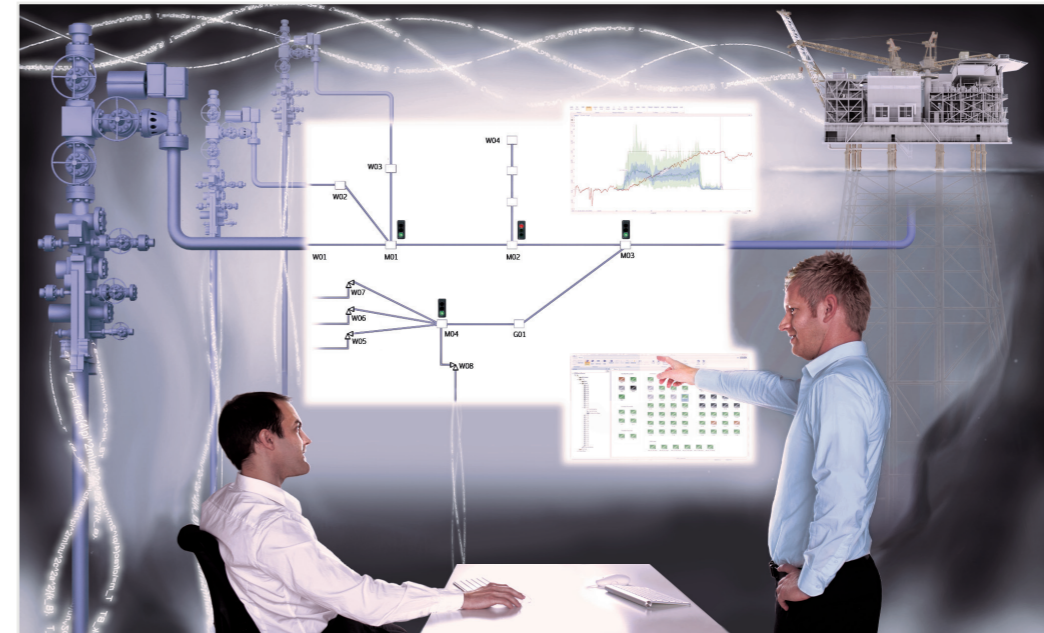
Statoil's Gullfaks C production platform in the North Sea has been using the same Roxar downhole gauge, uninterrupted and without maintenance since 1990. Through the continuous real-time transmitting of accurate pressure, temperature and flow rate data to local or remote well control facilities, Statoil can ensure that its field operates at optimum performance.

Providing a Sustainable Gas Supply to Tunisia

The Roxar downhole HS gauges are providing reliable downhole pressure and temperature information to BG Tunisia in its offshore Miskar field, operating at temperatures of up to **185°C**.

The gauges are continuously transmitting digitised pressure and temperature data to the surface, helping BG Tunisia determine the best production rates for the reservoir and ensuring a sustainable gas supply to Tunisia's state-owned electricity and gas company.

Roxar Fieldwatch - Turning Raw Data into Decision-Making Information



Having the most accurate, reliable and innovative solutions for downhole monitoring on the market today is not enough for Roxar, however. We also need to be able to turn the raw data into valuable decision-making that increases the lifetime of the reservoir.

That's where our leading production management software, Roxar Fieldwatch comes into its own, acting as a standard operator interface for all our downhole instrumentation.

Roxar Fieldwatch collects, monitors, visualises and analyses data from a range of sensors and instruments to enable operators to have a complete picture of the reservoir and production system. It also provides data input to reservoir and production engineers when making reservoir management decisions related to metering, production allocation or choke settings.

Fieldwatch also includes a series of custom-built modules in the areas of flow assurance, sand and erosion, corrosion, and virtual flow metering.

And the end result? Intelligent management of the reservoir and its processes, the transformation of data into intelligent and easy to use information, and increased production.

- A downhole track record that others can only envy.
- Availability and reliability in the world's most challenging reservoir settings.
- High temperature, high pressure performance.
- An integrated downhole network and field-wide production management system for maximum flexibility and high value data.

Roxar continues to lead the industry in downhole monitoring. Make sure you make the right downhole choice today.

