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Your Strategic Update on Flow, Temperature, and Pressure Measurement from Flow Research

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1. Letter from the president

Jesse Yoder

We Live for This!

This has been an extraordinary year at Flow Research. We started the year off by publishing two important new studies:

The World Market for Vortex Flowmeters, 6th Edition (www.flowvortex.com)

The World Market for Primary Elements, 2nd Edition (www.flowplate.com)

While these studies are not as "high profile" as our Coriolis and ultrasonic studies, they nonetheless form an important part of our research effort. While vortex meters are widely used for steam applications, they also can easily measure liquid and gas flows. There are some important new developments in vortex flowmeters, including incorporating two sensors downstream to detect the vortices. This enhances the reliability of the meter. Another new development is deploying two vortex meters in the process line and calibrating them together. This practice provides redundancy and makes for a more stable and reliable measurement. Our study found the size of the vortex flowmeter market in 2018, and forecast sales to 2023.

It's been 12 years since we did our last primary elements study – our first primary elements study was published in 2007. We found that there has been a lot of activity in this market since then. Suppliers have introduced multiple types of orifice plates, including concentric, eccentric, and segmental. They have developed averaging Pitot tubes to better handle flare gas and stack gas measurement. More companies are manufacturing wedge meters. And new companies – including Schlumberger/Cameron and EMCO Controls – have introduced cone meters, which were first popularized by McCrometer with its V-Cone.

Much of the year was devoted to researching and publishing two other important studies:

Volume X: The World Market for Flowmeters, 7th Edition (www.flowvolumex.com)

Volume X, Module A: Strategies, Industries, and Applications. (www.flowvolumex.com)

Together these two studies cover the entire worldwide flowmeter market in the process industries, including all flowmeter types. *Volume X* analyzes the 2018 market in dollars, units, and average selling price. It includes forecasts to 2023 for all technologies. This 612-page study gives growth factors and limiting factors for each flowmeter type, and identifies the main

manufacturers. It explains and justifies forecasts, both in terms of historical data and expected future developments.

Volume X, Module A adds the important aspect of industries and applications for each flowmeter type. For example, the 500-page companion or standalone study tells you in terms of revenues what industries Coriolis meters are sold into, worldwide and by eight regions – and it does the same for the applications that Coriolis meters are used for. Sample applications include custody transfer of natural gas, custody transfer of petroleum liquids, allocation metering, and LNG (liquefied natural gas). We have added three new chapters discussing industry growth factors, for a total of four chapters on the industries themselves. We have also added a much expanded strategies section totaling 55 pages that includes competitive guidance for each flowmeter type.

Besides the extensive market data, *Volume X* includes 31 company profiles, as well as market shares for each flowmeter type. The two studies together exceed 1,100 pages, and give the most complete analysis of the 2018 flowmeter market available anywhere.

How did we do it? Flow Research published our first *Volume X* study in 2003, although I also published a worldwide flowmeter study in 1994 for another company. Besides leveraging all of this historical data for our current edition, we sent out over 500 questionnaires to every known flowmeter supplier worldwide. The purpose of these questionnaires was to update the market to 2018, and to become aware of recent trends and growth factors for each technology. The entire enterprise took over a year and we devoted hundreds of hours to this effort. Flow Research is known for its accuracy and attention to detail in our studies, and we try to make every study better than the last.

We published *Volume X* in May and *Module A* in October. In between, in July, we published another extremely popular study: *The World Market for Mass Flow Controllers, 3rd Edition* (www.flowmfc.com).

Our last look at the MFC market was in 2016, when we published our Mass Flow Controller Update study. Like the 2nd Edition, the new 3rd edition contains fully detailed segmentation of the market. In this current study, we chronicle mass flow controller sales into the semiconductor industry. We also take an in-depth look at all industrial uses for mass flow controllers, and segment this market into 20 categories. These include biotech, gas analyzers, food & beverage, and many others.

What is on tap for the rest of the year? Watch for news of some surprising and unexpected new studies from Flow Research in the next few months. Then in 2020 we plan to publish new editions of both the Coriolis and ultrasonic studies.

It's never a dull moment around here and we feel honored to be the leading supplier of reliable data for the flowmeter market. We couldn't do this if we didn't love what we do. We also couldn't do this without your support for our research. As you can probably tell, we live to report on the flowmeter and instrumentation markets!

2. *Volume X, Module A* – bigger and better than ever

In May, Flow Research began shipping one of the most comprehensive studies ever published of the worldwide flowmeter market, the all-in-one ***Volume X: The World Market for Flowmeters,***

7th Edition. We are happy to report it's been flying off the shelves. This popular, 612-page study determines 2018 market size and market shares, and forecasts growth through 2023 for all flowmeters used in process environments.

Now we are very excited to announce that our comprehensive companion or standalone study, **Volume X, Module A: Strategies, Industries, & Applications, 7th Edition**, is also ready to fly off our virtual shelves to your inbox (and to your office as a hardcopy) to give you tactical and strategic insights you can start applying today.

***Volume X** and **Module A** give you handy, all-in-one sets of information tools for the world flowmeter market.*

We think it's our best *Module A* yet. This robust, 500-page study gives you data about industry trends and how they are impacting the flowmeter market. We researched the industries and applications that use flowmeters to determine the largest and fastest-growing for each flowmeter type and forecast the best areas for future growth.

In this edition, we pulled out more stops than ever before, drilling down to give you the strongest, most detailed information possible. We present the data by each flowmeter type, dicing and slicing it to show shipments in dollars and percentages in the industries and applications – worldwide and by region.

This expanded 7th edition *Module A* includes four chapters (instead of just one) on the major process industries. Then there's a chapter that discusses in detail many of the specific applications where flowmeters are being used today – from custody transfer to dosing.

In *Module A* we give you:

- Shipments in 2018 and forecasted through 2023 by industry and application in dollars and percentages for each flowmeter type worldwide and by region
- Advantages and disadvantages of the nine major flowmeter types: Coriolis, magnetic, ultrasonic, vortex, thermal, differential pressure flow transmitters, primary elements, positive displacement, and turbine
- Comprehensive data depicted worldwide and by eight regions: North America, Western Europe, Eastern Europe, Mideast/Africa, Japan, China, Asia/Pacific, and Latin America
- Insights, forecasts and trends in major industries: oil & gas, refining, chemical, petrochemical, food & beverage, pharmaceutical, power & energy, district energy, and water & wastewater
- Deep-dive data for each flowmeter type's usage by industry, including: oil & gas, refining, chemical, food & beverage, pharmaceutical, pulp & paper, metals & mining, power, textile, water & wastewater, and HVAC/industrial utilities
- Detailed data on the applications appropriate to each type of flowmeter. There are too many to list, however they include: custody transfer (petroleum liquids, natural gas, non-petroleum liquids, and steam), non-custody transfer (liquids, gas, and steam), check

metering, allocation metering, liquefied natural gas (LNG), flare/stack gas, process measurement, water flow, hydrofracking, slurries, boiler inlet, submetering, and HVAC.

Among other things, you will learn:

- What industry is #1 in shipments for both Coriolis and vortex meters (tip – not oil & gas)
- Why the magnetic flowmeter market is the largest among all flowmeter markets in the world and why magmeters are used across all industries
- Why oil distribution is one of the hottest areas for positive displacement flowmeters
- Why municipal and industrial gas is the top application for turbine meters worldwide and in every region
- …and much, much more

Module A is a labor of love and we think you'll agree it's been worth it. For complete details, go to www.flowvolumex.com. To get your copy, click the Order link or contact Flow Research. Call or email us soon for special pricing. Phone: 781-245-3200.
Email: jesse@flowresearch.com.

3. Applications are *so* demanding these days!

Flowmeter applications are becoming more demanding than ever, with increasingly complex and multi-faceted requirements. Applications may need a certain line size, a particular lining, a specific communication protocol, several approvals, important accuracy levels, along with other requirements.

Hydraulic fracturing (or "fracking"), for instance, has made it possible to retrieve oil from wells that were thought to be no longer viable. Subsea drilling has become more challenging as oil is discovered in more remote and deeper parts of the ocean. Multiphase flowmeters have proven useful in these applications, although their full promise has yet to be realized.

Custody transfer requires accurate, reliable, and in some cases redundant flow measurement. In some cases, end-users run two meters in sequence to provide redundancy and to gain additional accuracy and reliability. Ultrasonic, turbine, and differential pressure (DP) flowmeters compete for custody transfer of natural gas applications. Honeywell/Elster and SICK have produced highly competitive ultrasonic flowmeters for these applications. For petroleum liquids for downstream custody transfer applications, top suppliers include Emerson Micro Motion, Schlumberger/Cameron, Emerson Daniel, and KROHNE.

Gas flow measurement, which is typically measured as mass flow rather than as volumetric flow, has its own set of requirements. Mass flow can be measured directly with a Coriolis or thermal flowmeter, or indirectly with a multivariable flowmeter that measures fluid volume, pressure, and temperature and calculates the mass flow using those variables. Of these choices, Coriolis provides the most accurate measurement.

The impact on suppliers is that companies that have the "deep pockets" to produce flowmeters that satisfy multiple needs have an advantage over smaller companies that do not. Reaching certain accuracy levels can take significant investments of time, material, and testing. Some smaller companies also may not be able to afford to allocate their resources to gain hazardous or sanitary approvals, for example. Companies that want to market their products worldwide may have to gain regional approvals to do so.

Larger suppliers find it easier to compete all over the world because they invest their resources into getting the necessary approvals. They can also compete in multiple industries that require hazardous, sanitary, and other approvals.

This doesn't mean that smaller companies cannot compete, but it may mean that they need to pick their battles – focusing on a region, a market niche, or competing on service and delivery.

Some central European companies have used their geographic location to develop strong distribution channels into the Middle East and Russia. Companies located in Russia have an advantage in selling into Russia, which can be difficult for outside companies. Even though the magnetic flowmeter market is dominated by six major suppliers, there are many smaller companies in Europe that specialize in selling into the European market. Some smaller magmeter suppliers specialize in applications such as batching and blending, or selling into industries such as food & beverage or water & wastewater.

Dr. Yoder discusses the changing face of the flowmeter market in our Q1/Q2 2019 issue of *Market Barometer*, one of our Worldflow publications. For more information about Worldflow Monitoring Service publications, visit www.worldflow.com.

4. New JV, Sensia, to offer fully integrated measurement and automation solutions for oil & gas

It's official! Rockwell Automation and Schlumberger have launched a new joint venture designed to drive efficiencies in the oil & gas industry by leveraging measurement and intelligent automation. On October 2, 2019, the two companies announced the closing of their joint venture, Sensia, described as "the oil and gas industry's first digitally enabled, integrated automation solutions provider." They believe Sensia is the first single provider to offer fully integrated, end-to-end solutions for optimizing oilfield operations. Sensia's solutions are intended to help oilfield operators reduce the time from drilling to production, optimize well output, and extend well life.

"Sensia will make industrial-scale digitalization and seamless automation available to every oil and gas company so their assets can operate more productively and profitably," Allan Rentcome, Sensia CEO, said in the announcement. "It will make oil and gas production, transportation and processing simpler, safer, and more secure."

Sensia now operates as an independent entity based in Houston, Texas. Rockwell Automation, a global supplier of industrial automation and information, including Allen-Bradley programmable logic controllers (PLCs), is the majority owner with 53 percent. Rockwell is based in Milwaukee, Wisconsin. Schlumberger, an oil & gas technology and services giant with principal offices in Paris, Houston, London and The Hague, owns the remaining 47 percent. Sensia is

projected to generate initial annual revenue of $400 million and to have approximately 1,000 employees.

Earlier this year, in a February 19, 2019, press release, the now-retired Schlumberger Chairman and CEO Paal Kibsgaard said Sensia is a "next step" in plans to offer "smart, connected devices with rich diagnostic capabilities, coupled with measurement, automation, and analytics that improve oilfield operations, facilitate business decisions and reduce total cost of ownership throughout the life of a field."

Schlumberger acquired Cameron, a long-established and reliable worldwide supplier of a wide range of oil and gas measurement and control products – including flowmeters –three years ago. At the time, the companies said the merger would integrate Schlumberger's reservoir and well technology with Cameron's wellhead and surface equipment, flow control and processing technology in order to provide complete drilling and production systems. Before the acquisition, Cameron and Schlumberger had created a joint venture, OneSubsea™, to manufacture and develop products, systems, and services for the subsea oil and gas market. OneSubsea has been active in developing multiphase metering technology.

5. Now shipping: *The World Market for Mass Flow Controllers, 3rd Edition*

In July we shipped another well-received study, ***The World Market for Mass Flow Controllers, 3rd Edition.*** If you don't yet have your copy, please give us a call. The market has changed substantially in the last five years as MFCs gain popularity in industries beyond the traditionally strong semiconductor market. New environmental applications such as fuel cells and solar/photovoltaic have opened up new avenues for MFCs. In addition, new manufacturing processes and the push for automation in factories are driving MFC market growth.

The semiconductor market continues to be the dominant industry for mass flow controllers and a prime driver of MFC applications and revenues. However, MFC manufacturers – wary of the unpredictability and cyclical nature of the semiconductor industry – are more actively attempting to broaden their base in other industrial and laboratory/research market spaces. Some of these segments are growing faster than semiconductor manufacturing, and hold the promise of long-term MFC applications.

What the study provides:

- 2018 market size in US dollars and unit volumes for MFCs worldwide, both thermal and non-thermal types
- 2018 market shares of leading suppliers of MFCs worldwide
- Market growth forecast for all types of MFCs through 2023
- Industries and applications where MFCs are used, and growth areas
- Product analysis for the main manufacturers selling into the MFC market
- Strategies for selling into the MFC market
- Company profiles of the main MFC suppliers

To read the overview, please visit www.flowmfc.com. To order this study, contact Flow Research by email at jesse@flowresearch.com, or call Flow Research at 781-245-3200.

6. Studies from Flow Research

Upcoming studies:

- ***The World Market for Pressure Transmitters, 5th Edition*** (2020) www.PressureResearch.com
- ***The World Market for Coriolis Flowmeters, 6th Edition*** (2020) www.FlowCoriolis.com
- Ultrasonic Flowmeters Series (2020) www.FlowUltrasonic.com
  Core Study: The World Market for Ultrasonic Flowmeters, 6th Edition
  Module A: The World Market for Inline Ultrasonic Flowmeters
  Module B: The World Market for Clamp-on and Insertion Ultrasonic Flowmeters
- ***The World Market for Magnetic Flowmeters, 6th Edition*** www.FlowMags.com

Recently published studies:

- Covering all the main flowmeter types: www.FlowVolumeX.com
  Volume X: The World Market for Flowmeters, 7th Edition, published May 2019
  Volume X: Module A: Strategies, Industries, and Applications, published October 2019
- ***The World Market for Mass Flow Controllers, 3rd Edition,*** published July 2019, www.FlowMFC.com
- ***The World Market for Vortex Flowmeters, 6th Edition***, published January 2019 – www.FlowVortex.com
- ***The World Market for Primary Elements, 2nd Edition***, published January 2019 – www.FlowPlate.com
- ***The World Market for Thermal Flowmeters, 2nd Edition***, published January 2018 – www.FlowThermal.com
- ***The World Market for Magnetic Flowmeters, 6th Edition***, published October 2017 – www.FlowMags.com
- **Ultrasonic Flowmeters Series, 5th Edition** – www.FlowUltrasonic.com
  - ***Core Study***: published September 2017
  - ***Module A: Inline***, published July 2017
  - ***Module B: Clamp-on and Insertion*** (separate data sections), published August 2017
- ***Module A*** *(to Multiphase)***: *The World Market for Watercut Meters***, published April 2017 – www.WatercutMeters.com
  (for the multiphase study: www.FlowMultiphase.com)

- ***The Market for Temperature Sensors in the Americas, 3rd Edition***, published February 2017 – www.TempResearch.com

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Energy Monitor features news, trends and projects in the oil & gas, LNG & fracking, and power & renewables industries and related topics. It also includes "Issues and Perspectives" market analysis by Jesse Yoder, and a highlight of a region, organization, or company.

Market Barometer reports on industry news and trends, acquisitions, mergers and other company changes, industry-related topics and new product developments in categories covering each major flowmeter types plus several other process instrumentation types and flow calibration. It also includes "State of the Industry" summaries of current market research by Jesse Yoder, and a "Company Korner" profile.

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