Roxar MPFM 2600 MVG
Modular-based Multiphase and Wetgas Flow Meter

Operators today more than ever seek solutions for good quality multiphase flow measurements directly from the wellhead:

I need to increase production efficiencies while continuing to focus on the bottom line. Many multiphase metering solutions however, are too expensive and comprehensive to meet my required criteria for performance, flexibility and cost-effective metering solutions.

Multipurpose instrument

In response to this reality, Roxar has engineered the well proven MPFM 2600 into a modular and cost-effective meter that can provide solutions for multiple applications. These include applications such as: oil and wetgas wells, direct wellhead monitoring, multi-well testing, allocation and fiscal metering, as well as shale well flow back monitoring. The Roxar MPFM 2600 modular-based meter helps operators manage costs and increase efficiencies while enhancing production and making marginal fields more viable.

The one multiphase meter per well vision, to which so many operators aspire, is one step closer to a reality worldwide.

Challenging economic environments

With the cost value balance being a critical factor in progression of investments, oil and gas operators often struggle to justify the investment of a single multiphase or wetgas flow meter per well. The need is for individual well flow rate information with field proven technology whilst also being cost effective.

The MPFM 2600 modular-based meter version is one of the most compact and light-weight solutions on the market, which enables easy installations.
Configuration flexibility

Based on the well profile, operators often need a multiphase metering solution that can evolve and provide flexibility over time. The fields and their flow conditions continue to change, and often no single optimum measuring method or meter size is applicable for the complete lifetime of the wells.

There is a need for a flexible technology platform that can form the basis for the flow measurement requirements but can be customized to meet varying field conditions:

- **I want a multiphase metering solution that will last for the lifetime of the well. I don't want features I don't use or need as this adds costs complexity that can lead to increased risk of failure and increased maintenance requirements.**

The Roxar MPFM 2600 modular-based meter is the solution to those challenges. The modularity concept ensures customers only pay for the features they require. The meter has a high degree of freedom available regarding the components that can be separated and recombined to meet the specific requirements of the field / well.

As flow conditions and measurement requirements change over the lifetime of the field / well, additional modules can be retrofitted at any time.

As only modules required are supplied, this simplifies the metering solution, reducing risk of failure and maintenance requirements.

Improved user interface configuration tool

The Roxar MPFM 2600 M comes with a user-friendly configuration software tool. This allows the users to efficiently set up the meter for their requirements. The new software includes a unique, built-in feature of three different models / algorithms running in parallel, providing redundancy, self-checking and self-verification of the meter.

Measurement principle

The Roxar MPFM 2600 platform applies a combination of electrical impedance measurements and single high energy gamma for determining phase fractions, combined with venturi and cross correlation for velocity measurements. These measurement principles have been used by Roxar for more than 25 years and in over 1,400 meter installations around the world.

The full version meter (the MVG) employs all of these sensors and measurement techniques, in other versions one or more are omitted. All versions, including the base version (the M), includes the advanced signal processing, field electronics and electrode geometry utilizing 8 electrodes in two different planes.

The result is a meter that accurately characterizes flow and provides a cost-effective and flexible solution for a range of applications, from measurement at the wellhead to complex well testing.

Modules and options

The Roxar Multiphase meter 2600 technology platform comprises of the following options and modules:

- **Core modules**
  - MPFM 2600 M – Base version
  - MPFM 2600 MG – Base + Gamma
  - MPFM 2600 MV – Base + Venturi
  - MPFM 2600 MVG – Base + Venturi + Gamma

- **Optional modules/features**
  - Wetgas operating mode
  - Roxar Multiphase Salinity System (RMSS)

Based on the operator needs and preferences, these modules can be mixed and matched to suit the requirements of the application.

**MPFM 2600 M**

With the modular base version, the MPFM 2600 M, both phase fractions and velocities are obtained from the high-speed impedance measurements, running the patented non-gamma software. The non-gamma algorithm provides multiphase flow measurements without the need for a gamma system. Pressure and temperature measurements are not required for reporting flow rates at actual conditions in oil dominant flow, however temperature measurements are recommended in water dominant flows. Conversion from actual to standard conditions can be achieved with P&T input from one of the following options: Direct manual user input, add-on T-probe and T-transmitter integrated on the meter with pressure input from an external source, or P&T written to the Modbus register directly from a DCS with data from nearby measurements.

**MPFM 2600 MG**

Adding the gamma system (Cs-137 source + detector) to the meter adds improved accuracy and robustness to the measurements.

**MPFM 2600 MV**

Adding the venturi (designed as a field replaceable, insert sleeve), increases the GVF operating range, meter accuracy and robustness. The MPFM 2600 MV operates with the non-gamma algorithm, providing multiphase flow measurements without the need for a gamma system.

**MPFM 2600 MVG**

With the gamma system added, the full MPFM 2600 MVG meter is configured, for the best accuracy, robustness and greatest application flexibility.

**Wetgas mode**

Further, enabling the wetgas mode allows the MPFM 2600 to provide accurate measurements in gas, wet gas and gas condensate wells.

**Water salinity measurement**

If changes in the formation water and its conductivity are expected, the Roxar Multiphase Salinity System (RMSS) can be added, providing direct real-time measurements of water conductivity in high watercut wells.
**MPFM 2600 Model Selector**

**MPFM 2600 M**

The base model MPFM 2600 M is designed for permanent, single well installations, and is a well monitoring tool for trending watercut, gas/oil ratio and flowrates. This meter is ideal for detecting gradual or sudden changes, for example indicating gas break-through.

**MPFM 2600 MG**

The MPFM 2600 MG is designed for permanent, single well installations, and adding the gamma source improves accuracy and robustness to the meter, especially on the fraction measurements.

**MPFM 2600 MV**

The MPFM 2600 MV is designed for permanent, single well installations, for both oil and gas wells. This version provides good accuracy flow rates for oil, water and gas over a broader range of applications.

**MPFM 2600 MVG**

The MPFM 2600 MVG is essentially the “full” meter, with all three main modules included (electrical impedance, venturi and gamma). This meter can be used for both single well and multi-well applications such as flow back measurements, well testing, and allocation metering with the best accuracy.

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**Added value for the operator**

Roxar has built the MPFM 2600 MVG based on modularity, with a high degree of freedom to which a system’s components may be separated and recombined. In this way our customers are able to obtain a MPFM 2600 tailored specifically to their requirements. This separation of the MPFM 2600 modules/features into separate scalable, reusable modules consisting of isolated, self-contained functional elements also eases repair and maintenance as required - a highly cost-effective and field proven metering solution.

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**Applications MPFM 2600 M**

<table>
<thead>
<tr>
<th>Application Use</th>
<th>MPFM 2600 M</th>
<th>MPFM 2600 MG</th>
<th>MPFM 2600 MV</th>
<th>MPFM 2600 MVG</th>
<th>RMSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watercut trending (on a single well)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Flow rate trending (on a single well)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Allocation metering (on a single well)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Periodic well testing / multi-well metering</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Commingled wells metering</td>
<td>✔️</td>
<td>✔️</td>
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</tbody>
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**GAS VOLUME FRACTION (GVF)**

- Is the GVF 0-85%? 
  - ✔️
- Is the GVF 85-98%? 
  - ✗
- Is the GVF 95-100%? 
  - ✔️
- Is the GVF 0-100%? 
  - ✔️

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- The non-gamma versions (MPFM 2600 M and 2600 MV) are designed for low to medium GVF ranges (0-85%) and single well applications with relatively stable flow regimes. They are not designed for well testing applications or commingled flows; for which the gamma version is required.
- 1. The Wetgas operating mode software is used for GVF > 95%, and does not require a gamma system (as it is not an input to the algorithms in this mode), but if the GVF is also expected to be below 95%, then the gamma version (with the Wetgas mode) should be selected. Wetgas mode requires full PVT characterization of the produced hydrocarbons.
- 2. The Roxar Multiphase Salinity System (RMSS) is relevant for the following conditions:
  - If you expect high watercut (> 70% WLR, depending on the flow regime)
  - If the GVF is < 85%
  - If water with different salinities is expected in the well stream
  - For improved flow assurance and water type monitoring
  - If you want to avoid sampling in order to optimize reference water conductivity
- 3. For the MPFM 2600 M & MG, if the GVF is < 15%, then the quality and accuracy of the flow rates will be reduced, but the meter will still provide reliable water cut readings.
- 4. The MPFM 2600 M and MV requires an inline WLR or GOR calibration around the start operating point.
- 5. Can be used as a water fraction / moisture trending meter, flow rates will not be measured.

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**Incremental Values for the Operator**

Roxar has built the MPFM 2600 MVG based on modularity, with a high degree of freedom to which a system’s components may be separated and recombined. In this way our customers are able to obtain a MPFM 2600 tailored specifically to their requirements. This separation of the MPFM 2600 modules/features into separate scalable, reusable modules consisting of isolated, self-contained functional elements also eases repair and maintenance as required - a highly cost-effective and field proven metering solution.
**Specifications - Roxar MPFM 2600**

**System performance and characteristics**

<table>
<thead>
<tr>
<th>Operating range:</th>
<th>MPFM 2600 M &amp; MG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-100% water in liquid ratio (WLR)</td>
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<tr>
<td></td>
<td>0-85% gas volume fraction (GVF)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MPFM 2600 MV</th>
<th>0-85% gas volume fraction (GVF), and 95-100% gas volume fraction (GVF) in Wetgas mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPFM 2600 MVG</td>
<td>0-100% water in liquid ratio (WLR)</td>
</tr>
<tr>
<td></td>
<td>0-100% gas volume fraction (GVF)</td>
</tr>
</tbody>
</table>

**Meter sizes:** 1 ½" to 8"  

**Installation:** Vertical upwards flow  

**Typical uncertainty (95% confidence interval):**

| MPFM 2600 M & MG | Multiphase operating mode: Liquid rate: +/- 8-10% relative  
|------------------|---------------------------------------------------------------|
|                  | Gas rate: +/- 8-10% relative  
|                  | Water cut: +/- 3-5% absolute                                  |

| MPFM 2600 MV & MVG | Multiphase operating mode: Liquid rate: +/- 3-5% relative  
|---------------------|---------------------------------------------------------------|
|                     | Gas rate: +/- 6-8% relative  
|                     | Water cut: +/- 2-4% absolute                                  |

Wetgas operating mode:  
Total Hydrocarbon: +/- 5% relative  
Water Volume fraction: +/- 0.2% absolute

**Design pressure:** Standard: ANSI 300#, 600#, 900# and 1500# (up to 3,750 psi).  
Hub interface with 5,000 psi version also available

**Design temperature:** - 20 to +130 °C (266 °F)

**Mechanical and electrical components**

| Meter body wetted parts materials: | Duplex UNS 31803  
|------------------------------------|-----------------|
|                                    | Super Duplex UNS 32760  
|                                    | Stainless Steel UNS 31600  
|                                    | Alloy 625 UNS N06625  

| Flange connection: | ANSI flanges or Grayloc®/Techlok® hubs

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<table>
<thead>
<tr>
<th><strong>Length (M):</strong></th>
<th>730mm for a 3&quot; meter size (approximately, depending on flange rating)</th>
</tr>
</thead>
</table>
| **Venturi:**    | Insert design, field replaceable, with a compact isolation valve and manifold (MV & MVG)  
|                  | Rosemount Multivariable™ Transmitter (dp, P & T)                        |

| **Density measurements:** | Roxar non-gamma software (M & MV), or Compact gamma system (MG & MVG): Source: Cs-137, 2 mCi, Half-life 30.1 years |

| **Sensor technology:** | Electrical impedance and Roxar Zector® technology                        |

| **Power supply:** | 10-36 VDC, 85-264 VAC. Power consumption: 20 W |

| **Communication interface:** | RS-232/RS-485/Ethernet  
|                              | Communication protocol: Modbus RTU or TCP |

| **Flow computer mounting:** | SS 316 or Aluminum Exd housing for hazardous area installations  
|                             | Rack mountable or wall mountable stainless steel enclosure for outdoor use and safe area installations |

| **Electrical certification:** | ATEX, IECEx, CSA C/US and EAC |

| **Software:** | Roxar GUI |

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