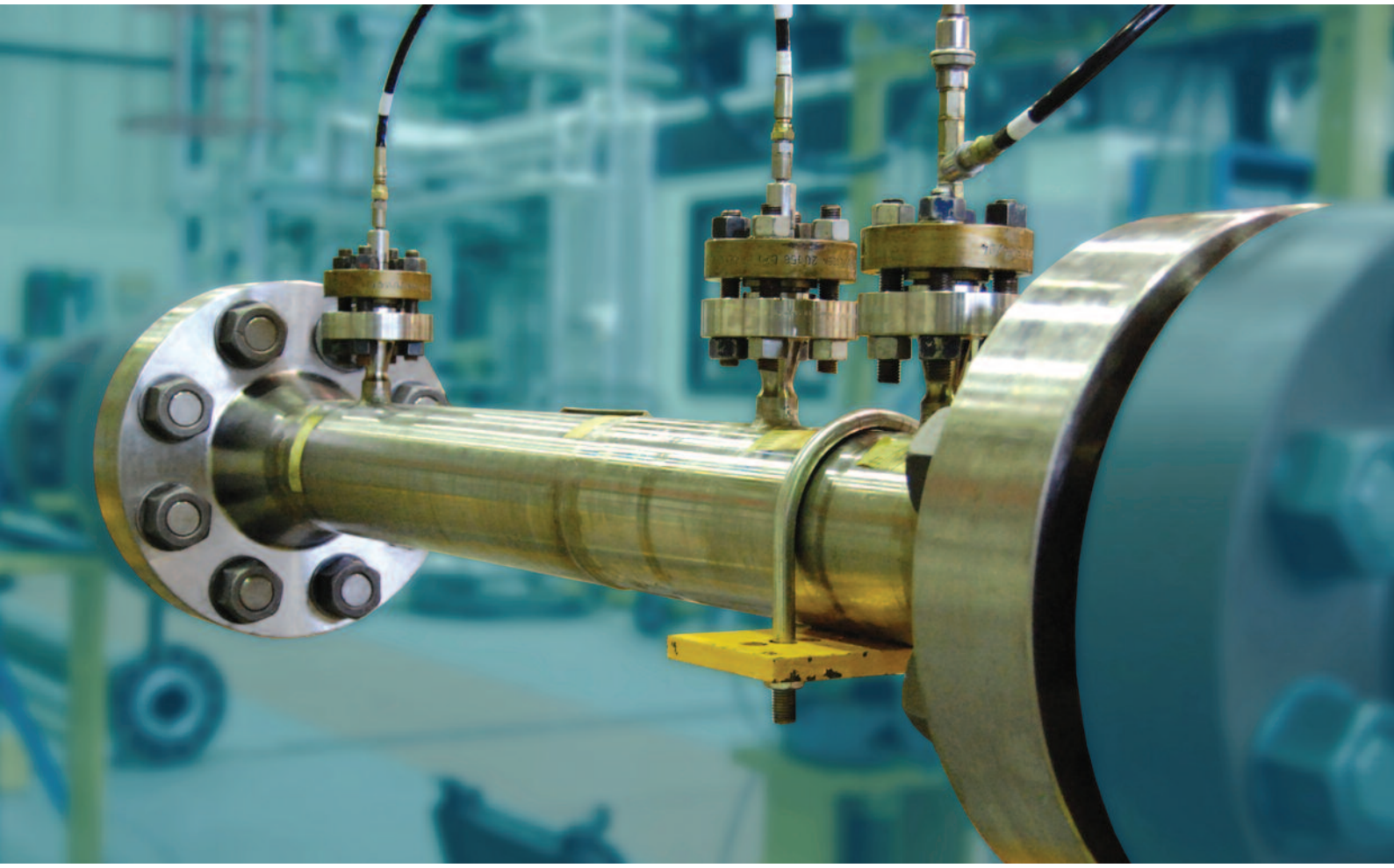
Wet Gas Metering

EXPRO



Metering systems for well surveillance

Wet Gas Metering Systems

During an exploration appraisal, oil companies need to be able to accurately measure gas and associated condensate to determine the presence and quality of produced fluids. Some gas condensate fields contain only small amounts of hydrocarbon liquid, leading to a growing requirement in the industry for the technology and expertise to measure gas flow and provide operators with accurate results.

Metering of this wet gas is difficult and the development costs of gas condensate fields can be high. However, Expro offers a solution to the industry that provides enhanced measurement and significant cost reduction.

Expro's SmartVent wet gas flow meters are utilised on applications both offshore and onshore, and are increasingly recognised as effective replacements for test separators and related infrastructure. Large size, weight and cost savings are realised by installing SmartVent wet gas meters on each of the flow lines.

Our wet gas metering systems are a cost-effective alternative to test separators, giving continuous readings of each well's production rates and providing enhanced reservoir management and production optimisation.

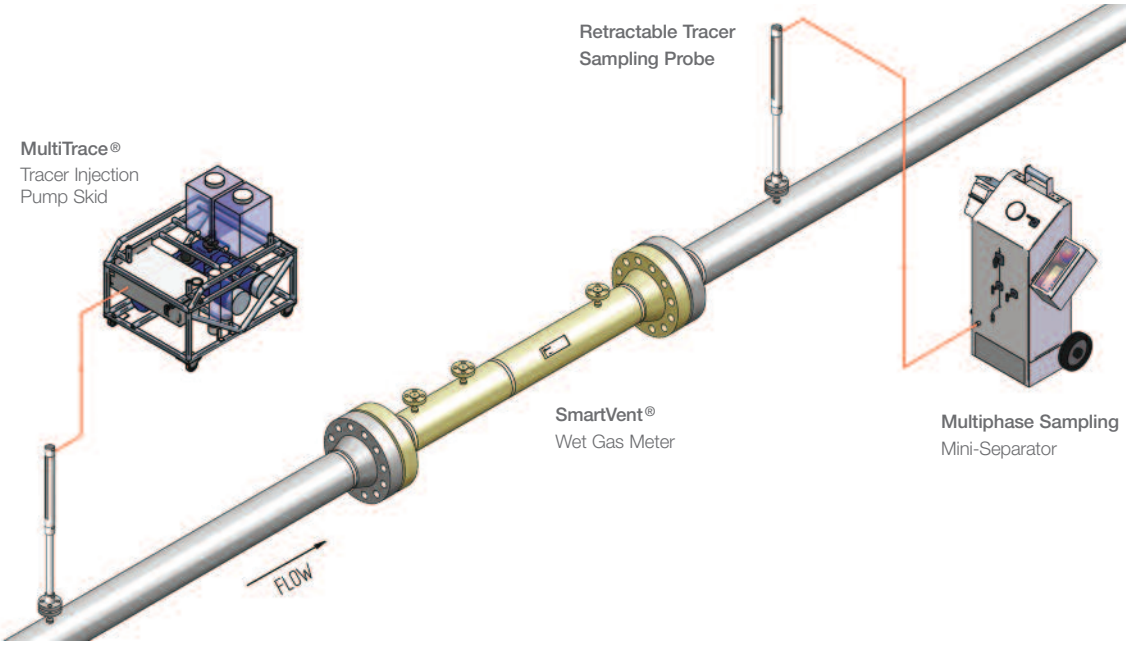
Expro's wet gas flow measurement system consists of SmartVent™ wet gas meter, which can be combined with multiphase PVT sampling by mini-separator and the MultiTrace™ tracer dilution technique, depending on specific requirements.

Expro has been involved in sampling work for more than 25 years, and our experience with MultiTrace and PVT sampling work has been extensive. We have the expertise and personnel to provide technical support worldwide though our global network of offices.

What our technology offers

The SmartVent venturi-based meter gives continuous readings of the total flow rate which are interpreted in terms of actual gas and an indication of the combined liquid flow (condensate / water). Individual water and condensate flow rates can be measured using the tracer technique. PVT flash calculations are used to obtain phase properties at operating and reporting conditions.

The tracer technology is also employed to enable on-site field calibration / verification of all the individual phase flow rates and fluid properties, as well as providing the opportunity to verify the system performance during field operation, if required.



SmartVent WGM combined with Mini-separator sampling for representative PVT samples and optional MultiTrace tracer sampling

Flow calculation & monitoring

Dedicated wet gas flow calculation and monitoring software options are available. The software seamlessly integrates the wet gas meter readings, fluid properties, and field calibration/verification data. Monitoring and trending of this data allow for immediate notification of well production changes.

- Multiple header configuration
- Real time data for each individual well
- Independent meter settings
- Daily totals
- Daily production reports
- All reports database archived
- Live trending

Field calibration & performance verification using tracers

SmartVent wet gas meters have been subjected to extensive wet gas testing programmes over recent years. The range of operating conditions and types of fluids tested are considered unique in the industry (majority high pressure hydrocarbon fluids). In addition, the MultiTrace tracer dilution technique can be used on-site to calibrate or verify the meter performance under actual conditions. Clearly, the overall accuracy and data confidence is greatly improved by this technique. Expro is one of the few companies offering this service.

Verification & Accuracy

Measurements of the MultiTrace technique are verified to the following DNV accuracy standards:

gas tracer – +/- 4%
oil / condensate – +/- 3.5%
water tracer – +/- 4.5%

What our technology offers

Fluid sampling technology

As gas-condensate behaviour is strongly dependent on pressure and temperature variations, an accurate wellstream composition needs to be established. Expro offers specialist wet gas sampling equipment to accurately determine the well composition.

Operating range and meter accuracy

Expro's SmartVent meter is designed to operate over the full wet gas metering flow regime. The operating range is typically from 90% to 100% GVF, depending on the actual line pressure and temperature.

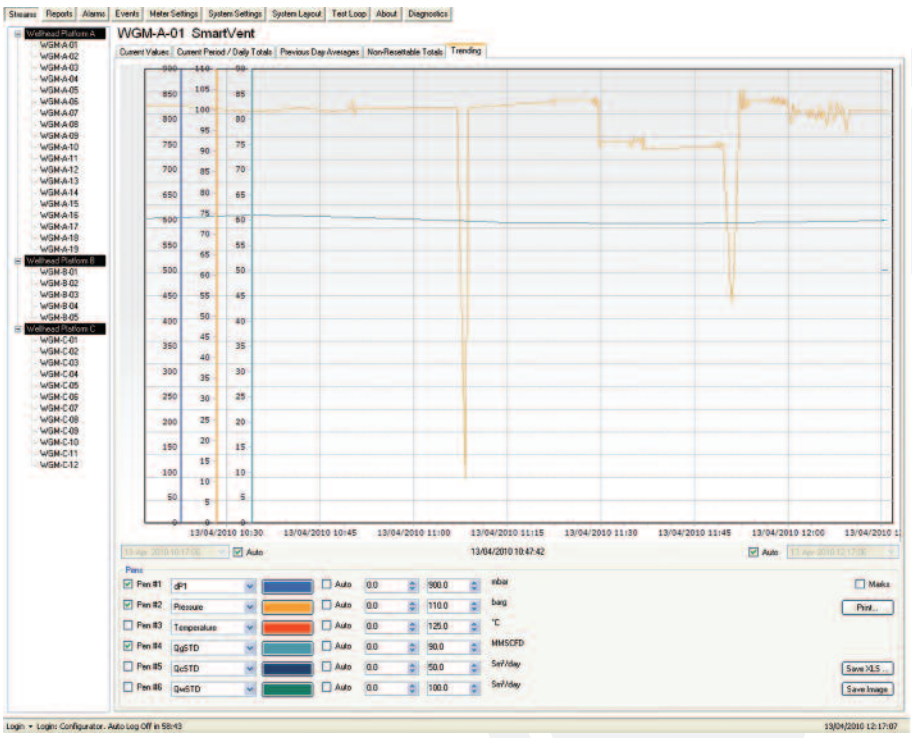
Typical uncertainties are: • Gas Flow Uncertainty: +/- 3-5% • Liquid Flow Uncertainty: +/- 20%

Note: uncertainty can be improved by applying tracer calibration

Meter output values

Typical output values to the user are as follows. Many other parameters however can be specified.

- Gas Flow Rate
- Liquid Flow Rate
- Water Flow Rate
- Condensate Flow rate
- GVF
- LMF
- Pressure
- Temperature
- Water breakthrough



Case studies

Our track record

A large number of major and minor oil and gas companies have applied the technique successfully to various applications over recent years. Locations include Norway, UK, The Netherlands, Middle East, South-East Asia and Australia.

Case Study 1

Wet gas metering technology was chosen by ExxonMobil for continuous well testing and advanced production measurement at two satellite platforms located in the South China Sea offshore Malaysia. The satellite facilities were equipped with permanently-installed SmartVent wet gas venturi-based meters at each well location. Special wet gas flow calculation and monitoring software was developed and installed on a separate flow computer installation interfaced to the host platform DCS system.

Prior to installation, the wet gas meters were subjected to full-scale testing at a representative high pressure gas/liquid flow test facility. This resulted in valuable measurement experience and a unique set of experimental wet gas data.

This application demonstrated that wet gas flow measurement is increasingly gaining acceptance in replacing well test separators and related infrastructure in gas/condensate field developments. Besides the significant cost savings, the availability of continuous readings of each well's production rates allows for enhanced reservoir management and production optimisation. At the same time experience has shown that successful implementation of wet gas flow measurement requires adequate attention to every aspect of the metering process.

Case Study 2

Multiphase wellhead flow measurements using the tracer technology method have been successfully applied to over 65 wells in the Dulang field, located offshore Malaysia. A large range of flow conditions were covered with gas rates ranging between 943 sm^3/d and 165,900 sm^3/d, oil rates between 20 m^3/d and 319 m^3/d, and water rates up to 489 m^3/d.

The water cut varied between 0% and 93%. The results obtained using the tracer technique were used as a cross-reference to the results obtained from conventional well tests using the test separator and to a separate multiphase meter during a trial period.

The application proved the tracer technology method to be a robust and accurate multiphase flow measurement technique over a wide range of flow conditions. In practice, the tracer method is capable of measuring over a much wider range than most test separators and multiphase flow meters, making the technique well suited for in-situ verification and calibration of installed multiphase and wet gas flow meters.

Expro's business is well flow technologies and specialised services, and our mission is to:

- **measure**
- **improve**
- **control** and
- **process**

flow from high-value oil and gas wells.

Our expertise is marketed through five segments:
Well Testing & Commissioning, Production Systems, Wireline Intervention, Connectors & Measurements and Deepwater Intervention.

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