

Multiphase Flow Measurement

Multiphase Flow Meter

Wet Gas Meter

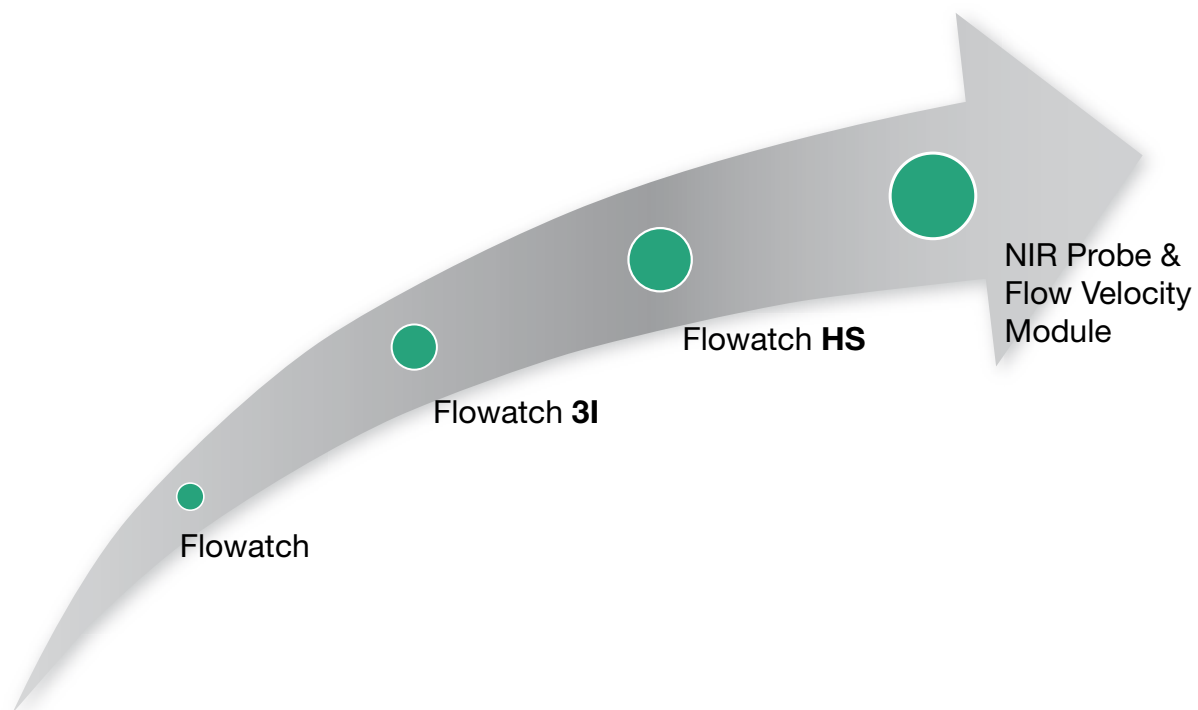
Multiphase - Wet Gas Flow Meter

Technology

The Pietro Fiorentini Multiphase and Wet Gas Flow Meters are non intrusive, inline systems providing real time measurement of oil, water and gas flow rates in the dispersed phase of the flow avoiding the use of large systems based on phase separation.

Evolution of our product

Flowwatch 3I and Flowwatch HS are the new generation of Pietro Fiorentini Multiphase Flow Meters, created as an evolution of the first non radioactive Flowwatch model, implementing the latest state of the art technologies to provide a more accurate, reliable and robust measurement system to our customers.



Principle of operation

The Flowwatch 3I utilizes a combination of DP measurement from 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 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.

The Flow Velocity Module is a high gas mixture velocity measuring device based on local turbulence pressure analysis.

MPFM Product Range

Flowatch 3I

Non radioactive model, suitable for strictly regulated areas.
Being radioactive free no specific permits are required.



Flowatch HS

Model with gamma source, easier calibration, ideal for applications requiring a better accuracy.



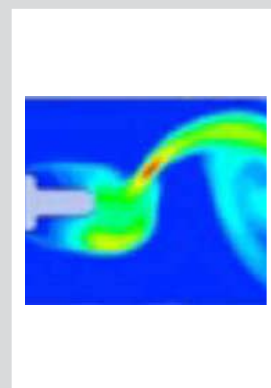
NIR Probe

A WLR sensor based on optical spectroscopy, ideal for applications in which a superior accuracy on the water cut is needed and applications with changing water salinity.



Flow Velocity Module

A mixture velocity system independent of flow regime, ideal for wet gas applications.



Key Features

Flowwatch 3I and Flowwatch HS Advantages:

- New patented metering section
- Retrievable venturi inlet
- Redundant cross correlation for a more reliable velocity measurement
- Widest size range on the market (starting from 0.5")
- Wide range of applicability with respect to types of fluids and flow regimes
- High repeatability and long term stability due to high quality components
- Improved mathematical model (slip model) for all flow patterns
- Suitable for mobile applications

HS Model:

- 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:

- High Accuracy for the entire 0-100% Water Liquid Ratio range and 0-99.5% GVF
- Independent of fluid composition
- Independent of flow regimes
- Independent of salinity and on salinity changes
- Light bulb can be replaced without disconnecting from the flow

Flow Velocity Module:

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



Multiphase Wet Gas Flow meter**Flowatch**

Thanks to the modular design the Flowatch 3I model can be easily upgraded with the addition of the gamma densitometer, NIR WLR sensor and Flow Velocity Module. As the well flow stream changes during its life cycle, the additional modules can be added to the system improving the accuracy.

Combining all the modules Pietro Fiorentini can offer a Multiphase - Wet Gas system suitable for all well conditions (0-100% GVF, 0-100% WLR).



Flowwatch

| | |
|---------------------------------|--|
| 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 or 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 certification Ex d IIB T4 |
| NIR Probe | <ul style="list-style-type: none">• Flanged or threaded connection• ATEX certification Ex d IIB T4 |
| Flow Velocity Module | Communication ports: <ul style="list-style-type: none">• RS-485/422 single or redundant, Ethernet Communication protocols• Modbus ASCII/RTU, TCP/IP |
| Electrical specifications | <ul style="list-style-type: none">• ATEX 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 aluminum enclosure• With local display (as optional) |
| HMI | HMI for Windows XP and Windows 7 |



Services

Pietro Fiorentini can provide well testing services with mobile Multiphase Flow Meter Systems and PVT analysis lab. MPFM are an easier solution for well testing operations 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.



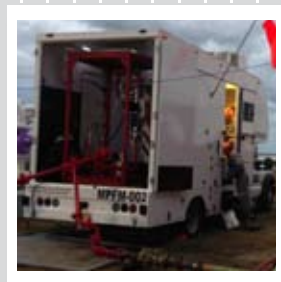
Providing Solutions for Oil and Gas



HIPPS



Subsea MPFM



Well testing service



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