Product Data Sheet
RXPS-002315, Rev A
October 2019

Roxar™ Subsea Wetgas Meter

A Specialized Meter for Gas and Gas Condensate Fields

Operators looking to develop a subsea wet gas field face a number of challenges, as the development and field operating conditions increase in complexity. In order to accommodate changing operating conditions and varying fluid compositions, they require access to real-time and accurate water, gas, and condensate information because it significantly impacts flow assurance ad hydrocarbon allocation strategies.

The Roxar Subsea Wetgas Meter (SWGM) addresses the following operator challenges (both long-term and immediate) related to subsea wet gas field development:

Immediate – Formation water breakthrough

- Increases risks of hydrate formation and therefore the need for increased Mono-ethylene glycol (MEG) injection
- Jeopardizes hydrocarbon production due to water coning in the reservoir
- Increases water flow and injected chemicals in lieu of hydrocarbon production

Long-term – Formation water production threatening pipeline integrity

- Pipeline scaling
- Pipeline corrosion and erosion

In addition, the lack of real-time accurate hydrocarbon measurements impacts the hydrocarbon metering and fiscal allocation strategies and obligations.

Performance without compromise

Roxar is continuously developing and improving its measurement solutions and now offers the next generation Subsea Wetgas Meter (SWGM). This meter builds on the same measurement principles as the previous generation, but is substantially upgraded with the latest in microwave (μW) technology and with added measurements and functionality.

The meter has improved performance in the entire operating range, but with the greatest enhancement in the ultra-high Gas Volume Fraction (GVF 99-100%). One of many key differentiators for the Roxar SWGM is the ability to accurately measure the absolute level of water in all phases.

Special considerations ensure less dependency on fluid composition data for pressure, volume and temperature (PVT). A separate salinity sensor has been added to the meter allowing for direct measurement of the conductivity of the produced water.

Improved measurement uncertainty

The latest meter includes a fundamental upgrade to the microwave electronics. While the previous system utilized analog Voltage Controlled Oscillator (VCO) circuits in order to create microwaves, the latest generation represents a transition into digital frequency measurements. This allows for improved long-term stability and time resolution resulting in a more accurate and sensitive measurement. The long-term drift of the microwave system is negligible, resulting in a calibration free meter.

In addition to improving the performance of the meter, the new microwave system also enables additional benefits, such as direct water conductivity measurements.

Measurement principle

In the Roxar SWGM, the water fraction measurement is obtained by microwave resonance, measuring the dielectric and real permittivity properties of the fluid with low uncertainty and very high sensitivity. Flow measurements are obtained by redundant differential pressure (DP) measurement over a cone. The cone and meter body form a resonant cavity for microwaves which is sensitive to the flow permittivity. At resonance, the microwaves propagate throughout the cross-section of the pipe. Therefore, the meter is sensitive to changes in the flow, independent of the type of flow. The permittivity of the flow is a function of fluid fractions, temperature and water conductivity.

Figure 1: Cone Signal Field

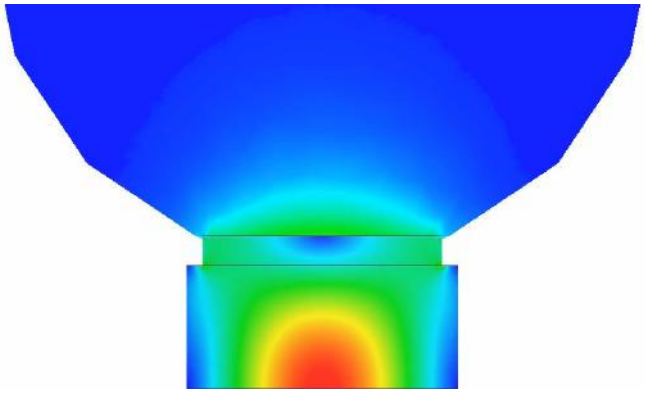
Pressure and temperature are measured by dedicated, redundant transmitters.

The use of a gamma densitometer in the Roxar SWGM is optional. It is used to measure the fluid density and to estimate the condensate content of the wet gas flow. The use of a gamma densitometer is relevant in cases where the hydrocarbon composition may vary, and where the condensate content in the well stream could be relatively high.

Best-in-class salinity measurement system

In order to allow for direct measurement of water conductivity, a dedicated microwave-based sensor is included in the meter. This sensor is a dielectric cavity resonator and is mounted flush in the wall of the meter body with one end facing the flow. It is extremely sensitive to saline water on the sensor surface, and can measure the salinity with a high precision at GVF levels up to 99.99%. It comes as an integrated part of the Roxar SWGM, with no changes to electronics or power consumption, as well as the size of the meter, compared to a standard SWGM.

Figure 2: Roxar Conductivity and Salinity Sensor



Best-in-class water measurements

The sensitivity and accuracy of the Roxar SWGM in detecting and quantifying water in a wet gas well is unparalleled in the industry. For example, comprehensive flow testing at CEESI in the United States shows that the measurement uncertainty of the water volume fraction for ultra-high GVF is in the range of ±0.01 – 0.02%, which represents an improvement in the range of 10 times that of the previous generation meter, which is still considered a very reliable and accurate wet gas flow meter.

The new microwave system allows for an improved uncertainty specification and sensitivity, and the meter is able to detect changes in the water content of the flow down to 0.2 ppm.

Critical time window for hydrate forming

There are field examples where the period from the formation of water breakthrough to hydrate growth, build-up, and pipeline plugging is done in less than 20 minutes.

Rapid, highly sensitive measurements are needed to capture the critical time window of a hydrate plug forming in order to take remedial actions to save the well. The Roxar SWGM has the ability to instantaneously detect and measure extremely small changes in water conductivity down to +/- 0.004 S/m. For comparative reference, typical sea water conductivity at 77 °F (25 °C) is 5.0 S/m.

Operating range and output

The Roxar SWGM is designed to operate from 85% to 100% GVF, and 0% to 100% Water Liquid Ratio (WLR).

The outputs are flow rates of hydrocarbon gas and condensates, formation water flow rate and condensed water flow rate, water salinity and conductivity, formation water indicator, pressure and temperature. The meter outputs data in both actual and standard conditions.

Added value for the operator

Roxar has a specialized SWGM for gas and gas condensate fields with their own specific set of challenges, providing an optimal solution with no technology compromises. Roxar has an unparalleled install base in several major gas fields all over the world and a long track record of successful applications on some of the world's most challenging wet gas fields.

The Roxar SWGM is fully redundant, and has an actual Mean Time To Failure (MTTF) that is greater than 250 years, and with more than 2,000 years of accumulated operational time. By providing sensitive, accurate and reliable measurements of the water in the wet gas stream, the Roxar SWGM enables operators to take preventative or remedial action, optimize production, prevent hydrate formation, scale and corrosion in the pipelines, and ensure reliability of the hydrocarbon supply.

Specifications

Roxar Subsea Wetgas Meter specifications

Item	Characteristics
Operating range	85-100% GVF 0-100% WLR
Meter sizes	3 in to 8 in
Installation	Vertical upwards flow (recommended)
Typical uncertainty (95% confidence interval)	Water fraction measurement: Uncertainty: ■ GVF > 98%: ±0.1 abs. vol.% ■ GVF < 98%: ±0.2 abs. vol.% Sensitivity: < 0.00002 abs. vol.% Total hydrocarbon mass flow: Uncertainty: ±5% relative Gas volumetric flow rate: Uncertainty: ±3% relative Repeatability (for both hydrocarbon mass flow and gas flow): ±0.5%
Design pressure and temperature	Up to 10,000 psi (689 bar) -40 °F (-40 °C) to 302 °F (150 °C)
Meter body wetted parts materials	Duplex UNS 31803 Inconel ® 625 UNS N06625
Flange connection	API, SPO compact or weld neck interface
Length	< 900 mm (35.43 in) flange to flange (all sizes)
Weight	~ 850 kg (4 in meter)
Density system (optional)	Source: Cs-137, 5 mCi, Half-life 30.1 years
Power	24 VDC (20-30 VDC) Power consumption: 23 W (nominal), 41 W (inrush)
Communication protocol	Modbus™ RTU, SIIS Level 2 & 3, IWIS
GUI software	Roxar Fieldwatch™
Redundancy	PT, DP, flow computer and electronics, power and communication interface

RXPS-002315
Rev. A
October 2019

Roxar
Head Office Roxar products:
+47 51 81 8800
info.roxar@emerson.com

CIS: +7 495 504 3405
Europe: +47 51 81 8800
North America: +1 281 879 2300
Middle East: +971 4811 8100
Asia Pacific: +60 3 5624 2888
Australia: 1 300 55 3051
Latin America:
Portuguese: +55 15 3413 8888
Spanish: + 52 55 5809 5473

www.Emerson.com/Roxar

ROXAR™

EMERSON™