

Oil and gas production measurement

From wellhead to pipeline





13-2H



Peace of mind – we've got you covered

TechnipFMC's products and supporting services will keep your wells producing and on budget and help you get automated quickly.

With more than 80 years of experience in hydrocarbon measurement, we bring measurement expertise to demanding custody transfer and allocation measurement applications. Products from TechnipFMC and our preferred suppliers provide complete solutions for precision measurement, automation and data management.

From design assistance and fabricated solutions to startup and commissioning support, TechnipFMC delivers the right solution to meet your application needs. Our offices are conveniently located near you, providing easy access to sales support, support services and inventory. We minimize our response time so you can maximize your uptime, delivering the expertise that allows you to focus on production.



Find out more about our U.S. manufacturing locations and our service and support locations. We are close by to offer support when you need it.

TechnipFMC also has a full portfolio of services to support you through your entire process.



Contact us
www.technipfmc.com

From wellhead to pipeline

Application	Flow metering technology	Other instrumentation and equipment
Well testing	Coriolis, vortex, electromagnetic, turbine, positive displacement, ultrasonic flowmeters and multiphase meters	Continuous level and interface, level switch, temperature, pressure and water cut monitor
Wellhead	DP flow and multiphase meters	Wireless options: Pressure and temperature
Enhanced oil recovery, waterflood, steam flood, miscible flood, chemical flood	Coriolis, vortex, electromagnetic, turbine and ultrasonic flowmeters	Wireless options: Level, temperature and pressure
Processing, separation, crude oil desalting, crude oil dehydration, crude oil stabilization, condensate stabilization, gas dehydration gas sweetening, stock tank vapor recovery, water treatment	Coriolis, vortex, electromagnetic, turbine and ultrasonic flowmeters	Wireless options: Continuous level and interface, level switch, temperature, pressure, electronic dP and pH water treatment specific analyzers: pH conductivity, chlorine, ORP and turbidity
Transportation, LACT units, gathering, truck and rail car loading and unloading	Coriolis, positive displacement and turbine flowmeters	Wireless options: Continuous level, level switch, temperature, pressure, water monitors and ultrasonic. Other: Valves, strainers, air eliminators, complete skids, presets and flow computers

Processing overview

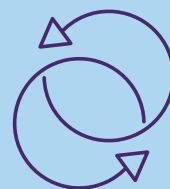


Produced wellhead fluids such as crude oil, natural gas and brine must be processed before sale, transport, reinjection or disposal. Oil and gas production involves several surface unit operations between the wellhead and the point of custody transfer. Collectively, these operations are called "field processing." Field processing of crude oil from storage, transportation and sale involves three processes:

- ▶ Separating the crude oil from any entrained solids, emulsified water or brine.
- ▶ Stabilizing the crude oil by removing dissolved gas so that it is safe to be transported and stored.
- ▶ Removing impurities and any separated or free gas from the crude oil.

Field processing natural gas for sale or reinjection into a pipeline or storage vessel for natural gas liquids involves these processes:

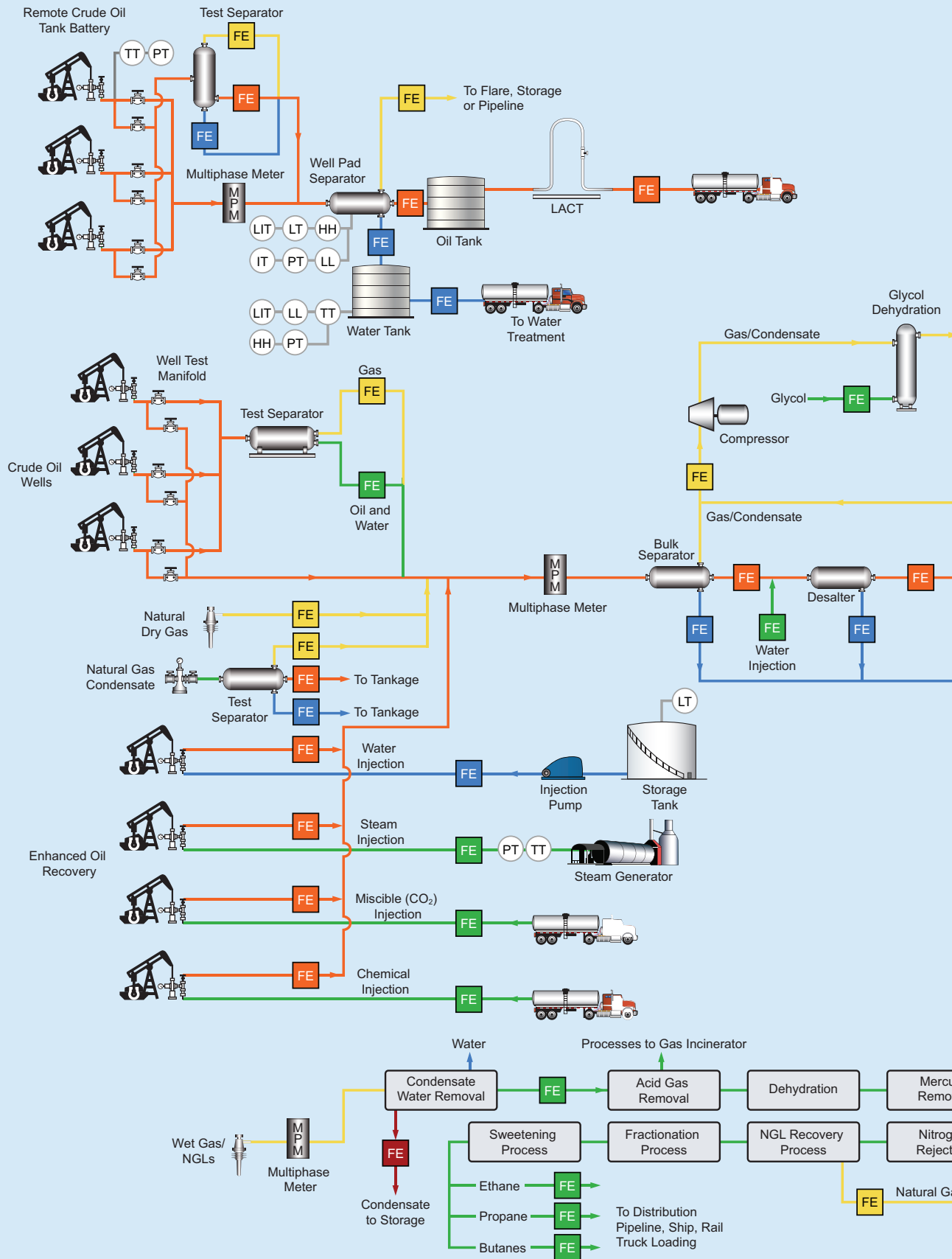
- ▶ Cleaning by removing liquids.
- ▶ "Sweetening," or treating by removal of acidic gases (H_2S and/or CO_2).
- ▶ Dehydrating by removing water vapor and controlling H_2O dew point.



Your Complete Solution

Your complex process requires you to minimize capital expenditure while maximizing efficiency. TechnipFMC understands the challenges you face, and can provide the system solution for your unique application needs.

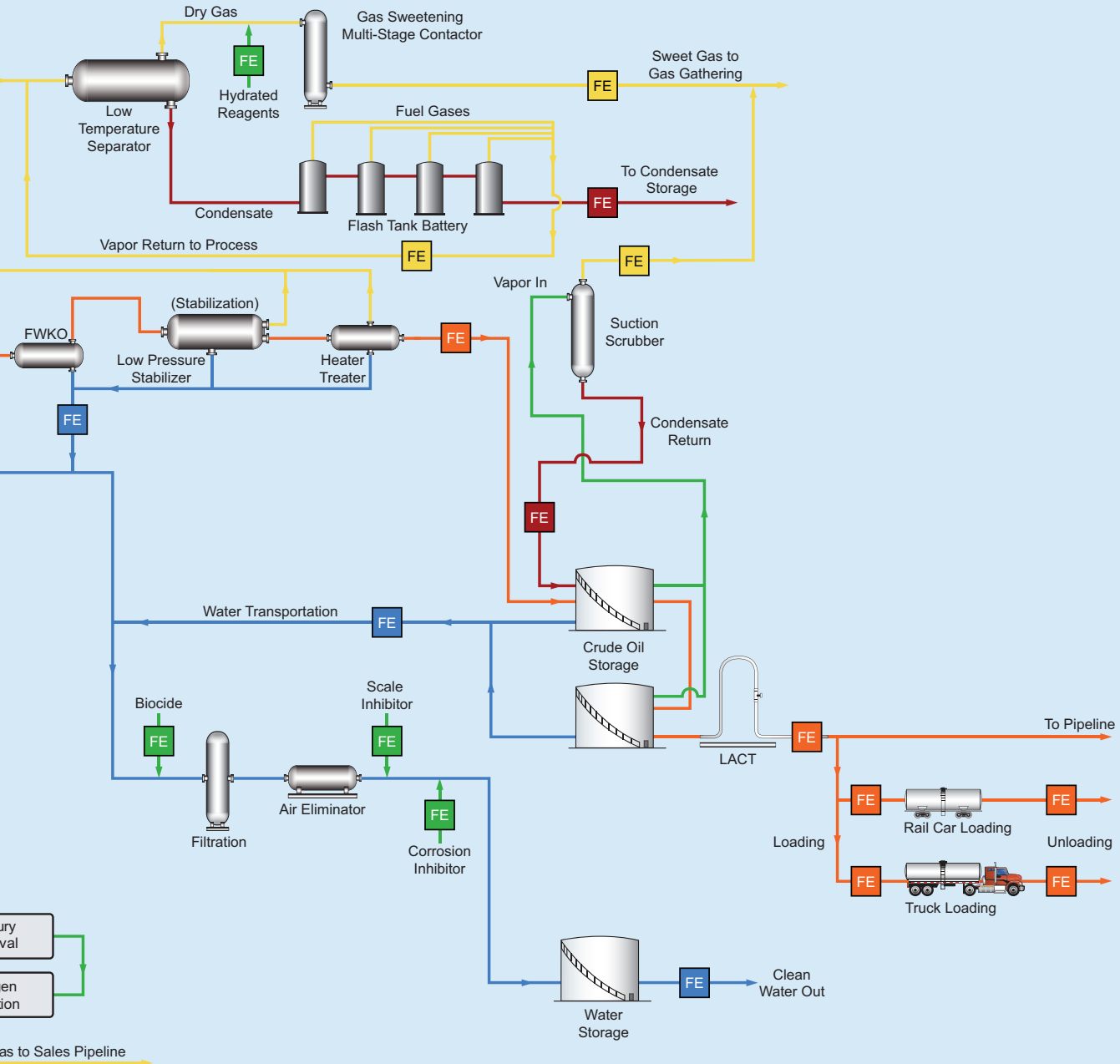
Measurement value chain



Key

Oil Lines	█	LT = Level Transmitter
Gases	█	LIT = Level and Interface Transmitter
Water	█	HH = High Level Switch
Condensate	█	LL = Low Level Switch
Other Process Liquids, Vapors and Gases	█	PT = Pressure Transmitter
Flow Element	FE	TT = Temperature Transmitter
		IT = Interface Transmitter

Note: Vessel instrumentation, tank vessels and separation equipment may include instrumentation such as level, interface, pressure, temperature transmitters, and high and low level switches. See individual line cards for more information.



Flow metering technologies

When selecting a meter technology, the following criteria should be considered:

Measurement, data and accuracy

The type of metering system and technology you need depends on the kind of measurement you perform and the data and accuracy the measurement provides. From custody transfer and monitoring of the efficiency of critical processes to the measurement of product composition including density, viscosity or BS&W, your applications require unique data output and accuracy:

- ▶ **Repeatability:** Accuracy of measurements for a given flow rate.
- ▶ **Linearity:** Accuracy of measurements over a range of flow rates.
- ▶ **Stability:** Accuracy of measurements over time (ability to maintain repeatability and linearity).
- ▶ **Quality:** Accuracy of combined output data from multiple devices in a measurement system.

Product characteristics

The characteristic of your product determines the kind of measurement technology you need for accurate measurement. Some common product characteristics include:

- ▶ Viscosity range
- ▶ API gravity range
- ▶ Density
- ▶ Percent water range
- ▶ Temperature and pressure
- ▶ Percent paraffin range
- ▶ Type and amount of contaminants and deposits

Flow Metering Technologies

Positive displacement (PD) meters' unique rotary vane design provides unsurpassed accuracy, long-term measurement stability "and many years of maintenance-free performance. These meters can handle a wide range of viscosity and flow rates and have a low pressure drop to maximize delivery rate. Other features include the resistance to paraffin buildup and electric-free operation.

Multiphase meters (MPM) works over the full GVF range. The MPM meter combines the input from a gamma detector, dP, pressure and temperature transmitters and radio frequency dielectric measurements to form a multi modal tomographic system. Along with measuring multiple fluid phases, the MPM offers remote access and operation, diagnostic features, and self configuration.



Smith Meter® F4 PD Meter



Multiphase Meter



With a complete range of products, TechnipFMC has the right solution for your application needs. We suggest the right fit based on our consultation with you.

Flow metering technologies (cont.)



Proline® Promass
Coriolis Meters

Coriolis meters have a very wide turndown flow range and unlike volume, fluid mass is not influenced by changing process conditions such as temperature, pressure and viscosity. Besides offering high accuracy and bidirectional flow, Coriolis meters have the ability to measure several process variables at the same time. Mass flow, density and temperature are the primary variables that can be used to derive other values such as volume flow, solids content, concentrations and complex density functions.



INVALCO Turbine Meters

Turbine meters are offered in several styles that provide rugged construction for long service life, high accuracy in the lower and medium viscosity range, high resolution pulse output and low maintenance in clean service applications for maximum cost-effectiveness.



Smith Meter® microFlow.net™

Flow computers are designed to monitor continuous or batch flow operations for liquid or gas. Microprocessor-based units, such as the Smith Meter® microFlow.net, can be operated stand alone or as part of a supervisory control and data acquisition (SCADA) system.



Electromagnetic flow meters measure the volume flow rate of electrically conductive fluids (greater than $1 \mu\text{S}/\text{cm}$) with or without solids. These measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions. The tried-and-tested Promag sensors have no pressure loss and are not sensitive to vibrations

Service and support

Start-up Services

Our certified service technicians provide quick and dependable startup and commissioning services. Measurement and instrumentation expertise ensure that project milestones are met.

Support

Instrumentation is vital to the safe operation of your processes and the quality of your product. TechnipFMC customer support engineers provide you with support 24/7, 365 days a year, assisting you with onsite installation, commissioning and troubleshooting. Our offices are located near your operations, with local inventory and measurement experts at the ready for quick responses to your service needs. Stock is available for many of our products, with more than 80 percent of all instrumentation that is shipped to U.S. customers built in the United States. We offer maximum flexibility in shipping options and schedules.



Training

We recognize the challenging task of finding and retaining well-trained staff. That is why we have applied years of experience to our training schools so your employees receive the hands-on skills and support to get the job done. We offer training to fit your needs, including premium training at our BMP (best measurement practices) workshops.



Customer Support and Services
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24/7 Service Department
844-798-3819

Instrumentation and process control

TechnipFMC and our network of preferred suppliers offer a complete line of products and tailor-made solutions to meet your process control need



Level measurement

When selecting a level measurement device, there are many considerations and different technologies:

- ▶ Multiparameter (capacitance and guided radar combined)
- ▶ Guided radar
- ▶ Capacitive
- ▶ Vibronic
- ▶ Ultrasonic
- ▶ Hydrostatic
- ▶ Gamma
- ▶ Conductive

How do you know which technology is the best fit for your application?

The experts at TechnipFMC can help guide you through. Here are just a few things we take into consideration when helping you select the right device:

First, you must decide if you need to measure continuous overall level, point level or interface level. Is it a separator or tank? Is the vessel vertical or horizontal?

Next, there are several process parameters to consider: Is your liquid still turbulent, or does it have an emulsion layer? Is there any buildup potential?

We would need to consider the density range, pressure and temperature, as well as factors like viscosity, conductivity and dielectric constant. We would also need to consider your accuracy needs. Finally, the installation requirements you have (process connections, tank height, mechanical fixtures in tank and so on) must also be taken into consideration.

With this information, we help find the best fit technology tailored to meet your specific needs.

Pressure measurement

When measuring pressure, we first need to determine whether you need to measure gauge pressure, absolute pressure, differential pressure or hydrostatic pressure. No single instrument is suited for all application areas. We find the right one for you. If you have corrosive or abrasive materials in your process, this would be a good fit for our ceramic cell we offer for pressure transmitters. If you have high temperatures or pressures in your process, we offer metal cells with or without diaphragm seals, which are ideal under these extreme conditions.



DS1

Temperature measurement

While temperature measurement may seem like a simple measurement, there are still several things to consider. Will you need a transmitter for your application? Field transmitter, head mounted or DIN rail? There are many mechanical variations to fit your tank or process, even in extreme conditions.

Will you measure with thermocouples or RTDs? Our products are designed with your specific application in mind.

Analysis measurement

We offer a complete line of analytical systems that measure a variety of parameters:

- ▶ pH
- ▶ ORP
- ▶ Conductivity
- ▶ Chlorine
- ▶ Dissolved oxygen
- ▶ Turbidity
- ▶ Chemical analysis (iron, hardness, nitrates, phosphates, ammonium, aluminum, chromate, copper, hydrazine, manganese and silicate)



RT1-RT2



Superior testing, proving and calibration

TechnipFMC's world-class hydrocarbon flow research and test facilities in Erie, Penn., is an ISO 17025:2005 accredited lab capable of testing meters against the industry's widest range of fluid flow conditions from laminar to turbulent flow on hydrocarbon fluids.

Our meters can measure a wide range of viscosities, the accuracy of which is proven in our testing facilities. Our experienced technicians perform dynamic testing of flow rates to 6,670 m³/h (42,000 bph) and viscosities to 250 cSt - the most wide-ranging test capabilities in the world.

Our Flow Research and Test Center is the only petroleum test laboratory that can ensure true calibration over a dynamic Reynolds number range of 100 to 1,000,000. The test center is accredited through NVLAP Lab Code 200939-0.





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