

Multiphase Flow Measurement

Multiphase Flow Meter

Wet Gas Meter

Multiphase Wet Gas Flow Meter

Well Testing Service

Multiphase Flow Meter

Technology

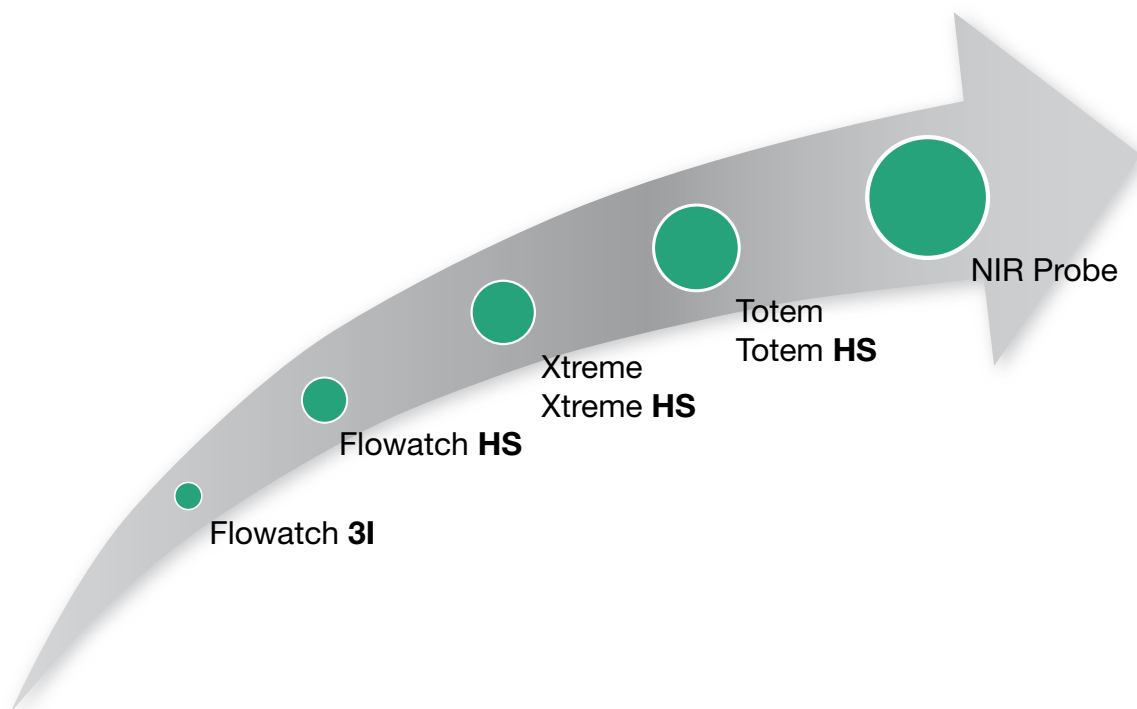
The Pietro Fiorentini Multiphase and Wet Gas Flow Meters provide real-time simultaneous measurement of oil, water and gas flow rates. They measure the three phases flowing together without separation, eliminating the need for separation before measure and avoiding installation of large and costly equipment. The meters are non-intrusive and operate inline.

Main advantages of Multiphase and Wet Gas meters

- More accurate decline curves permitting accurate reserves calculations helping the development strategy.
- Reduced drilling and completion costs by better understanding interference between wells and better characterizing the stimulation zone
- Optimize production by observing continuous flow rates
- Increased data confidence allowing earlier recognition of well problems

Evolution of our product

Flowwatch, Xtreme and Totem are the latest Multiphase Flow Meters developed by Pietro Fiorentini. These systems have evolved from the first non-radioactive Flowwatch model, implementing state-of-the-art technologies that provide a more accurate, reliable and robust measurement system to our customers.



Multiphase Flow Meters

Flowatch 3I

Non-radioactive model, suitable for strictly regulated areas.

Without a radioactive source, no specific permits are required.

Flowatch HS

Based on the Flowatch 3I technology, it utilizes our quick gamma densitometer, ideal for applications requiring a better accuracy and for high gas applications



Wet Gas Meters

Xtreme

The Xtreme meter is our non-radioactive system for wet gas applications.

Xtreme HS

Based on the Xtreme technology, the addition of our quick gamma densitometer provides improved accuracy.

All the models can be upgraded with the addition of a Near Infra Red (NIR) watercut probe module, our latest development, guaranteeing the best performance on the watercut measurement independent of variations in salinity.

Principle of operation

The Flowatch 3I utilizes a combination of DP measurement across a venturi, impedance measurement (capacitance/conductance of the oil/water mixture) and bulk velocity measurement via sensor cross-correlation.

In the HS model density is measured by a gamma densitometer with a patented high-speed detector resulting in a higher accuracy.

The Flow Velocity Module, a high gas mixture velocity measuring device based on local turbulence pressure analysis, is used for wet gas measurement.

The NIR probe is a water liquid ratio (WLR) sensor based on differential optical absorption spectroscopy. It relies on the large difference in the absorption of near infrared (NIR) light between crude oil and water. The measurement is not affected by flow regime or water salinity.

Key Features

Flowatch Multiphase Flow Meter:

- Retrievable venturi inlet
- Redundant cross correlation for a more reliable velocity measurement
- Widest size range on the market (starting from 0.5")
- High repeatability and long term stability due to high quality components
- Improved mathematical model (slip model) for all flow patterns

Xtreme Wet Gas Meter:

- Local turbulence pressure measurement using pressure sensitive transducers
- Suitable for flow measurement in annular flow regime
- Effective in both dry and wet gas condition
- Operates up to high velocities (40m/s)

Quick Gamma Densitometer (HS versions):

- Patented detector specifically developed for multiphase metering
- Highest speed available on the market for density measurement
- High accuracy due to the fast gamma detector
- Dose rate value at surface close to background level

NIR Probe Module:

- High Accuracy for the entire 0-100% Water Liquid Ratio range
- Independent of fluid composition
- Independent of flow regimes
- Independent of salinity and on salinity changes
- Light source can be replaced without disconnecting from the flow

Multiphase Wet Gas Flow Meter

The Totem Multiphase Wet gas meter includes all the measurement modules and the functionalities of the Flowatch and Xtreme meters. It can cover the whole 0-100% GVF range and water cut.

Thanks to the modular design as the well flow stream changes during its life cycle, the additional modules can be added to the system improving the accuracy and extending the operating range.



Combining all the modules Pietro Fiorentini can offer a Multiphase Wet Gas system suitable for all well conditions.

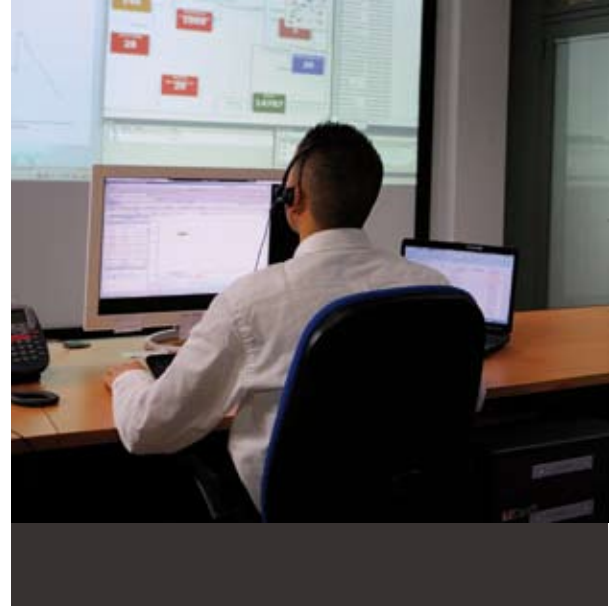
Flowatch

Operating range	<ul style="list-style-type: none"> • 0-100% Water Liquid Ratio (WLR) • 0-100% Gas Volume Fraction (GVF) • All flow regimes • All water salinity
Size	0.5" to 12", others upon request
Design pressure and temperature	<ul style="list-style-type: none"> • Up to 714 bar (10,000 PSIG) • Up to 150° C (320° F)
Body material	SS316, Duplex, Inconel 625, others upon request
Venturi	<ul style="list-style-type: none"> • Insert field replaceable • Max pressure drop < 1 Bar
Density measurement (HS Model)	<ul style="list-style-type: none"> • Gamma source: Cs 137 • Half-life: 30.1 years • Dose level: 0.1 µSv/h @0 cm (natural background) • Detector: Pietro Fiorentini Fast Gamma • Counts per second: 2 millions • ATEX/IECEX certification Ex d IIB T4
NIR Probe	<ul style="list-style-type: none"> • Flanged • ATEX/IECEX certification Ex d IIB T4
Flow Velocity Module for Wet Gas	<ul style="list-style-type: none"> • Pressure sensitive transducers • ATEX/IECEX certification Ex ia IIB T4 Ga • IP66 protection
Communication interface	<p>Communication ports:</p> <ul style="list-style-type: none"> • RS-485/422 single or redundant, Ethernet <p>Communication protocols</p> <ul style="list-style-type: none"> • Modbus ASCII/RTU, TCP/IP
Electrical specifications	<ul style="list-style-type: none"> • ATEX/IECEX certification Ex ia IIB T4 Ga • Ambient temperature -40° C/ +70° C
Flow computer	<ul style="list-style-type: none"> • Real time controller, operating system VxWorks • Ambient temperature -40° C/ +70° C • Power supply: 24VDC or 110-240 VAC 50-60 Hz • Enclosure for safety area or for hazardous area • Stainless steel or aluminium enclosure • With local display (as optional)
HMI	<ul style="list-style-type: none"> • HMI for Windows XP and 7



Well Testing Services

Pietro Fiorentini provides well testing services with mobile Multiphase Flow Meter Systems and PVT analysis lab. MPFM offers many advantages compared to conventional test separators, especially in HP/HT, and their use results in a time and cost efficient campaign.



The MPFM can be monitored via Internet allowing the metering technicians to monitor the wells remotely. Pietro Fiorentini can also offer personalized remote diagnostics and maintenance services aligned with the customers requirements.



Providing Solutions for Oil and Gas



HIPPS



Subsea MPFM



Well testing service



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