Measurement Products and Systems for the Oil and Gas Industry
FMC Technologies delivers technical superiority with a complete range of liquid and gas custody transfer solutions. As a world leader in flow measurement and control products since 1926, FMC Technologies Measurement Solutions provides the broadest range of solutions complemented by global engineering, project management expertise and after-sales support for all segments of the oil and gas industry.
# Introduction

Served Markets

Product Application Guide

## Products

- **Liquid Measurement**
  - Positive Displacement Meters
  - Turbine Meters
  - Ultrasonic Flowmeters
  - Coriolis Meters
  - Electronics
  - Flow Computers
  - Line Accessories
  - Terminal Line Accessories
  - Marketing Terminal Systems
  - Bottom Loading
  - Truck Meter Packages
  - Tank Truck Systems

- **Gas Measurement**
  - Ultrasonic Flowmeters
  - Orifice Meters
  - Venturi Tubes
  - Unions, Meter Tubes and Accessories
  - Flow Computers

- **Subsea Measurement**
  - Single Phase Flowmeters

## System Technologies

- **Liquid Measurement Systems**
- **Gas Measurement Systems**
- **Floating Production, Storage and Off-Loading Systems**
- **Liquid and Gas, Control Systems and Flow Computers**

## Life Cycle Maintenance, Training and Support

## Global Locations

For more detailed information, visit our documentation library on the web at http://info.smithmeter.com/literature/online_index.html
FMC Technologies is a market leader in the design, manufacture and supply of measurement products and systems for the oil and gas industry worldwide. From the wellhead to the final consumer, FMC equipment can be found at each stage of the production, processing and delivery chain for both liquid and gas petroleum products.
FMC Technologies Measurement Solutions traces its heritage to 1926 when Erie Meter Systems introduced the world’s first electric service station gasoline dispenser. When the company was bought by A.O. Smith, this measurement expertise formed the foundation to such technology innovations as the Positive Displacement meter, and later, the turbine meter. Both products are known throughout the oil and gas industry as the global standards for custody transfer measurement.

In 1963, Smith Meter Systems built its first skid-mounted integrated metering station; now there are more than 2,000 installations in over 100 countries. Today, FMC Technologies Measurement Solutions offerings include liquid custody transfer metering products, tank truck metering packages, flow computers, as well as complete gas and liquid metering systems.

FMC’s commitment to quality is unrelenting. Its products deliver accurate performance in some of the world’s most harsh environments. To ensure high-quality standards and prompt delivery, all supply phases of Measurement Solutions’ products and packaged systems are controlled by a comprehensive quality program. The program meets ISO 9001-2000 compliance requirements for design, service and manufacture of measuring systems and products used throughout the petroleum and gas energy sectors.

Through continued focus on the development and delivery of cost-effective products and systems, FMC is meeting customers’ needs for integrated measurement solutions on a global basis.

The technology of the petroleum industry has changed since its early origins in 1859 at the Drake Well in NW Pennsylvania.
FMC Technologies Measurement Solutions engineers systems and manufactures products the oil and gas industry relies on to ensure processes operate efficiently while reducing operational costs and minimizing the risk associated with custody transfer. Through FMC’s comprehensive understanding of the industry and its relentless obsession with performance, FMC develops innovative, real-world solutions helping its customers overcome even the most daunting challenges.

FMC Technologies Measurement Solutions is a trusted partner that provides experience and technical know-how to identify the right product or system solution to solve any application challenge.
As global energy demand continues to increase, the quest for new oil and gas discoveries will lead energy companies to greater depths and harsher environments with an ever-increasing emphasis on measurement equipment reliability and accuracy.

FMC Technologies’ heritage dates back to the roots of oil and gas production. The company has pioneered virtually every significant advancement for measurement applications both at the wellhead and on the platform. Rapidly evolving production techniques have resulted in new and varied demands for measurement, reliability and accuracy; FMC Technologies has an unparalleled array of measurement solutions and can offer the right solution for any unique application found in oil and gas production.

**Offshore**

Offshore production of oil and gas is perhaps the most arduous and hazardous operating environment, demanding solutions that reliably meet high-volume and high-risk requirements. Since measurement products and systems must account for virtually every measurement variable, FMC Technologies is the ideal choice for unattended measurement applications with its broad range of trusted measurement technologies. Applications include:

- **Crude oil**
  - Wellhead
  - Gas-oil separation
  - Storage and transportation
- **Gas recovery**
  - Gas treatment
  - Storage and transportation

**Onshore**

FMC Technologies continues to develop measurement solutions that reliably perform in the harshest onshore landscapes. The potentially harmful effects of entrained gases, sediment, water and chemicals are all factors that must be effectively mitigated through proper operations and processes. Positive Displacement meters, turbine meters, gas and liquid ultrasonic flowmeters and advanced control systems allow measurement applications to run remotely and reliably across a wide range of application requirements. Applications include:

- Wellhead
- Flowline gas-oil separation
- Gathering line storage

<table>
<thead>
<tr>
<th>Key Products</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smith Meter® Positive Displacement Meters</td>
<td>18</td>
</tr>
<tr>
<td>Smith Meter® MV Series Turbine Meters</td>
<td>20</td>
</tr>
<tr>
<td>Smith Meter® Ultra Series® Ultrasonic Flowmeters</td>
<td>21</td>
</tr>
<tr>
<td>Coriolis Meters</td>
<td>22</td>
</tr>
<tr>
<td>Smith Meter® microFlow.net® Liquid</td>
<td>27</td>
</tr>
<tr>
<td>Smith Meter® Net Oil Flow Computer TCP-NOC</td>
<td>28</td>
</tr>
<tr>
<td>MPU™ Series Ultrasonic Flowmeters</td>
<td>38</td>
</tr>
<tr>
<td>Differential Pressure Meters</td>
<td>39</td>
</tr>
<tr>
<td>Smith Meter® microFlow.net® Gas</td>
<td>43</td>
</tr>
<tr>
<td>Liquid Measurement Systems</td>
<td>50</td>
</tr>
<tr>
<td>Gas Measurement Systems</td>
<td>52</td>
</tr>
<tr>
<td>Fmc2™ Flow Management Computers</td>
<td>57</td>
</tr>
</tbody>
</table>
served markets

Crude Oil and Gas Transportation

With the promise of new and greater oil and gas reserves pushing exploration and production to the farthest corners of the earth, reliable transportation and accurate measurement of petroleum products are increasingly critical.

FMC Technologies Measurement Solutions is the recognized leader in designing innovative and accurate measurement solutions for oil and gas transportation. Through its highly regarded Smith Meter® and Kongsberg heritage brands, FMC Technologies offers a complete range of liquid and gas metering products and systems for:

- FPSO
- Pipeline
- Gas transmission
- Gas processing
- Underground storage
- Gas distribution

With more than a century of experience dealing with petroleum product transport and delivery issues, FMC Technologies has an expert understanding of the best measurement practices, application know-how and product knowledge to meet the pressing challenges of transporting crude oil and gas. Since transporting petroleum products are affected by a myriad of variables including: temperature, viscosity, vapor pressure, entrained gases and contaminants, reliable and versatile measurement solutions are required. FMC Technologies’ broad product range and highly experienced engineers ensure proper selection and sizing of meters for each application.
served markets

Petroleum Refining

Perhaps no other aspect of petroleum-related products entails the diversity of measurement applications as that found in petroleum refining. Oil companies continue to innovate to meet the demands for “boutique” fuels while maximizing output.

High temperatures and pressures characterize the operating environment for refining-process equipment, and the need for robust, reliable solutions extends to the equipment used to measure its products. FMC Technologies is recognized for accurate and versatile measurement solutions that span the measurement needs of the oil refinery. Whether handling heavier fractions, lighter liquid elements, automotive- or aviation-grade fuels, waxes or lubricants, the right selection of products can be found in the FMC family of solutions. Flowmeters from FMC Technologies exist in virtually every refining application where accurate measurement is required:

- Process control
- Storage
- Transfer to marketing terminal
- Truck and railcar loading

Large refineries may have dozens of hydrocarbon blending streams for the complex processes that produce today’s refined products; such process stream and application variables require accurate measurement solutions under a broad range of scenarios. FMC Technologies combines a deep understanding of measurement principles, applications know-how and product portfolio diversity necessary to meet complex measurement needs in petroleum blending, including newer requirements involving renewable fuels such as ethanol.
served markets

Refined-Product Transportation

Given their numerous types and widely varying characteristics, the task of safely transporting and accurately measuring refined petroleum products is no simple matter. Many factors impact measurement accuracy including, temperature, viscosity, density, vapor pressure and contaminants.

Through its extensive product lines, including its highly esteemed Smith Meter® and Sening® heritage brands, FMC Technologies sets the standard for petroleum supply chain management. FMC Technologies’ accurate and reliable measurement solutions make the daily routine of petroleum product transportation and delivery faster, safer and more economical. Whether transporting automotive or aviation-grade fuels, distillates or LPGs, FMC has the array of products and depth of applications expertise to meet these diverse measurement requirements:

- Tank trucks
- Railcars
- Pipeline
- Marine

<table>
<thead>
<tr>
<th>Key Products</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smith Meter® Positive Displacement Meters</td>
<td>18</td>
</tr>
<tr>
<td>Smith Meter® Sentry Series Turbine Meters</td>
<td>19</td>
</tr>
<tr>
<td>Smith Meter® MV Series Turbine Meters</td>
<td>20</td>
</tr>
<tr>
<td>Smith Meter® Ultra Series® Ultrasonic Flowmeters</td>
<td>21</td>
</tr>
<tr>
<td>Smith Meter® microFlow.net® Liquid</td>
<td>27</td>
</tr>
<tr>
<td>Liquid Measurement Systems</td>
<td>50</td>
</tr>
<tr>
<td>Fmc2™ Flow Management Computers</td>
<td>57</td>
</tr>
</tbody>
</table>
Petroleum marketing terminal operators strive for maximum efficiency and throughput. To accomplish this, they depend on the most cost-effective loading equipment with unsurpassed accuracy, precision and safety. Equipment must be engineered for continuous trouble-free performance under severe operating conditions with predictable maintenance and minimal downtime; and, it must satisfy all legal accuracy requirements.

Proper system design is essential for accurate loading and unloading of straight and blended refined products at the marketing terminal. FMC Technologies’ high-quality Smith Meter® and Sening® products and systems provide the ultimate metering solutions for terminal operations of all liquid products, including:

- Loading, unloading and batching for trucks, railcars and ships
- Blending capabilities and additive control
- Aircraft fueling operations
- Biofuels terminals

From individual product components to complete skid-mounted load rack packages, FMC Technologies provides the power, flexibility and configurability for today’s highly efficient and regulated terminals.
CRUDE OIL AND GAS PRODUCTION
- PD Meters
- Coriolis Meters
- Turbine Meters
- Automatic Temperature Compensators, Strainers and Air Eliminators
- MeasureMaster™ and OrificeMaster™
- Venturi Tubes
- Flow Computers

CRUDE TRANSPORTATION PIPELINE
- Complete Measurement System and Prover
- PD Meters
- MV Series Turbine Meters
- Sentry Series Turbine Meters
- Liquid Ultrasonic Flowmeters
- Strainers and Air Eliminators
- SyberTroll®, microFlow.net™ and Fmc2™ Flow Computers

REFINED PRODUCTS PIPELINE
- Complete Measurement System and Prover
- PD Meters
- MV Series Turbine Meters
- Sentry Series Turbine Meters
- Liquid Ultrasonic Flowmeters
- Strainers and Air Eliminators
- SyberTroll®, microFlow.net™ and Fmc2™ Flow Computers

GAS UNDERGROUND STORAGE
- Complete Measurement System
- MeasureMaster™ and OrificeMaster™
- Gas Ultrasonic Flowmeters
- Flow Computers

GAS PIPELINE
- Complete Measurement System
- MeasureMaster™ and OrificeMaster™
- Gas Ultrasonic Flowmeters
- Flow Computers

BULK TEST SEPARATOR UNIT
- MeasureMaster™ and OrificeMaster™
- Coriolis Meters
- PD Meters
- Turbine Meters
- Venturi Tubes

NATURAL GAS PRODUCTION
- MeasureMaster™ and OrificeMaster™
- Gas Ultrasonic Flowmeters
- Flow Computers

GAS COMPRESSION
- MeasureMaster™ and OrificeMaster™
- Gas Ultrasonic Flowmeters
- Flow Computers

LACT
- Complete Measurement System and Prover
- MV Series Turbine Meters
- PD Meters
- Coriolis Meters
- Strainers and Air Eliminators
- SyberTroll® and microFlow.net™

TEST SEPARATOR
- MeasureMaster™ and OrificeMaster™
- Coriolis Meters
- PD Meters
- Turbine Meters
- Venturi Tubes

LIQUID CRUDE REFINERY
- Complete Measurement System (skid based)
- PD Meters
- Turbine Meters
- Coriolis Meters
- Control Valves
- SyberTroll®, microFlow.net™ and Fmc2™ Flow Computers

GAS REFINERY/PROCESSING PLANT
- Complete Measurement System
- MeasureMaster™ and OrificeMaster™
- Gas Ultrasonic Flowmeters
- Flow Computers

BULK PLANT/TERMINAL ENTRY
- Card Reader

LPG LOADING
- Complete Measurement System (skid based)
- PD Meters
- GL Series Turbine Meters
- Coriolis Meters
- PB/RE™ 4 PD Motor
- AccuLoad® III Controller and microLoad.net™
- Set Stop Valves
- Condensing Tanks and Strainers

BUTANE/FUEL UNLOADING
- Complete Measurement System (skid based)
- PD Meters
- GL Series Turbine Meters
- Coriolis Meters
- PB/RE™ 4 PD Motor
- AccuLoad® III Controller and microLoad.net™
- Set Stop Valves
- Strainers and Air Eliminators

Sening® Bottom Loading Systems (APIs, footvalves and vapor recovery)
Sening® Fuelline Cross Over Prevention System

LUBE OIL PACKAGING
- Complete Measurement System (skid based)
- PD Meters
- GL Series Turbine Meters
- Coriolis Meters
- PB/RE™ 4 PD Motor
- AccuLoad® III Controller and microLoad.net™
- Set Stop Valves
- Strainers and Air Eliminators

BARGE/TANKER FUELING/OFFLOADING TERMINAL
- Complete Measurement System and Prover
- PD Meters
- MV Series Turbine Meters
- Sentry Series Turbine Meters
- Strainers and Air Eliminators
- SyberTroll®, microFlow.net™ and Fmc2™ Flow Computers

RAILCAR LOADING
- Complete Measurement System (skid based)
- PD Meters
- Turbine Meters
- Coriolis Meters
- AccuLoad® III Controller and microLoad.net™
- Strainers and Air Eliminators
- Set Stop Valves
**PRODUCT APPLICATION GUIDE**

### SYSTEMS

#### LIQUID

- Smith Meter® Positive Displacement Meters
- Smith Meter® Sentry Series Turbine Meters
- Smith Meter® Guardsman Series Turbine Meters
- Smith Meter® Guardsman L Series Turbine Meters
- Smith Meter® MV Series Turbine Meters
- Smith Meter® Coriolis Meters
- Smith Meter® PD Meters
- Smith Meter® Complete Measurement System

#### GAS

- Smith Meter® Positive Displacement Meters
- Smith Meter® Sentry Series Turbine Meters
- Smith Meter® Guardsman Series Turbine Meters
- Smith Meter® Guardsman L Series Turbine Meters
- Smith Meter® MV Series Turbine Meters
- Smith Meter® Coriolis Meters
- Smith Meter® PD Meters
- Smith Meter® Complete Measurement System

#### FLOATING PRODUCTION AND OFF-LOADING SYSTEMS

- Smith Meter® Positive Displacement Meters
- Smith Meter® Sentry Series Turbine Meters
- Smith Meter® Guardsman Series Turbine Meters
- Smith Meter® Guardsman L Series Turbine Meters
- Smith Meter® MV Series Turbine Meters
- Smith Meter® Coriolis Meters
- Smith Meter® PD Meters
- Smith Meter® Complete Measurement System

#### LIQUID CONTROL SYSTEMS

- Smith Meter® Positive Displacement Meters
- Smith Meter® Sentry Series Turbine Meters
- Smith Meter® Guardsman Series Turbine Meters
- Smith Meter® Guardsman L Series Turbine Meters
- Smith Meter® MV Series Turbine Meters
- Smith Meter® Coriolis Meters
- Smith Meter® PD Meters
- Smith Meter® Complete Measurement System

#### GAS CONTROL SYSTEMS

- Smith Meter® Positive Displacement Meters
- Smith Meter® Sentry Series Turbine Meters
- Smith Meter® Guardsman Series Turbine Meters
- Smith Meter® Guardsman L Series Turbine Meters
- Smith Meter® MV Series Turbine Meters
- Smith Meter® Coriolis Meters
- Smith Meter® PD Meters
- Smith Meter® Complete Measurement System

### LINE ACCESSORIES

- Smith Meter® Strainers, Air Purgers, Air Eliminators and Deaerators
- Smith Meter® Prowers and Pipeline Spheres

### FLOW COMPUTERS AND ELECTRONICS

- Smith Meter® Accuload III Controller
- Smith Meter® microLoad.net
- Smith Meter® microFlow.net Liquid Flow Computer
- Smith Meter® SyberTroll Flow Computer
- Smith Meter® Net Oil Flow Computer TCP-NOC
- LACT Master Flow Computer with TCP-LU
- Fmc2 Flow Management Computer
- Smith Meter® Proximity Card Reader
- Smith Meter® GateMate

### SUBSEA MEASUREMENT – LIQUID, GAS AND CHEMICAL

- Smith Meter® Accuload III Controller
- Smith Meter® microLoad.net
- Smith Meter® microFlow.net Liquid Flow Computer
- Smith Meter® SyberTroll Flow Computer
- Smith Meter® Net Oil Flow Computer TCP-NOC
- LACT Master Flow Computer with TCP-LU
- Fmc2 Flow Management Computer
- Smith Meter® Proximity Card Reader
- Smith Meter® GateMate

- Ocean-flo Single Phase Flowmeter
# PRODUCT APPLICATION GUIDE

**Product/System**

## SYSTEMS

- Liquid Measurement Systems
- Gas Measurement Systems
- Floating Production Storage and Off-Loading Systems
- Liquid Control Systems
- Gas Control Systems

### LIQUID

<table>
<thead>
<tr>
<th>Liquid Measurement Systems</th>
<th>Smith Meter® Positive Displacement Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smith Meter® Sentry Series Turbine Meters</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® Guardsman Series Turbine Meters</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® Guardsman L Series Turbine Meters</td>
</tr>
<tr>
<td>Meters</td>
<td>Smith Meter® MV Series Turbine Meters</td>
</tr>
<tr>
<td></td>
<td>Turbine Meter Accessories</td>
</tr>
<tr>
<td></td>
<td>Coriolis Meters</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® Ultra Series™ Ultrasonic Flowmeters</td>
</tr>
<tr>
<td></td>
<td>Sening® MultiSeal Sealed Parcel Delivery System</td>
</tr>
<tr>
<td></td>
<td>Sening® NoMix Cross Over Prevention and Hose Supervision System</td>
</tr>
<tr>
<td></td>
<td>Sening® MultiLevel Level Gauging System</td>
</tr>
<tr>
<td></td>
<td>Sening® MultiFlow Truck Flow Computer</td>
</tr>
<tr>
<td></td>
<td>Sening® MultiControl Remote Control and Overfill Protection Amplifier</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® and Sening® Truck Meter Packages</td>
</tr>
<tr>
<td>Truck Meter Packages</td>
<td>Smith Meter® Bottom Loading Equipment</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® 200 Series Control Valves</td>
</tr>
<tr>
<td>Line Accessories</td>
<td>Smith Meter® Strainers, Air Purgers, Air Eliminators and Deaerators</td>
</tr>
<tr>
<td></td>
<td>Meter Provers and Pipeline Spheres</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® Accuload® III Controller</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® microLoad.net™</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® microFlow.net™ Liquid Flow Computer</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® SyberTrol® Flow Computer</td>
</tr>
<tr>
<td>Flow Computers and Electronics</td>
<td>Smith Meter® Net Oil Flow Computer TCP-NOC</td>
</tr>
<tr>
<td></td>
<td>LACTMaster Flow Computer with TCP-LU</td>
</tr>
<tr>
<td></td>
<td>Fmc²™ Flow Management Computer</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® Proximity Card Reader</td>
</tr>
<tr>
<td></td>
<td>Smith Meter® GateMate</td>
</tr>
</tbody>
</table>

### GAS

- MeasureMaster™ Dual Chamber Orifice Meters
- OrificeMaster™ Single Chamber Orifice Meters
- Venturi Meters and Flow Measurement Accessories
- MPU™ Series Ultrasonic Flowmeters (200, 600, 800 and 1200)
- Smith Meter® microFlow.net™ Gas Flow Computer
- Fmc²™ Flow Management Computer

### SUBSEA MEASUREMENT – LIQUID, GAS AND CHEMICAL

- ocean-flo™ Single Phase Flowmeter
<table>
<thead>
<tr>
<th>MARKET</th>
<th>Crude Oil and Gas Production</th>
<th>Crude Oil and Gas Transportation</th>
<th>Petroleum Refining</th>
<th>Refined-Product Transportation</th>
<th>Petroleum Marketing and Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FMC Technologies has the right solution for all petroleum liquids, custody transfer and control applications. Working in partnership with its customers, FMC assists with application know-how, as well as process and system design expertise through equipment specification, installation and start-up. Regardless of the application, FMC provides proven products with highly reliable and repeatable accuracy. In addition, FMC finds solutions for those unique special-purpose applications through its innovative, industry-leading measurement technologies.
The Right Solution for Your Liquid Measurement Application
Superior design, a wide range of proprietary technologies and unsurpassed knowledge of liquid petroleum custody transfer and control set FMC Technologies Measurement Solutions’ liquid measurement equipment apart from that of all competitors. From supply of individual meters and accessories to supply of complex, automated fully integrated measurement and product analysis systems, FMC offers technically superior liquid measurement products:

• Metering Products
  – Smith Meter® Positive Displacement Meters
  – Smith Meter® Guardsman, MVTM and Sentry Turbine Meters
  – Smith Meter® Ultra Series™ Ultrasonic Flowmeters
  – Coriolis Meters
  – Smith Meter® and Sening® Tank Truck Meter Products and Packages

• Automation and Controls
  – Smith Meter® AccuLoad®
  – Smith Meter® microLoad.net™
  – Smith Meter® microFlow.net™
  – Smith Meter® SyberTrol®
  – Fmc2® Flow Management Computer
  – Supervisor Supervisory Computer

• Provers and Related Equipment
  – Bidirectional
  – Unidirectional
  – Spheres and Accessories
  – Master Meters
  – Proving Tank

• Skid-Based Measurement Systems
  – Loading
  – Unloading
  – Blending

• Sensors
  – Temperature
  – Pressure
  – Density

• Line Accessories
  – Control Valves
  – Strainers
  – Air Eliminators
  – Deaerators
  – Air Purging Systems
liquid metering products

Smith Meter®
Positive Displacement

The Standard for Measurement Accuracy
The Smith Meter® Positive Displacement meter is the centerpiece of FMC Technologies Measurement Solutions’ vast liquid measurement product line, performing with unsurpassed accuracy and durability. Boasting high measurement stability and a low pressure drop, Smith Meter PD meters offer unmatched service life and ease of maintenance. From petroleum production to marketing to transportation, Measurement Solutions is the most trusted supplier of accurate and reliable Positive Displacement metering equipment.

Applications
• Petroleum production
• Pipeline custody transfer
• Leak detection
• Loading and unloading
• Bulk plants
• Inventory control
• Batch control
• Blending

Benefits
• Superior accuracy and measurement stability
• Low pressure drop
• Low operating cost
• Long service life

Steel Double Case Meters
Smith Meter double case Positive Displacement meters, the most accurate meters for volume measurement, utilize a direct-flow measurement principle that is virtually unaffected by variations in velocity and viscosity. Furthermore, they are engineered to operate with low pressure drop and low slippage for superior accuracy and stability.

Single Case Meters
Smith Meter single case Positive Displacement meters have been the choice for terminal and bulk plant operators since 1926. The unique rotary vane design provides unmatched accuracy, long-term measurement stability and years of maintenance-free performance. The streamlined nozzle design minimizes pressure drop, thereby reducing slippage and maximizing accuracy.
Conventional and Helical Turbine Meters

Conventional Turbine Meters
For pipelines, terminal load racks and crude oil service, the Smith Meter® turbine meter line provides the optimum solution.

Applications
- Crude oil and refined product pipelines
- Loading rack service
- Ship loading and unloading
- Inventory control
- Volume balance
- Leak detection

Benefits
- Rugged construction for long service life
- High accuracy over a wide viscosity range
- High-resolution pulse output
- Low maintenance for maximum cost-effectiveness
- Field-proven stability

Smith Meter® Guardsman Series Turbine Meters
Specifically designed for smaller pipelines where repeatability is required, the Guardsman ensures accurate measurement of low-lubricity fluids ranging from natural gas liquids to light fuel oils.

<table>
<thead>
<tr>
<th>GUARDSMAN SERIES*</th>
<th>Size</th>
<th>Max. Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inches</td>
<td>BPH (m³/h)</td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td>200 (32)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>400 (64)</td>
</tr>
<tr>
<td>LF3</td>
<td></td>
<td>600 (96)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>930 (148)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>1,700 (270)</td>
</tr>
</tbody>
</table>

* Available with Class 150, 300, 600 and 900 ANSI flanges.

Smith Meter® Guardsman L Series Turbine Meters
Engineered to precisely measure LPG, kerosene, ethanol or light fuel oils, Guardsman L meters provide the versatility of either horizontal or vertical installation for truck loading service.

<table>
<thead>
<tr>
<th>GUARDSMAN L SERIES*</th>
<th>Size</th>
<th>Max. Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inches</td>
<td>GPM (L/min)</td>
</tr>
<tr>
<td>1 (25)</td>
<td></td>
<td>80 (300)</td>
</tr>
<tr>
<td>1.5 (38)</td>
<td></td>
<td>130 (500)</td>
</tr>
<tr>
<td>2 (50)</td>
<td></td>
<td>250 (950)</td>
</tr>
<tr>
<td>3 (75)</td>
<td></td>
<td>700 (2,650)</td>
</tr>
<tr>
<td>4 (100)</td>
<td></td>
<td>1,200 (4,500)</td>
</tr>
</tbody>
</table>

* Available with Class 150 and 300 ANSI flanges.

(Continued on next page)
liquid metering products

Conventional and Helical Turbine Meters

Smith Meter® MV Series Helical Turbine Meters
With low pressure drop and a rugged bearing system, the MV Series is the preferred turbine meter for crude oil applications.

The unique helical rotor design of the Smith Meter MV Series Turbine Meters minimizes the effect of changes in viscosity for increased accuracy and repeatability. The sturdy rotor and mounting system are virtually immune to shock and pressure surges, translating into reduced maintenance requirements and long service life.

Applications
• Pipeline terminals
• LACT skids
• Marine terminals – loading/offloading
• Floating storage and offloading vessels (FSOs and FPSOs)
• Line balance
• Inventory control

Benefits
• Superior multi-viscosity test stand capabilities provide accuracy and performance verification
• Exclusive UPC Compensator delivers the highest accuracy over the widest flow and viscosity range
• Low pressure drop significantly reduces operating costs
• Rugged bearing system yields maximum reliability

<table>
<thead>
<tr>
<th>Size (Inches)</th>
<th>Flow Range* (BPH (m³/h))</th>
<th>Flange to Flange (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (75)</td>
<td>90-900 (14-140)</td>
<td>10.0 (254)</td>
</tr>
<tr>
<td>4 (100)</td>
<td>190-1,900 (30-300)</td>
<td>12.0 (305)</td>
</tr>
<tr>
<td>6 (150)</td>
<td>400-4,000 (64-640)</td>
<td>14.0 (356)</td>
</tr>
<tr>
<td>8 (200)</td>
<td>750-7,500 (119-1,190)</td>
<td>16.0 (406)</td>
</tr>
<tr>
<td>10 (250)</td>
<td>1,250-12,500 (199-1,990)</td>
<td>20.0 (508)</td>
</tr>
<tr>
<td>12 (300)</td>
<td>1,900-19,000 (302-3,020)</td>
<td>24.0 (610)</td>
</tr>
</tbody>
</table>

* Available with Class 150 and 300 ANSI flanges. Other types of end connection and flange ratings are available.
+ Minimum and maximum values indicated.

Available Turbine Meter Accessories
• Flow-straightening assemblies, sections and inserts
  – Conventional flow conditioners
  – High-performance flow conditioners
  – Strate plate
• Totalizer/rate meter
  – Model MMRT
  – Invalco 505 flow computer
• Preamplifiers
  – PA-6 preamplifier
  – AccuLert ID 2000 smart diagnostic pre-amp
• UPC compensators
• Presets
  – AccuLoad® III controller
  – microLoad.net®
• Flow computers
  – microFlow.net® liquid
  – SyberTrol®
  – Fmc²®

* Available with Class 150 and 300 ANSI flanges. Other types of end connection and flange ratings are available.
+ Minimum and maximum values indicated.
The Smith Meter® Ultra® Liquid Flowmeter is a six-path ultrasonic flowmeter with an on-board Signal Processing Unit (SPU) for custody transfer of petroleum products.

The Ultra® utilizes transit time measurement to provide highly accurate custody transfer measurement and is compliant with API MPMS Chapter 5.8 and OIML R-117-1. With no moving parts, the non-intrusive design requires little maintenance while offering a wide dynamic flow range, wide viscosity application range and low pressure loss.

Applications
• Pipelines
• Marine terminal loading and unloading
• Floating storage and offloading vessels (FSOs and FPSOs)

Benefits
• Custody transfer accuracy with high-speed processing for excellent repeatability and VPC algorithm for linearity over a wide operating range of product conditions
• Six paths for flow profile correction:
  – Four paths for flow profile correction
  – Two paths for swirl and cross-flow compensation

The Smith Meter® Ultra® Liquid Flowmeter is a four-path ultrasonic flowmeter with an on-board Signal Processing Unit (SPU) for highly accurate measurement of petroleum products. The FMC Smith Meter Ultra® is based on the extremely accurate Smith Meter Ultra® for custody transfer applications, and has four straight measurement paths in comparison to the Ultra®.

The Ultra® is designed to be the most accurate meter for non-custody transfer applications like allocation, inventory control and leak detection. The meter is available in two versions; one without the advanced Velocity Profile Correction (VPC) for refined products and light crude oils; and one with the VPC for medium to heavy crude oils.

Applications
• Line balance
• Inventory control
• Allocation
• Leak detection

Benefits
• Field-proven electronics
• Real-time diagnostics
• Up to 20 times less sensitive to outside noise interference than other ultrasonic meters
• In-line transducer replacement does not require special tooling or process

<table>
<thead>
<tr>
<th>Size</th>
<th>Max. Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BPH (m³/h)</td>
</tr>
<tr>
<td>6 (150)</td>
<td>4,500 (720)</td>
</tr>
<tr>
<td>8 (200)</td>
<td>8,000 (1,270)</td>
</tr>
<tr>
<td>10 (250)</td>
<td>12,500 (1,990)</td>
</tr>
<tr>
<td>12 (300)</td>
<td>19,000 (3,020)</td>
</tr>
<tr>
<td>16 (400)</td>
<td>28,000 (4,450)</td>
</tr>
<tr>
<td>20 (500)</td>
<td>43,000 (6,835)</td>
</tr>
</tbody>
</table>
liquid metering products

Mass Flow and Density
Coriolis Meters

Proline® Promass F Coriolis Meters
High accuracy, low pressure drop and diverse interface capabilities make the Proline Promass F Coriolis mass flow and density meters the perfect solution for many petroleum metering applications. From wellhead to refined-product distribution, any measurement requirement can be managed with efficiency and precision. High sensitivity, zero stability and modest overall cost of ownership make Promass F the first choice for applications that demand custody transfer accuracy and repeatability.

With a variety of outputs, the Promass F can be interfaced to nearly any flow computer or control device. FMC presets offer additional data communications services to Promass F meters, for optimum integration.

Benefits
• Wide operating ranges
• Increased immunity to common pipeline noise
• Immunity to pipeline loading stress
• Routine re-zeroing of the meters is not necessary
• Compact, self-draining design
• Smart electronics with digital display and interface
• Multivariable-flow, density and temperature measurement
• Temperature changes do not affect zero point stability
• Life cycle cost savings – maintenance free with no moving parts and no wear and tear

Applications
Applications for the petroleum market, from the wellhead to the refinery gate including the production field and crude pipeline include:

• LACT units
• Tank truck gas production
• Crude oil, LPG, asphalt and bitumen used at pipelines and terminals
• Marine terminals loading/unloading
• Railcar loading/unloading
• Floating storage and offloading vessels (FSO and FPSOs)
• Refining
• Terminals and distribution (tank truck loading, locomotive, marine and aircraft refueling)
• Lube plants
When operators select preset solutions for marketing terminals, the overwhelming choice is the Smith Meter® AccuLoad® III family of products. With the latest configurations, including the Split Architecture System and the AccuLoad II-to-III Upgrade package, terminal operators have even more options for maximum load control and flexibility.

AccuLoad III has ethernet and serial communications network compatibility for direct link to Terminal Automation Systems and the Smith Meter Card Reader. Ethernet connectivity complies with TCP/IP standards. Other communication features include modbus protocol, network printing and Smith Meter® Sening® BlueTooth® connectivity or meter communication.

Applications
- Preset loading, unloading and batching for trucks, railcars and ships
- Blending capabilities, management of grounding, overfill and additive control

Smith Meter® AccuLoad® III Controller
The AccuLoad III product line provides the power, flexibility and configurability required for today’s highly efficient and regulated terminals. By offering a wide variety of loading arm configurations – mixing blend arms with straight product – AccuLoad III maximizes efficiency and product throughput like never before.

AccuLoad III offers a host of product blending configurations. Up to six products can be blended via either sequential or ratio methods. Enhanced additive controls include piston, standard metered or smart, as well as higher-volume additive with flow control.

(Continued on next page)
AccuLoad® III Controller

AccuLoad® III-S or Q
AccuLoad III with ALX firmware is a microprocessor-based instrument that can be configured to control one to six loading arms, as either a blending or straight product device.

- AccuLoad III-S
  - Up to three single- or dual-pulse product meter inputs
  - Up to 14 additive meter inputs
- AccuLoad III-Q
  - Up to six single- or dual-pulse product meter inputs
  - Up to 24 additive meter inputs

AccuLoad® III-N4
AccuLoad III-N4 is a microprocessor-based instrument that is capable of handling up to two arms and three meters, and is approved for Class I, Division 2, Groups C&D locations.

- One- or two-arm simultaneous operation
- Up to three single- or dual-pulse product meter inputs
- Up to four additive meter inputs with local I/O and up to 24 additive meter inputs with remote I/O

AccuLoad® III-SA
The AccuLoad III Split Architecture System is a multiple-arm, multiple-meter measurement system allowing an entire lane or facility of up to 18 loading arms and 24 meters to be controlled and monitored with one system. Its components include a Man-Machine Interface (MMI) and Flow Control Module (FCM).

- Up to 24 single- or dual-pulse product meter inputs
- Up to 56 additive meter inputs with local I/O and up to 96 additive meter inputs with remote I/O
- Class 1, Division 2, Group C&D approved for general purpose rack mountable enclosure allows control room installation for any AccuLoad configuration

Upgrades
The AccuLoad Upgrade provides AccuLoad I and II users the latest technology with minimal installation costs.
Smith Meter® microLoad.net™
This dynamic breakthrough for single product loading application, microLoad.net, is a microprocessor-based instrument designed to monitor and control single products in straight loading applications. The units can operate either as a stand-alone instrument or be part of a system where they communicate with an automation or SCADA system.

Applications
- Bulk plants
- Aircraft loading
- Marine terminals
- Processing installations
- Tank farms

The Smith Meter microLoad.net is a preset that is easy to use and configurable to any application.

Efficient System Monitoring and Easy Process Management
- Continuously monitors system-critical functions
- Automatic volume correction for temperature per the API and ISO tables and the expansion coefficients for chemicals

Flexible and Configurable Programming and Reporting
- Communicates with Promass F Coriolis meter
- Ethernet and serial network compatible
- Multi-drop communication ports for maximum system expansion
- Smith Meter or modbus protocols for bi-directional communications or TCP/IP
- Boolean and algebraic programmable software for easy customization
- Customizable report formats to fit the needs of the application
- Options for multiple languages, customized messages, and text communication
- Customizable formats for inputs and outputs
- Event log and audit trail

Built for Safety and Reliability
- Multi-level security access
- Explosion-proof housing
- OIML-compliant display offers prolonged visibility during unplanned power outages
liquid metering products

Electronics

Gate Entry

**Smith Meter® Proximity Card Reader**
The Smith Meter Proximity Card Reader offers terminal operators an alternative for maintaining control and security by providing a reliable method of identifying drivers and users by communicating directly with AccuLoad® III or the terminal’s automation system.

Configured to operate as either a gate reader or an island reader, the card reader can be supplied in a general-purpose enclosure or in an explosion-proof enclosure that is designed and approved for Class I, Division I, Groups C&D locations. The cards for the reader have also been approved to be used in Class I, Division I, Groups C&D locations and may be the only cards on the market approved for use in this environment.

**Smith Meter® GateMate Software**
The Smith Meter GateMate is a companion software tool designed to work in conjunction with the Smith Meter Proximity Card Reader. The GateMate software will allow the Smith Meter Proximity Card Reader to work in a stand-alone application. The software can be installed on any PC and requires only a communications line to the Card Reader. GateMate allows a Smith Meter Proximity Card Reader to be installed at the gate (entry or exit) of a load rack and provide authentication for entry accessibility. The software can be configured to manage driver databases, manual opening and closing of the gate, time stamped logs and much more. The software is user friendly; setup takes only a few minutes, and provides the most efficient solution to terminal accessibility needs.
Smith Meter® microFlow.net™ Liquid Flow Computer
The Smith Meter microFlow.net Liquid is a flow computer for single product monitoring of continuous flow applications.

Applications
• Pipelines
• Marine terminals

Process Management
• Continuously monitors system-critical functions
• Automatic volume correction for temperature per the API and ISO tables and the expansion coefficients for chemicals
• Sampler support
• Batch recalculation
• Communications with Ultra Series™ ultrasonic flowmeters

Flexible, Configurable Programming and Reporting
• Ethernet and serial network compatible
• Multi-drop communication ports for maximum system expansion
• Smith Meter or modbus protocols for bi-directional communications either through serial port, ethernet or TCP/IP
• Boolean and algebraic programmable software for easy customization
• Customizable report formats to fit the needs of the application
• Options for multiple languages, customized messages, and text communication
• Customizable formats for inputs and outputs
• Event log and audit trail

Built for Safety and Reliability
• Multi-level security access
• Explosion-proof housing
• OIML-compliant display offers prolonged visibility during unplanned power outages
liquid metering products

Flow Computers
SyberTrol® and TCP

Smith Meter® SyberTrol® Flow Computer
The power of custom configuration makes the Smith Meter SyberTrol the industry’s most advanced custody transfer flow computer. Its unique split architecture design provides ease of installation and cost savings by allowing mounting at the metering skid or control room.

The many unique features of SyberTrol make it the ideal choice for high accuracy process applications and the custody transfer of petroleum liquids.

Applications
• Pipelines, marine facilities, product batching and proving

Benefits
• Custom configurable I/O to meet your unique requirements for diverse system arrangements
• Four multi-drop programmable communication ports for maximum flexibility and system extension
• Five-level security system provides measurement integrity
• Rugged construction allows operation in most environments
• SyberMate software enables quick and easy setup and customization

Features
• Peer-to-peer communications
• Redundancy
• Flow balancing for proving

Smith Meter® LACTMaster Flow Computer
The Smith Meter LACTMaster Flow Computer (TCP-LU) makes it possible to automate LACT systems with confidence.

Applications
• Tank storage transfer, pipeline transfer

Features
• Automatic measurement, control, temperature compensation and data transfer in one unit
• PD or turbine meter pulse input compatible
• Online sampling and BS&W monitoring
• Instantaneous data recording and storage

Smith Meter® Net Oil Flow Computer (TCP-NOC)
The Smith Meter Net Oil Flow Computer is a well test device used to determine the quality and flow of oil produced at a given well. TCP-NOC utilizes industry-proven formulas, to calculate net oil and water in the flow stream for up to 50 wells per unit

Applications
• Oil gathering operations

Features
• Monitors temperature and density
• Reports three product flow rates: emulsion, oil and water
• Operates in two modes: continuous and well test
• Provides real-time information on flows in progress via dynamic displays
liquid metering products

Line Accessories
Control Valves, Strainers and Air Eliminators

Measurement Solutions offers a complete line of valves and line accessories that can be used with Smith Meter® products.

**Smith Meter® 200 Series Control Valves**

Smith 200 Series control valves feature hydraulically operated, diaphragm-actuated globe valves and high-performance wafer sphere valves. Flow control is accomplished by using fluid line pressure or an external pressure source to actuate the valve.

**Set-Stop Valve Packages**

- **Model 210**
  - Sizes: 2” to 6”
  - Diaphragm-globe valve, steel body
  - Digital electrohydraulic
  - Operating pressures up to 285 psig (1965 kPa)
  - Viscosities up to 40 cP
  - For use with electronic preset controllers

- **Model 215**
  - Wafer-type (3” to 12”) or ball type (3” or less), steel body
  - Digital electrohydraulic
  - Externally activated air or hydraulic
  - Operating pressures up to 285 psig (1965 kPa)
  - High-viscosity liquids
  - For use with electronic preset controllers
  - Wide turn-down range
  - Optional hydraulic power unit

**Valve Pilots**

Valve pilots are available for block valves, flow limiting, pressure limiting, pressure sustaining, pressure relief, pressure reducing and thermal relief valves.

- Compact design and mechanical simplicity
- Low maintenance costs
- In-line serviceability
- No external packing gland

---

### 200 SERIES CONTROL VALVES

<table>
<thead>
<tr>
<th>Size</th>
<th>Nominal Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches (mm)</td>
<td>USGPM (L/min)</td>
</tr>
<tr>
<td>2 (50)</td>
<td>150 (550)</td>
</tr>
<tr>
<td>3 (75)</td>
<td>500 (1,900)</td>
</tr>
<tr>
<td>4 (100)</td>
<td>800 (3,000)</td>
</tr>
<tr>
<td>6 (150)</td>
<td>1,200 (4,600)</td>
</tr>
</tbody>
</table>

**Smith Meter® Strainers**

Metering system components require protection against the damage potential of dirt and debris. Smith Meter pipeline strainers provide this protection for 4” and larger turbine and Positive Displacement meter applications. Standard features include: 304 stainless steel perforated plate basket, blind flange-type cover with lifting lug, ½” NPT differential pressure taps, NPT vent and drain taps and a basket seal.

- Pipeline strainers designed and fabricated per ANSI B31.4. Available in sizes 4” to 16” (150 to 600 lb typical). Models GLS are specifically designed for European requirements (1.5” to 16”).
- In-line carbon steel strainers with streamlined flow path for lower pressure drop (2” to 8” and 150 to 300 lb typical).
- E-Type strainers are typically used in loading and off-loading systems (U.S.: 3” to 4”; European: 2” to 4”).

**Smith Meter® Air Eliminators**

Complete elimination of air or gas from liquids is essential for accurate metering. Choose the Smith Meter Model AR air eliminators to effectively release air or gas before they are passed through the meter, causing inaccurate measurement.
liquid metering products

Terminal Line Accessories
Strainers, Air Purging Systems and Deaerators

FMC Technologies Measurement Solutions offers Strainers, Air Purging Systems and Deaerators for the European Market that can be used with Smith Meter® products.

Strainers
Strainers are necessary to protect the metering and the downstream equipment against dirt and contaminants. They are available as a standard in-line design for loadrack applications or large flow rates with excessive filtration area to minimize pressure drops in the event of plugging risk.

Air Purging Systems
Smith Meter air purging systems are a combination of a strainer and air eliminator. This provides excellent metering protection with less space requirements.

Applications
- Ideal for truck and rail loading
- Ensures accurate measurement for all metering technologies
- Protects the metering system from dirt, contaminants and slugs of air

Benefits
- Low pressure drop to maintain flow rates
- Cost effective

Deaerators
Smith Meter deaerators release air from the metering system which is essential for accurate measurement.

Applications
- Ensures accurate measurement for all metering technologies
- Stabilizes operation for Coriolis and ultrasonic metering
- Protects the metering system from slugs of air
- Operates with a mechanical or electrical air release system
- Low pressure drop to maintain flow rates

Benefits
- Ensures accurate measurement for all metering technologies
- Stabilizes operation for Coriolis and ultrasonic metering
- Protects the metering system from slugs of air
- Operates with a mechanical or electrical air release system
- Low pressure drop to maintain flow rates

### Strainers

<table>
<thead>
<tr>
<th>Type</th>
<th>Max. Flow</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>50E-20 to 100E-20</td>
<td>10 to 100 bar</td>
<td></td>
</tr>
<tr>
<td>GLS</td>
<td>60 to 2, 100 m/h</td>
<td>10 to 100 bar</td>
</tr>
</tbody>
</table>

### Air Purging Systems

<table>
<thead>
<tr>
<th>Type</th>
<th>Max. Flow</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>APS25</td>
<td>150 m/h</td>
<td>16 bar</td>
</tr>
<tr>
<td>APS35</td>
<td>210 m/h</td>
<td>16 bar</td>
</tr>
</tbody>
</table>

### Deaerators

<table>
<thead>
<tr>
<th>Type</th>
<th>Max. Flow</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDR</td>
<td>60 to 2,100 m/h</td>
<td>10 to 25 bar</td>
</tr>
</tbody>
</table>
liquid metering products

Marketing Terminal Systems
Loading, Unloading and Blending Systems

One-Step Solutions
In the ever-expanding industry of biofuels production and distribution, a thorough knowledge of the special product characteristics and blending considerations associated with biofuel handling is required to meet industry standards for petroleum product distribution. FMC Technologies has the experience and petroleum industry expertise to properly blend biofuels with traditional fuels ensuring custody transfer accuracy requirements are met. From design to installation and throughout the life of your equipment, FMC ensures that your system runs at peak performance with the accuracy and performance you have come to expect from Smith Meter® products.

Because each installation’s success is dependent on the seamless integration of new equipment and electronics with the automation and infrastructure that is currently on site, FMC provides cost effective system integration with a flexible approach and open architecture products such as Smith Meter AccuLoad.net.

FMC offers complete system fabrication that complies with all internal, logistical and Weights and Measures requirements, using only Smith Meter equipment and FMC electronics to ensure custody transfer accuracy and performance. FMC is the only supplier worldwide who can access, without bias, all required state-of-the-art technology components from its own product line. This technological spectrum coupled with reliable services makes FMC the preferred business partner for customers and end-users all around the world.

FMC Technologies has the capability to provide complete systems, skid mounted for loading, unloading and blending. Skids and related equipment comply with worldwide standards such as: API MPMS Chapter 6.2 (Loading Racks), NIST Handbook 44 Section 3.30, Pressure Equipment Directive 97/23/EC (PED), Directive 94/9/EC Equipment and Protective Systems intended for use in potentially explosive atmospheres (ATEX), National Weights and Measures Directives (W&M) and especially the New European Measurement Instrumentation Directive 2004/22/EG (MID) now statutory in the European Community.

(Continued on next page)
The basic system includes the entire measuring section from the supply line inlet connection to the air purger systems required by Weights and Measures regulations, and ends at the control valve exit or, optionally, at the top or bottom loading arm coupling. For markets changing from top to bottom loading standard, both loading techniques can be combined into one system. Standard modules are designed for typical operating ranges of petroleum tank truck flow rates from 250 liters/min to 2,500 liters/min. Customized systems are available upon request.

Whether you require loading, unloading or blending systems to complete your terminal’s current functionality, FMC Technologies provides complete turnkey services:

- Marine, truck and rail facilities
- Design flexibility and wide capabilities for:
  - Blending systems: biodiesel and ethanol
  - Asphalt and additive systems
  - Loading and unloading systems
  - Complete product load systems/lanes
- Safety and access equipment integration
- In-house design, engineering support and testing facilities
- Project management
- Formalized and documented quality plan and process
- Qualified and certified welders
- Start-up and commissioning
- Outstanding customer service

FMC Technologies loading, unloading and blending system modules are based on the experience and quality of the Smith Meter® brand. The system modules have been designed to fulfill internal and logistical requirements and to comply with all Weights and Measures requirements.
Sening® Bottom Loading

Sening® Bottom Loading and Truck Meter Equipment
Sening offers a complete range of proven mechanical products and systems for bottom loading and truck metering applications which can be combined with state-of-the-art electronic technology.

Conforming to API1004 and European CEN requirements, the Sening range of bottom loading and vapor recovery components brings safety and environmental protection to petroleum tank truck transportation.

Whether the application requires an individual component or a complete bottom loading system, FMC can supply the appropriate solution for any bottom-loading operation.

Overfill Protection
- Pneumatic level sensors
- Electronic overspill protection for delivery to customer tanks

Vapor Recovery
- Compartment vent valves
- Flame arrestor and vapor hood
- Vapor recovery adaptor and valves

Pneumatic Control Equipment
Includes individually designed switches and control components.

Valves, Sight Glasses, Flanges, Couplings and Fittings
Includes foot valves and discharge valves, API couplings and other line accessories and fittings.
Truck Meter Packages
The Smith Meter® and Sening® truck meter packages are designed to satisfy all applicable legal accuracy requirements and maintain extended reliability under severe operating conditions. Packages are engineered to be manually operated or fully automated, based on the optional equipment selected, including combination air eliminators/strainers, mechanical counters, preset controllers and preset valves. Because of their modular component design and arrangement flexibility, Smith Meter and Sening truck meter packages can be fitted into nearly any installation.

- Sening GMVT and GMVZ series compact meters with gas extractor
- Stand-alone gas extractors
- Mechanically or pneumatically activated discharge valves
- Advanced product drain system

Aviation Meters
Smith Meter non-ferrous single case aircraft fueling meters operate under the same proven principle that minimizes pressure drop across the measuring chamber to maximize accuracy and service life. Available in both straight-through or right-angle flow paths, the Smith Meter PD meter is the ideal choice for aircraft fueling applications.

### TRUCK METER PACKAGES

<table>
<thead>
<tr>
<th>Model</th>
<th>Size (Inches)</th>
<th>Max. Flow Rate GPM (L/min)</th>
<th>Max. Working Pressure psig (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T11</td>
<td>2 (50)</td>
<td>100 (375)</td>
<td>150 (1,034)</td>
</tr>
<tr>
<td>T20</td>
<td>3 (75)</td>
<td>240 (900)</td>
<td>150 (1,034)</td>
</tr>
<tr>
<td>T40</td>
<td>4 (100)</td>
<td>500 (1,900)</td>
<td>75 (517)</td>
</tr>
<tr>
<td>GMVT</td>
<td>3 (75)</td>
<td>214 (800)</td>
<td>150 (1,034)</td>
</tr>
<tr>
<td>GMVZ</td>
<td>4 (100)</td>
<td>265 (1,000)</td>
<td>150 (1,034)</td>
</tr>
<tr>
<td>GMVZ</td>
<td>4 (100)</td>
<td>265 (1,000)</td>
<td>150 (1,034)</td>
</tr>
</tbody>
</table>

* With MID system approval depending on configuration
** Available with mechanical counter and printer

### AVIATION METERS*

<table>
<thead>
<tr>
<th>Model</th>
<th>Size (Inches)</th>
<th>Max. Flow Rate GPM (L/min)</th>
<th>Max. Working Pressure psig (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-11-NF (Angle Type)</td>
<td>2 (50)</td>
<td>100 (375)</td>
<td>150 (1,034)</td>
</tr>
<tr>
<td>T-20-NF (Angle Type)</td>
<td>3 (75)</td>
<td>250 (915)</td>
<td>150 (1,034)</td>
</tr>
<tr>
<td>SD or ASD-3-NF</td>
<td>3 (75)</td>
<td>420 (1,600)</td>
<td>150 (1,034)</td>
</tr>
<tr>
<td>SF or ASF-4-NF</td>
<td>4 (100)</td>
<td>800 (3,000)</td>
<td></td>
</tr>
<tr>
<td>ASG 100</td>
<td>4 (100)</td>
<td>1,200 (4,600)</td>
<td></td>
</tr>
<tr>
<td>SG or ASG-6-NF</td>
<td>6 (150)</td>
<td>1,200 (4,600)</td>
<td></td>
</tr>
</tbody>
</table>

* Maximum working pressure: 150 psig (1,034 kPa)

### Discharge Pumps
Centrifugal-type and self-priming truck pumps designed for the delivery of light petroleum products featuring low maintenance and long service operation.

### Additive Injection System
Pneumatically operated piston pumps for on-truck fuel oil blending, controlled by MultiFlow flow computer or simply by meter pulses.

### Available PD Meter Accessories
- Pulse transmitters
  - E pulse transmitter
  - UPT high-resolution transmitter
  - LNC pulse transmitter
- Counters, preset counters and printers
  - LNC (Large Numeral Counter)
  - LNC/TP (Large Numeral Counter and Ticket Printer)
  - Push-button set-stop counter
- Automatic temperature compensators
  - ATC and ATG (Mechanical-Type)
- Electronic presets
- MultiFlow – a flow computer for accurate volume registration of liquids, temperature compensation and invoicing
Sening® tank truck products and systems offer state-of-the-art technology for mission-critical solutions to the highest industry standards. Over a century of experience has provided F.A. Sening with the know-how to design innovative, customized solutions for fuel oil distribution as well as service station, industrial and bulk delivery. A full range of electronic and mechanical components and systems, combined with quality Smith Meter® products, allow Sening’s tank truck systems to deliver unsurpassed accuracy and safety.

**Sening® Electronic Tank Truck Systems**
Sening electronic products and systems have set the standard in petroleum supply-chain management. They offer customized solutions to many of the issues occurring in supply-chain management, such as product loss, product contamination, crossovers, safety and environmental issues, electronic monitoring, accountability, and data communication between truck and external electronic devices (depot – service station – office). At the same time they reduce loading and unloading times, providing fast turnaround, which allows for trucks to be on the road for 24-hour service.

All Sening systems are modular in design, enabling cost-effective solutions tailored to the changing needs of the market.

**MultiSeal Electronic Product Security and Monitoring System**
Sening’s MultiSeal system provides product security with electronic monitoring of loading and discharge valves. Its flexible design allows custom configuration of standard components for Sealed Parcel Delivery (SPD) applications, which can be combined with the Sening NoMix cross over prevention technology.

**NoMix Cross Over Prevention and Hose Supervision System**
Fully featured system for petroleum product distribution utilizing NoMix hose communication technology to prevent crossovers when loading and unloading tank trucks. The system fulfills VOC directive and water protection legislation for hose supervision.

The system uses NoMix hose communication technology to prevent crossovers when loading and unloading tank trucks.

**MultiFlow**
A flow computer for accurate volume registration of liquids, temperature compensation and invoicing.

**MultiControl**
A remote control and overfill protection system used in conjunction with MultiFlow for fuel oil delivery.

**MultiLevel**
A level gauging system for volumetric measurement of liquid petroleum products.

**EMIS**
Interface to allow communication between tank truck systems and business management systems.
From supply of individual meters and accessories to the supply of complex, fully integrated measurement and product analysis systems, FMC Technologies offers technical expertise and superior gas measurement products.
With unequalled technical experience and expertise, FMC Technologies provides gas measurement solutions of the highest quality, accuracy and performance. If your application requires a simple, reliable orifice fitting or the most complex and customized integrated measurement system, FMC has the right products, complete project management capabilities, support and services to provide the most efficient and cost-effective solutions, including:

- MPU™ Series Ultrasonic Flowmeters
- Orifice Meters
- Flow Nozzles
- Meter Tubes
- Venturi Tubes
- Orifice Flange Unions
- Flow Computers
- Other Gas Conditioning Accessories and Ancillary Services
gas metering products

Gas Ultrasonic Flowmeters

MPU™ Series

FMC Technologies’ MPU™ Series Gas Ultrasonic Flowmeter is built for long-term accuracy and reliability. The meter electronics and communication options allow for easy system integration. Leading-edge technologies include self-diagnostic smart software and are designed and tested in accordance with AGA 9, NORSOK, NACE, CRN, PED, ASME B31.3 and B31.8. The MPU 1200 and 800 are suitable for fiscal metering of dry, high-pressure and non-condensing gases. The MPU 200 is ideal for applications with lower accuracy requirements.

The MPU series of ultrasonic flowmeters interfaces easily with field-mounted flow computers, distributed controls, SCADA systems or as integral components to a metering system.

Applications
• Onshore/offshore gas custody transfer metering
• Pipeline bidirectional measurements
• Gas terminals and mixing stations
• Gas power plants
• Pipeline junctions
• Compressor stations
• City gate facilities
• Ethernet

Benefits
• Profiles axial and transverse flows, providing higher accuracy and greater flow turndown ratios
• Zero stability, no drift or ∆T correction with reciprocity in the design
• Advanced signal processing to handle system noise (SNR 0.1:1)
• Winscreen advanced self-diagnostic software
• Titanium encapsulated transducers can be replaced without flow interruption or loss of reading measurement
• Up to 60% cost, space and weight savings compared to conventional metering devices

MPU 1200 Ultrasonic Gas Flowmeter
The MPU 1200 Series B Ultrasonic Gas Flowmeter is a six-path ultrasonic meter with non-intrusive and flush-mounted transducers providing undisturbed and accurate measurement of gas flow. Six paths give this meter unique functionality to measure transverse velocity components and compensate the axial velocity for more accurate measurement over the flow range. Accuracy with dry calibration: ≤±0.5% of measured value; with flow calibration: ±0.1% of measured value.

MPU 800 Ultrasonic Gas Flowmeter
The MPU 800 Series B Ultrasonic Gas Flowmeter is a four-path meter with the best repeatability. It is the most rugged and dependable meter on the market featuring the most advanced electronics package. Accuracy with dry calibration: ≤±0.5% of measured value; with flow calibration: ±0.1% of measured value.

MPU 600 Ultrasonic Gas Flowmeter
The MPU 600 Series B Ultrasonic Gas Flowmeter is a three-path meter and is best applied in more stable flow conditions where transverse velocity components are not present. Accuracy with dry calibration: ≤±0.7% of measured value; with flow calibration: ±0.3% of measured value.

MPU 200 Ultrasonic Gas Flowmeter
The MPU 200 Series B Ultrasonic Gas Flowmeter is a single-path meter. It is an excellent choice as a backup meter to the MPU 1200 or 600, as a check meter or in applications where reliability is of highest priority.
gas metering products

Differential Pressure Meters

Orifice Meters

OrificeMaster™
Single Chamber Orifice Fitting
OrificeMaster is engineered to ensure complete safety, is in compliance with API and AGA, has a simple design and is economical. Its single chamber design allows for single orifice plate inspections when the process line can be shut down or bypassed. The simple, yet effective design enables the OrificeMaster to be installed either vertical or horizontal, with no fitting changes required.

Benefits
- All parts can be replaced without removing the fitting from the line
- Slip-lock design prevents cover plate blow-off in the event the line has not been depressurized
- Tested for positive plate sealing, pressure tap integrity, seal protrusion and eccentricity
- Meets all API 14.3 Part 2 (AGA 3) and ISO 5167 industry specifications and tolerances
- 100% inspection and testing with documentation
- Sizes ½” through 38” (and larger, if required) can be mounted at any angle
- Can be cast in standard and exotic materials
- Discharge accuracy of ±1%

Highest Measurement Standards
Both OrificeMaster™ and MeasureMaster™ are designed in accordance and are in compliance with the latest editions of:
- PED 97/23/EC
- API 14.3, Chapter 14 Natural Gas Fluids Measurement, Section 3 Concentric, Square-Edged Orifice Meters (AGA Report No. 3, American Gas Association)
- GPA 8185-90, Part 2, Gas Processors Association
- ISO 5167-1:2003, applicable to fittings 4” and larger
- BS 1042, applicable to fittings smaller than 4”

(Continued on next page)
MeasureMaster™
Dual Chamber Orifice Fitting
MeasureMaster is engineered and manufactured by FMC to ensure complete safety and simplicity of operation and economy, and is in compliance with API and AGA. For maximum operational stability and efficiency, its design allows regular orifice plate inspections without interrupting product flow.

Benefits
• Designed to allow inspection or replacement of the orifice plate without interrupting the flow
• All replacement parts can be changed without removing the fitting from the line
• Slip-lock design prevents cover plate blow-off in the event the upper chamber has not been depressurized
• Tested for positive plate sealing, pressure tap integrity, seal protrusion and eccentricity
• Meets stringent requirements of the latest API 14.3 Part 2 (AGA 3) and ISO 5167 specifications and tolerances
• Thorough and complete inspection and testing with documentation
• Sizes 2” through 48” (and larger, if required) can be mounted horizontal or vertical
• Can be cast in standard and exotic materials
• Discharge accuracy of ±1%
Differential Pressure Meters

Venturi Tubes

FMC Technologies Venturi Tubes are manufactured to comply with the exact needs of the client. Venturi Tubes are available in long and short form, depending upon accuracy requirements. Venturi Tubes are virtually maintenance free as there are no internal seals or moving parts. They can be used to measure a wide variety of applications such as air, gas, vapor, liquid, steam, sludge and slurry.

FMC Technologies Venturi Tubes are the right choice when specialized flow measurement is required. Custom designed and engineered to cover a wide range of applications and measurement needs, FMC’s Venturi Tubes provide accurate, economical and efficient flow measurement with minimal permanent pressure loss. While they are primarily used in low static line pressure applications where high-pressure recovery is essential, FMC’s Venturi Tubes are ideal for measurement of viscous flows and flows containing suspended solids.

Benefits

- Maintenance free – no moving parts
- Mounted through any angle (vertical or horizontal)
- Can be used to measure a variety of mediums
- High-pressure recovery and low permanent pressure loss

- Available in 2” to 60” sizes (larger sizes available upon request)
- Available in a variety of standard and exotic materials
- Meets all ISO 5167-4 and ASME MFC-3M industry specifications and tolerances
- Short and long form (15° or 7° convergent cone) options
- Cast, machine bar and rolled plate versions available
- Discharge accuracy of ±1%

Accuracy

Each FMC Venturi Tube has a coefficient of discharge accuracy of ±1% though greater accuracy can be obtained by calibrating the Venturi Tubes in a test laboratory. FMC Measurement Solutions will calibrate the Venturi Tubes at the customer’s request.

FMC Venturi Tubes have wide range capability and will operate down to 200,000 pipe Reynolds number. Laboratory flow calibrations below 200,000 pipe Reynolds number are recommended.

Measurement Standards

FMC Venturi Tubes are manufactured in strict accordance with the latest editions of:

- ISO 5167-4: 2003
- ASME MFC-3M: 2004
Differential Pressure Meters
Unions, Meter Tubes and Accessories

Orifice Flange Unions are engineered by FMC and represent the entry level for DPM measurement equipment. As an economical alternative to an OrificeMaster™, Orifice Flange Unions also provide an accurate and convenient orifice fitting. All flanges are primarily manufactured in accordance ASME B16.36, though can be manufactured to other standards if required.

**Benefits**
- Most cost efficient method of orifice measurement with simple operating procedures
- All parts can be replaced, though the line would need to be shut down and split
- Meets all API 14.3 Part 2 (AGA) and ISO 5167 industry specifications and tolerances
- No size or pressure limitations apply
- Can be supplied in standard and exotic materials
- Discharge accuracy of ±1%

**Meter Tubes**
FMC Technologies Meter Tubes are manufactured in accordance with AGA 3, ISO 5167 and MFC-3M. They are the ideal addition to any FMC differential pressure meter. Engineered and manufactured to incorporate the client’s specific requirements for upstream and downstream measurement, the meter tubes can include additional components such as flow conditioners, pressure and temperature and density take off points.

**Flow Measurement Accessories**

**Straightening Vanes and Flow Conditioners**
Whether choosing weld fabricated tube bundles from steel or stainless steel tubing, FMC Measurement Solutions straightening vanes are made to AGA 3 and ISO specifications for any pipe size. They are available in flanged and pin-type configurations. Flow Conditioners are made from stainless or steel alloy variants made in accordance with ISO 5167 and PAI 14.3 Part 2 (AGA 3). They can be offered in both pin type and flanged configurations for ease of assembly.

**Restriction Orifice Plates**
FMC’s Restriction Orifice Plates are used in applications where line pressure needs to be reduced to a specific pressure drop.

**Restriction Orifice Unions**
Restriction Orifice Unions are like orifice single plates, but supplied with orifice flanges and accompanying bolting and gaskets.

**Multi-Plate Restriction Orifice Spools**
In extreme pressure drop applications several plates at varying bore diameters are positioned within a spool piece allowing required drops to be achieved where a single plate offering would not suffice.
Smith Meter® microFlow.net™ Gas
Flow Computer
The Smith Meter microFlow.net Gas is a flow computer for single product monitoring of continuous flow applications.

Process Management
- Continuously monitors system-critical functions
- Automatic volume correction for temperature per the AGA and ISO tables and the expansion coefficients for chemicals
- Sampler support
- Batch recalculation

Flexible, Configurable Programming and Reporting
- Ethernet and serial network compatible
- Multi-drop serial and ethernet communications ports for maximum system expansion
- MPU™ Series ultrasonic flowmeter communications
- Smith Meter or modbus protocols for bi-directional communications
- Boolean and algebraic programmable software for easy customization
- Customizable report formats to fit the needs of the application
- Options for multiple languages, customized messages, and text communication
- Customizable formats for inputs and outputs
- Event log and audit trail

Built for Safety and Reliability
- Multi-level security access
- Explosion-proof housing
- OIML-compliant display offers prolonged visibility during unplanned power outages

Applications
- Onshore/offshore gas custody transfer metering
- Pipeline bidirectional measurements
- Gas terminals and mixing stations
- Gas power plants
- Pipeline junctions
- Compressor stations
- City gate facilities
FMC Technologies delivers technical superiority with a complete range of liquid and gas custody transfer solutions. Combining this capability with industry leading subsea production equipment and systems, FMC Measurement Solutions has developed the ocean-flo™ single phase flow meter.

The ocean-flo™ has been designed to provide significant advantages over existing methods for measuring recovery enhancing media introduced into offshore production wells. In addition to a standard range of sizes and specifications customized solutions can be configured to ensure individual project objectives are realized.
The ocean-flo™ SPFM is a single phase flow meter used in subsea applications to assist ageing or depleting oil and gas wells.

ocean-flo is integrated within the subsea mainframe system within a tree, manifold or flow jumper. It is primarily used to boost the extraction rates of oil or gas where the reservoir pressure has depleted over time.

The injection of water directly into the subsea gas well creates the required pressure to enable further extraction thus maximizing the output of the reservoir and optimizing the life of the field. The same effect is created by injecting gas into the oil production lines coming from the well, thus creating a pressurized “lift” effect.

The class leading subsea electronics interface along with the flexibility of the design offerings make the ocean-flo a winning formula with subsea installations.
subsea metering products

Single Phase Flowmeter

ocean-flo™

ocean-flo™ Single Phase Flowmeter

ocean-flo single phase flow meter developed by FMC Technologies brings together decades of measurement and subsea knowledge and experience.

The ocean-flo measures introduced mediums for the recovery of oil or gas within depleting wells and lifting production fluids to topside.

The ocean-flo is built in strict accordance with established differential pressure measurement practices and is coupled with leading industry instrumentation. This winning combination provides the confidence expected of Subsea Measurement.

Benefits

• No intrusions in line
• No maintenance required
• High repeatability
• No moving parts
• Simple and robust subsea flow measurement
• Can be installed in any orientation
• Qualified and class leading subsea DP transmitter
• Customized design service
• Precision made venturi tube
• API flanges or weld neck to suit client
• FAT includes electrical continuity test, hydrostatic and gas test as standard

Specifications

• ±5% uncertainty over 10:1 turndown ratio (Lower uncertainties achieved through flow testing)
• DP cell accuracy of ±0.065%
• Design life: 25 years
• Design depth: 10,000 ft (3000 m)
• Pressure ratings up to 15000 psi (1,035 bar)
• Standard product offerings 2” and 6” (other sizes upon request)
• Operating temperature: -40 to 248°F (-40 to 120°C)
• Storage temperature: -4 to 158°F (-20 to 70°C)
Configurations
- DP Transmitter: RS485/KOS, 4-20 mAmp, CANOpen
- DP ranges:
  0-4.641 psi (0-0.32 bar)
  0-18.855 psi (0-1.300 bar)
  0-72.52 psi (0-5 bar)
  0-435 psi (0-30 bar)
- DP cell connection: Bennex, ODI or Tronic
- DP cell connection type: ROV, Diver Mate
- Dual DP cell or redundancy
- Flowmeter materials: Carbon Steel with Inconel overlay, Duplex or Super Duplex. Other materials are available upon request
- Standard Coating: NORSOK M-501 system 7. Other coatings are available upon request

Optional Requirements
- Flow Loop testing (calibration)
- Hyperbaric testing
- EFL’s (Electrical Flying Leads)

Quality Control
FMC Technologies is certified to quality assurance systems approved by Lloyd’s Register Quality Assurance:
ISO 9001:2000
FMC Technologies manufactures to a complete range of standards relating to design, manufacture and all aspects of testing and quality. Ocean-flo is designed and manufactured in strict accordance with the following:
ISO 5167-1 and 5167-4, API 6A, API 17D,
ISO 13628-1, ISO 13628-6, ASME B31.3,
ASME B31.8, ASME IX, NACE MR-01-75,
BS EN 10204
With over 2,000 installed projects in over 100 countries worldwide, FMC Technologies has unparalleled experience in designing and constructing diverse liquid and gas systems that meet the needs of its customers.

Our engineers and project management staff are experts, many with decades of experience in the measurement industry, and offer complete support at every phase of the project’s development. Whether a project necessitates language translations, compliance with non-standard regional practices or project commissioning in remote locations, FMC’s project teams have the know-how to solve any measurement system challenge.
Customers choose FMC Technologies Measurement Solutions because of its ability to provide turnkey solutions and systems that meet their critical needs:

- Seamless integration into the current upstream and downstream plan or operational requirements
- Designed to be built, installed, commissioned and maintained within the customer’s fiscal limitations
- Capable of producing accurate, traceable data no matter how varied the product quality or how severe the operational environment
- Designed to provide the utmost safety and ease of operation

**Experience Combined with Innovation**
Taking a comprehensive approach to every project, FMC succeeds where many integrators fail. Through its significant industry experience and long-term customer relationships, FMC has learned the importance of minding the details, including environmental conditions, ease of operation and total life-cycle costs.

Although many of the systems FMC completes are already specified with equipment requirements, customers benefit from the in-depth technical expertise and experience acquired from the development of FMC’s own robust line of metering products and accessories.

FMC has designed premium custody transfer systems for a variety of applications:

- Liquid metering systems range from relatively small liquid production LACT units to huge crude export facilities
- Gas metering capabilities include systems for production wells, fuel gas metering for power generation, large-scale pipeline transportation, regasification terminals, border stations, gas supply grids, and city gate metering facilities
- FMC has designed and completed more FSO metering facilities than any other company in the world

**Technical Services**
FMC Technologies has acquired vast knowledge that can be applied to any liquid or gas measurement challenge. A thorough understanding of diverse operating conditions, local requirements and customer specifications enables FMC Technologies to design premium systems that provide reliable and accurate data through numerous years of operation.

**Services Include:**
- Front-end engineering and budget pricing
- System component specification
- Specialized man-machine interface packages
- Customized software modules for security and reporting of fiscal data
- Integration of product quality analysis equipment
- Integration and testing of completed system at the factory
- Documentation, training and specialized field support
- Facility surveys for upgrade recommendations
- Life-cycle management contracts for services, maintenance, parts and ongoing support

The world leader in designing liquid and gas measurement systems
Liquid custody transfer metering solutions from FMC Technologies are developed and applied reliably to a broad range of processes, from small LACT units and FSOs to huge crude export facilities.

We design to our customers’ specifications and offer our experience and advice to customize systems specific to any application.

FMC is a complete systems provider offering the most comprehensive and trusted portfolio of measurement solutions in the oil and gas industry. Our products and our integrated systems are engineered to handle the diverse measurement, monitoring and sampling requirements required by the world’s most prestigious companies.

FMC brings a dedicated project management team and single-source responsibility to every quality measurement system it builds by providing and integrating best-of-class equipment and all of the leading technologies in the market, including:

- Various metering technologies
- BS&W monitors
- Densitometers
- Viscometers
- Samplers
- Valves and pumps
- Supervisory control systems
- Data acquisition systems
- Custom software
- Instrumentation packages
- Analyzer Shelters
- Control Rooms
- Flow computers

<table>
<thead>
<tr>
<th>Global Market Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuwait Oil Company Sea Island and South Pier</td>
<td>2000</td>
</tr>
<tr>
<td>Surgutneftegas (Russia)</td>
<td>1993</td>
</tr>
<tr>
<td>Sonatrach (Algeria)</td>
<td>2004</td>
</tr>
<tr>
<td>Cameron Highway (USA)</td>
<td>2004</td>
</tr>
<tr>
<td>Sohar (Oman)</td>
<td>2005</td>
</tr>
<tr>
<td>Sinovensa (Venezuela)</td>
<td>2006</td>
</tr>
<tr>
<td>Piranema (Brazil)</td>
<td>2006</td>
</tr>
<tr>
<td>Chevron (Angola)</td>
<td>2007</td>
</tr>
<tr>
<td>NK Rosneft (Russia)</td>
<td>2008</td>
</tr>
<tr>
<td>Enbridge (USA and Canada)</td>
<td>2008</td>
</tr>
<tr>
<td>Saudi Aramco (Saudi Arabia)</td>
<td>2009</td>
</tr>
<tr>
<td>TransCanada (USA and Canada)</td>
<td>2009</td>
</tr>
<tr>
<td>BP/Valhall (Norway)</td>
<td>2009</td>
</tr>
<tr>
<td>BP/Skarv (Norway)</td>
<td>2009</td>
</tr>
<tr>
<td>Tupi TLD (Tesle de Longa Duracao) (Brazil)</td>
<td>2009</td>
</tr>
<tr>
<td>StatoilHydro/Gjøa (Norway)</td>
<td>2009</td>
</tr>
</tbody>
</table>
LACT Units
The Lease Automatic Custody Transfer (LACT) unit is a critical system in the ownership transfer of crude oil and petroleum products from the production site to trucks, pipelines or storage tanks. Through decades of experience in LACT unit design and manufacturing, FMC Technologies has managed to provide precision measurement in even the harshest environments. LACT units from FMC Technologies offer the flexibility of completely-automated or semi-automated 24-hour operation.

FMC Technologies combines an unparalleled depth of engineering expertise and the industry’s most reliable system components:

- Positive Displacement meters
- Turbine meters
- Ultrasonic flowmeters
- Bidirectional, unidirectional and compact provers
- Valves and pumps
- Mixers
- Strainers
- BS&W monitors
- Flow computers
- Control and data acquisition systems
- Complete instrumentation packages

Like any system, a LACT unit must be operated correctly to deliver accurate results. FMC Technologies provides support services, training and consultation to ensure end users always have access to the requisite information pertaining to component performance, calibration and sampling frequency requirements. In addition, FMC applications experts can provide guidance and solutions to ensure the LACT system is adaptable and dependable for all foreseeable circumstances with provisions for heat tracing, insulation, NACE trim and additional meter runs.

Prover Systems
Flowmeters need to be calibrated to ensure accurate measurement. To accomplish this, proving systems are designed to reduce the uncertainty associated with meter performance. With its years of measurement and verification experience, FMC Technologies is well known for developing accurate proving systems to validate the petroleum industries’ numerous critical custody transfer applications.

FMC Technologies offers complete portable or stationary proving systems for pipelines, tanker and barge loading and unloading operations and refiners. Employing unidirectional, bidirectional and compact prover technologies, FMC prover systems incorporate industry-leading components to ensure the highest measurement excellence.

In partnership with Maloney Technical Products, FMC Measurement Solutions offers a complete line of heavy-duty, solid foam or inflatable proving spheres in a variety of elastomers and specialty materials. Maloney Pipeline Spheres are compression molded at cavity pressures exceeding 2000 psi, yielding a wear life that is unmatched in the industry.

With FMC prover systems and Maloney pipeline spheres, customers are ensured improved operational efficiency, reduced operating costs and accurate custody transfer measurement.
Energy Measurement
FMC understands that energy measurement is of key importance in large-scale transaction points, such as border stations, gas refinery outlets and gas grid inlet points.

It is possible for a traditional gas metering system to measure energy directly by the incorporation of an online gas chromatograph at the point of metering. However, coupled with the volumetric flow results generated from the meter, the system can calculate energy flow “online,” rather than “offline” at a laboratory, to substantially increase the accuracy of related financial transactions.

In this energy hungry world, with ever-increasing natural gas prices, it is of critical importance to know, to a very high degree of accuracy, not only the quantity of gas bought or sold, but also the “quality,” as it is the gas composition which dictates the energy content of the gas.

Very large quantities of natural gas move through pipelines every day; a tiny error in measurement can result in a very significant loss of revenue by the selling company or the buyer, according to the direction in which the error occurs. FMC’s gas systems and products are designed to decrease the uncertainty of the measurement error and provide reliable, traceable data for operational efficiency and custody transfer.

From initial design through testing and commissioning, FMC brings single-source responsibility to every system it builds by integrating the leading technologies for maximum results, including:

• Differential pressure meters
• Ultrasonic flowmeters
• Vertical vane separators
• Horizontal and vertical filter-separators
• Heaters
• Control and data acquisition systems
• Complete instrumentation packages
• Gas chromatographs
• H2S analyzers
• Hydrocarbon dew point analyzers
• Moisture analyzers
• Mercaptan analyzers
• Densitometers
• Analyzer shelters
• Control rooms
Pressure Regulation
With the experience gained from designing and manufacturing measurement systems since 1926, FMC Technologies possesses extensive knowledge of pressure regulating systems. Whether an application merits a stand-alone or an integrated system, FMC’s pressure regulation systems provide the optimum solution for any measurement objective.

For every pressure regulation system there are numerous options available with varying degrees of complexity. FMC’s highly-skilled project engineers consider the following factors when developing a pressure regulation system, including:

- Upstream pressure
- Extent of required pressure reduction
- Noise level specification
- Turndown requirements
- Sensitivity of downstream equipment to pressure variations
- Degree of redundancy required for uninterrupted operation

Backed by unparalleled engineering expertise, exceptional technical support services and the industry’s most reliable system components, pressure regulation systems by FMC are able to meet any application requirement.

Filtration and Conditioning
Fuel reaching the gas turbine ignition box must be properly conditioned to meet the required firing temperature, pressure and cleanliness standards. Metered fuel gas is normally required at a steady operating temperature and at a safe margin above dew point. Severe damage may be caused to the turbine if the gas is not ultra clean and dry.

FMC Technologies’ gas filtration and conditioning systems provide clean, dry metered gas at the required pressure and temperature from an untreated, unregulated gas source. FMC has extensive experience in the design and application of custom and integrated gas filtration and conditioning systems, including those for onshore and offshore production and power generation facilities.

Applications
- Fiscal metering
- Superheating
- Filtration
- Coalescing
systems technologies

Floating Production Storage and Off-Loading Systems

With each transaction involving large volumes of product and many millions of dollars, measurement accuracy is more significant in marine loading transfers than in any other application. Precision and reliability is required for Floating Production, Storage and Off-Loading (FPSO) metering systems.

FMC Technologies has the experience and products to ensure operational integrity. FMC has provided more FPSO metering systems than any other company in the world. As a result, FMC has developed unique capabilities and experiences related to measuring the large flow rates characteristic of marine loading operations. This specialized knowledge and experience is applied to each demanding measurement application to ensure successful project execution from start to finish.

FPSO metering systems from FMC Technologies incorporate the industry’s most reliable system components, including:

- Positive Displacement meters
- Turbine meters
- Ultrasonic meters
- Differential pressure meters
- Bidirectional, unidirectional and compact provers
- Valves and pumps
- Mixers
- Strainers
- Control and data acquisition systems
- Flow computers
- Complete instrumentation packages

### HIGHLIGHTED FPSO SYSTEMS

<table>
<thead>
<tr>
<th>Global Market Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chevron (Angola)</td>
<td>1982</td>
</tr>
<tr>
<td>Modoc (Indonesia, China, Mexico, Thailand)</td>
<td>1989</td>
</tr>
<tr>
<td>Conoco (Indonesia, Venezuela)</td>
<td>1992</td>
</tr>
<tr>
<td>FELS (Norway)</td>
<td>1995</td>
</tr>
<tr>
<td>SBM (Russia, Myanmar)</td>
<td>1998</td>
</tr>
<tr>
<td>Statoil/Asgard A&amp;C (Norway)</td>
<td>1999</td>
</tr>
<tr>
<td>Exxonmobile/Jotun (Norway)</td>
<td>1998</td>
</tr>
<tr>
<td>Tanker Pacific (Vietnam, Angola, Thailand, Malaysia)</td>
<td>2000</td>
</tr>
<tr>
<td>BP/Holstein LACT Unit (Platform)</td>
<td>2002</td>
</tr>
<tr>
<td>BP/Thunderhorse LACT Unit (Platform)</td>
<td>2002</td>
</tr>
<tr>
<td>BP/Mad Dog LACT Unit (Platform)</td>
<td>2003</td>
</tr>
<tr>
<td>BP/Atlantis LACT Unit (Platform)</td>
<td>2003</td>
</tr>
<tr>
<td>PAS Maritime (Indonesia)</td>
<td>2004</td>
</tr>
<tr>
<td>Talisman (Malaysia)</td>
<td>2004</td>
</tr>
<tr>
<td>Petrochina – LPG Yuyo (Indonesia)</td>
<td>2005</td>
</tr>
<tr>
<td>Madura Jaya (Indonesia)</td>
<td>2006</td>
</tr>
<tr>
<td>Marathon/Alvheim (Norway)</td>
<td>2006</td>
</tr>
<tr>
<td>JVPC Rang Dong – Modoc (Vietnam)</td>
<td>2007</td>
</tr>
<tr>
<td>Tanker Pacific Cuu Long Su Tu Vang (Vietnam)</td>
<td>2008</td>
</tr>
<tr>
<td>Truong Son FPSO (Vietnam)</td>
<td>2008</td>
</tr>
<tr>
<td>Bumi Armada Berad (Nigeria)</td>
<td>2009</td>
</tr>
<tr>
<td>Total/DSME (Angola)</td>
<td>2009</td>
</tr>
</tbody>
</table>

FMC Technologies’ flow computers and control systems are the superior choice for managing and monitoring liquid and gas measurement systems. FMC control systems allow incorporation of the widest range of industry-standard flowmeters, instrumentation, valve actuators and process control systems to provide customers with a full range of solutions to attain cost-effective, accurate and innovative measurement systems.

Applications
- Custody transfer
- Fiscal measurement
- Batch loading and deliveries
- Proving control
- Sampling and analysis

FMC 217 Metering Control System
The FMC 217 is a complete metering control system, including field cable termination, signal conditioning, flow computers, supervisory computers and an advanced man-machine interface. The system meets not only recognized international standards but the strictest statutory and regulatory requirements as well.

Features
- Additional meter runs added easily without software changes
- Process variable trending
- Easy-to-understand graphic user interface
- Quick and easy navigation
- Available in fully redundant configuration
- Compatible with a variety of flow computers
- Microsoft Windows based operating system

SyberVisor Supervisory Control System
FMC Technologies’ Supervisory Control System, developed and supported in Corpus Christi, TX USA, is a state-of-the-art data acquisition and control system for hydrocarbon measurement.

(Continued on next page)
systems technologies

Liquid and Gas
Control Systems
and Flow Computers

The Supervisory System employs the latest off the shelf Personal Computer hardware, Microsoft’s Windows Operating System, and Wonderware’s® InTouch® Human-Machine Interface (HMI). InTouch provides the user with an intuitive, graphical interface that makes metering operations clear and observable. The Supervisory System efficiently controls meter, bank, and prover operations. Additionally, the Supervisory System collects, processes, and reports meter and proving data.

The Supervisor controls each metering bank in one of two operational modes: batch or pipeline. Batch mode delivers preset amounts based on user entered loading parameters. Pipeline mode provides for flow monitoring and flow balancing. The Supervisor interfaces to the metering bank and prover via communication with various flow and proving computers, i.e. the Fmc²™, the SyberTrol®, etc. The Supervisor controls valves and other auxiliary I/O via communication with a Programmable Logic Controller (PLC). Additionally, the Supervisor reads product quality instrumentation such as densitometers, viscometers, and water and sediment content devices. Furthermore, the Supervisor will also collect a representative “sample” during a batch or time period by pacing the sampling device at an appropriate rate.

The Supervisor can calibrate, or “prove” a meter while it is in operation and at operating flow rates. The Supervisor will align the meter to a displacement prover or a master meter prover, perform the prove, and then ask the user to accept or reject the new meter factor. To facilitate the acceptance decision, statistical analysis of previously accepted meter factors can be provided.

The Supervisor and the reports it generates are based on American Petroleum Institute (API) and AGA recommendations as well as Russian GOST and Regulatory Document requirements and ARAMCO standards.
**Fmc² Flow Management Computer**
The Fmc², a fully programmable, fully configurable microprocessor-based flow computer, is the most advanced in the industry. Beyond its ability to continuously monitor and control flow of liquid and gas petroleum products, it allows operators the ease and convenience of full-screen visibility of multistream operations. Compact and flexible, the Fmc² can act as a high-integrity, stand-alone flow computer or as a powerful building block in a supervisory computer control system.

**Features**
- LCD touch screen with full-color graphics
- Interfacing for remote communications
- Process loop control
- Report printing
- Analog and digital outputs

**FPM 207CE Flow Computer**
The Kongsberg FPM 207CE is a panel-mount or rack-mount flow computer capable of handling multistream applications with a wide variety of flowmeters. The FPM 207CE can operate as a high-integrity, stand-alone flow computer or as a powerful component in sophisticated metering applications integrated into a supervisory or PCDA system.

**Features**
- High-performance advanced I/O board with multiple processor computation
- PC104 CPU board with Pentium® class processor
- Rack or panel mount options
- Controlled security access
- Built-In PLC logic for value monitoring and control
- Supports all major international standards for both liquid and gas flow calculations
Life Cycle Maintenance, Training and Support

FMC Technologies’ life cycle maintenance, training and support team is dedicated to providing customers with first-class service to enhance metering system effectiveness, improve productivity and increase profitability.
FMC Technologies has the experience, the skills and the focus to replace, repair or rebuild any measurement equipment or liquid or gas metering system anywhere in the world. Supported by an extensive network of authorized service representatives, FMC’s staff of factory-trained field service engineers can improve metering equipment longevity and operational efficiency.

Plant personnel and environmental safety is of paramount importance in product design and maintenance. FMC Technologies’ commitment to safety is relentless. FMC’s service engineers and technicians are fully knowledgeable of and compliant with governmental and industrial safety requirements, both globally and locally.

**Benefits**
- Improved liquid measurement efficiency
- Increased profitability and throughput
- Reduced operating costs
- Reduced downtime
- Access to measurement specialists
FMC Technologies’ field service and customer support engineers are available, on call, anywhere in the world to perform and/or assist in the installation, commissioning, service, troubleshooting and verification testing of liquid measurement equipment. By providing superior support, service and quality products, FMC can improve metering equipment longevity and operational efficiency for our customers.

**Services Provided Include:**
- On-site diagnostics, calibration and repair of meters, valves and electronic equipment
- Preset and flow computer programming and interfacing to automation systems
- Factory PD meter evaluation, repair, testing and special testing can also be provided
- Factory turbine meter evaluation, repair, testing and tuning to bring existing turbines up to new product standards
- Repair of flow control valves, strainers, transmitters, electronic equipment and other ancillary line accessories
- On-site training for meter technicians, operators, maintenance and engineering personnel
- Operational assistance
- 24/7 on-call or on-line technical support via phone, fax, email or internet for long-distance equipment diagnostics

**Turnkey Services**
Through its Installed Product Services (IPS) group, FMC Technologies provides turnkey measurement services to the global petroleum and gas industry. Working in unison with the local distributor, IPS provides expert advice and innovative solutions to help customers regain optimum performance of all installed measurement equipment and systems.

- System upgrades
- Maintenance and service contracts
- Installation, commissioning and start-up support
- Measurement consulting services for installed equipment evaluation
- Feasibility studies
- Project management services

IPS will examine your measurement system and define problem areas, then provide an itemized list of equipment and actions required to bring your system out of obsolescence and into excellent working condition. Whether your system was supplied by FMC Technologies or any other manufacturer, IPS has the capability to manage the improvement process from start to finish.
Quality Remanufactured Equipment
FMC Technologies is the industry’s leading supplier of quality, factory remanufactured equipment. All remanufactured equipment is rebuilt with genuine Smith Meter® replacement parts and assembled to meet new specifications. Each product is performance tested through its complete operating range and meets or exceeds current published linearity and repeatability specifications. All remanufactured equipment carries the same full one-year warranty as new equipment.

Equipment Buy-Back Program
To meet the demand for quality remanufactured products, Measurement Solutions has an aggressive equipment buy-back program. Under this program, FMC Technologies will purchase used, surplus and obsolete metering equipment for use in these applications:

- Pipeline
- LACT unit
- Marine loading and unloading
- Terminal load rack
- Tank truck equipment

Equipment Exchange Programs
FMC Technologies Measurement Solutions’ Equipment Exchange Programs offer a great opportunity for our customers to reduce inventory management requirements and minimize maintenance costs for a wide range of equipment types and applications. By taking advantage of stocked and fully warranted remanufactured items exchanged for your damaged or worn parts, you can eliminate costly service repairs, environmental, and safety concerns while returning your vital measurement devices to their intended performance standards quickly and confidently. Typically within 24 hours, your replacement equipment can be shipped from the factory to your location for immediate installation and operation. From pipeline meters to marketing terminal electronics, the Equipment Exchange Program is your source for fast, reliable and genuine Smith Meter replacement parts.

Available Exchange Programs:
- PD meter innermech
- Turbine meters (IPK)
- Electronic board assembly
- Transmitters
World-Class Test Facility Guarantees Optimum Performance Verification

A meter’s ability to measure a wide range of viscosities creates the need to accurately prove it on similar liquids. FMC Technologies’ comprehensive test facility is capable of testing meters to the highest flow ranges and viscosities of any testing facility in the world and is the industry’s leading facility for verifying the accurate performance of PD meters, turbine meters, Coriolis meters and ultrasonic meters in any crude oil application.

- Closed-loop, crude oil test stand allows liquid meters to be tested over viscosities of up to 650 cSt with the capability of testing up to 10,000 cSt when required.
- Multi-viscosity test stand system tests flow ranges up to 8,500 BPH and viscosities in the 2 to 650 cSt range.
- Thirty-thousand-gallon capacity test stand system tests flow ranges up to 42,000 BPH and viscosities in the 10 to 50 cSt range.
- The verifiable data produced at this facility assures customers that the meters supplied for their custody transfer applications will perform accurately over a wide range of viscosities and flow rates.
life cycle maintenance, training and support

Customer and Distributor Training

Service Training Workshops
FMC Technologies provides technical training for customers and distributors. Workshops employ a state-of-the-art flow demonstration laboratory that encompasses truck loading and unloading, truck metering, sequential and ratio blending and hydraulic flow control utilizing the AccuLoad® family of preset load controllers. Reflecting FMC Technologies’ industry-leading product and system expertise, these workshops address the needs of:

• Companies demanding accurate and reliable systems measurement
• Personnel encountering new metering applications, design changes, improved metering methods and equipment

Training programs may be held on-site at the installation or customer facilities or at any of the FMC facilities, as well as in a variety of other worldwide locations.

Demonstration Stand for Proper Metering System Design
Proper metering system design is essential for accurate loading and unloading of refined products at the terminal. FMC’s demonstration stand simulates a variety of loading and unloading scenarios, allowing customers to fully comprehend various metering system configurations before selecting the correct design for their terminal application.

Utilizing a variety of components in configurations recommended for accurate load control, the demonstration stand has the following capabilities:

• AccuLoad II to III Upgrade Metering System demonstrates the features of the upgrade using up to a four-product ratio blender.
• AccuLoad III-S Sequential Blender System demonstrates sequential blending of two products through one metering system.
• AccuLoad III-S Ratio Blender System demonstrates the ratio blending of three products through three metering systems and into a single loading arm.
• Unloading System demonstrates the features of the Division II/NEMA IV-approved AccuLoad III-N4, which senses the position of the floats in the air eliminator to control the flow control valve and flow rate of the product being offloaded and measured from the transport.
• AccuLoad III-Q system demonstrates loading of three straight products into a truck compartment that has been fitted with a Civicon overfill and grounding system and includes an explosion-proof Smith Meter® Proximity Card Reader for driver identification and authorization for loading.

Best Measurement Practices Workshops
Best Measurement Practices workshops offer companies and groups the opportunity to learn metering products and system fundamentals in an unbiased forum that provides methods to determine proper product selection and fundamental principles. Workshops are taught by experts in both products and global metering standards. Best Measurement Practices workshops are organized locally upon customer request and are customized in several time formats and according to attendee experience levels.
Supporting Customers Worldwide

Visit our website at www.fmctechnologies.com/measurementsolutions for more detailed contact information.
FMC Technologies and Our Measurement Solutions
Legacy Brands

FMC Technologies, Inc. is a global leader providing mission-critical technology solutions for the energy industry. Its Measurement Solutions business unit excels in process systems, measurement technologies, transportation, and custody transfer of gases and liquids in the oil and gas industry. FMC Technologies employs approximately 10,000 people and operates 23 manufacturing facilities in 19 countries.

FMC Technologies Measurement Solutions sets the standard for global Best Measurement Practices by designing, manufacturing and servicing the precision products and systems used to measure and control liquids and gases in industrial applications. The Smith Meter® brand is known worldwide for its ability to produce reliable, accurate and consistent measurement results. Similarly, our Sening® brand tank truck components and systems are trusted to provide safety and environmental protection while ensuring accurate measurement during the transport and transfer of liquid products. Both Smith Meter® and Sening® are trademarks owned by FMC Technologies, Inc.