

FloWatcher

Flow rate, fluid density, and PT monitoring system

APPLICATIONS

- Production and injection allocation
- Well productivity and trend analysis (productivity index and bubble point)
- Continuous well testing
- Multizone production monitoring
- Flow anomaly diagnosis (e.g., slugs, scale, wax)
- Early identification of water and gas breakthrough
- Well cleanup monitoring in real time
- GOR and water cut determination in two-phase flow
- Time-lapse nodal analysis

BENEFITS

- Reduces capex by eliminating subsea test flowline
- Reduces time, costs, and risks by eliminating production well testing
- Enables early remediation to optimize recovery by continuously monitoring reservoir and production
- Minimizes costly interventions with real-time surveillance

FEATURES

- Continuous downhole flow rate, fluid density, pressure, and temperature measurements
- Absolute flow rate and density data for two-phase flows
- Retrievable venturi nozzle
- Highly accurate and stable quartz sensors
- 1-s data sampling rate

Early detection of production anomalies

The FloWatcher* flow rate, fluid density, and PT monitoring system acquires reliable data in onshore, offshore, and subsea wells. The continuous stream of real-time downhole measurements enhances production planning and reporting accuracy. For example, the data can be used for pressure transient analysis to estimate the permeability, skin, and drainage area over the life of the well. The data can also identify production and reservoir anomalies, such as water and gas breakthrough, helping reduce the cost of remediation, optimize production, and improve total recoverable reserves.

Using these downhole flowmeters in multiple deepwater wells with a common pipeline allows operators to avoid the time, expense, and risk of production well testing in individual wells and to validate and adjust field-scale reservoir models via history matching. Additional benefits include the reduction of capital expenditures through the elimination of subsea test flow lines and real-time, simultaneous production allocation for multiple wells.

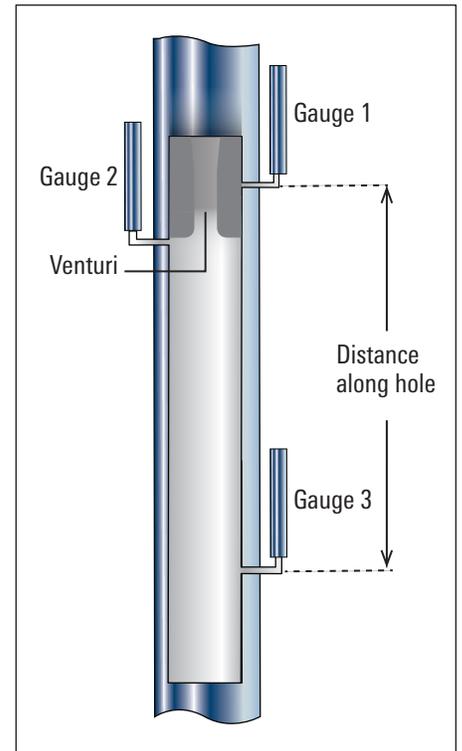
Durable design and construction

Designed and qualified for permanent installation, the FloWatcher system eliminates the need for subsea and surface flowmeters. It is manufactured to ISO and API standards with materials that ensure high resistance to erosion and corrosion.

All engineering, manufacturing, calibration, and qualification of WellWatcher* permanent monitoring systems is performed at an in-house facility in France, where Schlumberger has been developing downhole electronics since 1959.

Long-term monitoring in two-phase flow

The FloWatcher system identifies the total flow rate and water or gas cut for two-phase flow in gas and oil wells, its data closely correlating with measurements taken at the surface. Two high-precision quartz gauges measure the pressure drop across a venturi nozzle; this drop is directly proportional to the square of the fluid velocity.



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The pressure difference between one of these gauges and a third quartz gauge placed farther down the well is also measured. The fluid density can be determined from the pressure gradient.

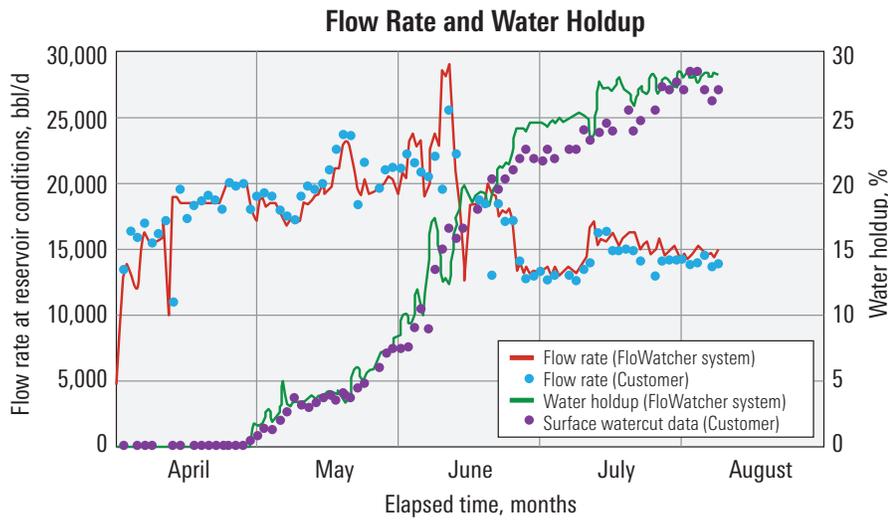
Proven track record

Having installed permanent gauges since 1972, Schlumberger is the recognized industry leader in permanent downhole monitoring. WellWatcher systems, which include the FloWatcher system, are engineered to deliver highly accurate and stable measurements, essential in long-term reservoir and production monitoring applications.

FloWatcher System Specifications

Initial pressure accuracy, kPa [psi]	Better than ± 21 [± 3], worst case, full scale
Pressure resolution, kPa [psi]	0.07 [0.01] at 1-s sampling rate
Pressure drift, kPa/year [psi/year]	± 6.9 [± 1] over full scale
Initial temperature accuracy, degC [degF]	± 0.15 [± 0.27]
Temperature resolution, degC [degF]	0.001 [0.002]
Working pressure, [†] kPa [psi]	172,369 [25,000]
Working temperature, degC [degF]	175 [347]
Flow rate range, bbl/d	1,000 to 50,000
Density range	Water to volatile oils

[†]Mandrel pressure ratings may vary according to the completion specifications.



Downhole flow rate and water holdup data acquired over several months by the FloWatcher system correlated closely with the customer's independent measurements of flow rate and surface water cut taken at the surface.