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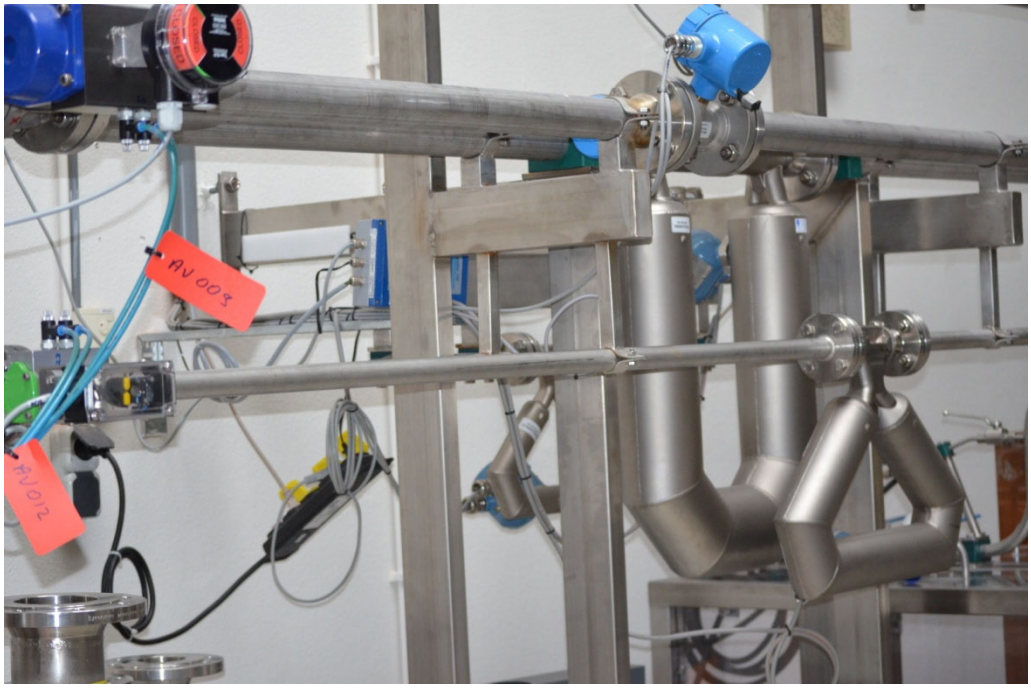
The World Market for Coriolis Flowmeters, 6th Edition

— OVERVIEW —



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www.FlowCoriolis.com

The World Market for Coriolis Flowmeters, 6th Edition

Flow Research has published a new study on the worldwide Coriolis flowmeter market. Our primary goals were to determine the size of the Coriolis flowmeter market in 2019 and to forecast market size through 2024. The study is called, ***The World Market for Coriolis Flowmeters, 6th Edition***.

Reasons for Growth

Coriolis flowmeters are the most accurate flowmeter made, and this high accuracy – up to 0.05 percent – is one of the major reasons for their continued growth. Companies that need flowmeters for custody transfer, or want highly accurate measurements in terms of mass, have good reasons to select Coriolis flowmeters. They find that despite a relatively high price tag, Coriolis flowmeters can provide a good return on investment.

Even though Coriolis meters have a higher purchase cost than many other flowmeters, they may cost less over the lifetime of the meter due to reduced maintenance costs – and most users today distinguish between purchase cost and cost of ownership. Aside from the vibrating tube, Coriolis meters do not have any moving parts subject to wear. With many companies reducing their engineering and maintenance staffs, having a meter that does not require a great deal of maintenance can be a major advantage.

Key Issues Addressed

This study addresses the key issues in the Coriolis flowmeter market, including:

- Growth in the use of smart Coriolis flowmeters
- Growth in the popularity and availability of low-cost Coriolis flowmeters to reduce sticker shock
- Relative merits of straight tube *vs.* bent tube meters
- Growing use of Coriolis flowmeters to measure gas flow, including custody transfer
- Emerging market for Coriolis in steam flow measurement
- Growth in the market for large line size Coriolis meters
- Use of Coriolis flowmeters for multiphase flow measurement
- Technological improvements in Coriolis flowmeters

We have determined that significant growth in the Coriolis market is due to growth in the oil & gas and other energy markets. When oil prices began dropping a few years ago and many oil and gas exploration projects were postponed or cancelled, associated instrumentation industries experienced a ripple effect. This downturn especially impacted the Coriolis, ultrasonic, differential pressure, positive displacement, and turbine flowmeter markets. Fortunately, when oil prices began recovering in early 2016, the worldwide flowmeter market got back on a healthy upward track. We expect Coriolis flowmeters, which are industry-approved for custody transfer of both gas and liquids, will experience fast market growth rates over the next five years.

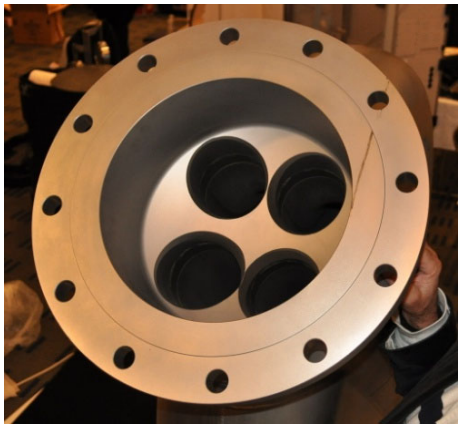
Suppliers have made a number of improvements in Coriolis technology over the past five years that are also contributing to growth. Coriolis meters now come in larger line sizes that are much

better able to measure gases. Straight tube meters – which reduce fluid build-up and pressure drop – have become more accurate and reliable, thereby addressing some of the drawbacks of bent tube meters.

To sweeten the pot further, some suppliers have broken price barriers by offering Coriolis meters at considerably lower price points. Performance specifications for the lower-cost flowmeters are not at the same level as those of the higher-priced meters. However, these lower-cost meters help satisfy the most essential needs of users who want the benefits of Coriolis technology, but seek to avoid the higher price premiums.

Rationale for Study

Flow Research published the fifth edition of our worldwide Coriolis flowmeter study in December 2016. We have continued to follow the Coriolis flowmeter market regularly since then, and have been providing technical, corporate, and marketing updates in our quarterly publication ***Market Barometer*** (www.worldflow.com). Our end-user interviews indicate that the interest in Coriolis flowmeters remains at a very high level, and that end-user needs have become more complex and demanding.



The World Market for Coriolis Flowmeters, 6th Edition analyzes overall market size and market growth forecasts from 2019 to 2024 in depth, worldwide and regionally. We explore a range of growth factors as we research the market.

This study achieves multiple goals:

- Determine worldwide market size for the Coriolis flowmeter market in 2019
- Determine worldwide market shares for the Coriolis flowmeter market in 2019
- Forecast market growth for all types of Coriolis flowmeters through 2024
- Segment data both on a worldwide basis and for each of eight global regions
- Identify the industries and applications where Coriolis flowmeters are used, and identify market growth sectors
- Analyze products for the main companies selling into the Coriolis flowmeter market
- Provide company profiles of the main suppliers of Coriolis flowmeters
- Provide strategies to manufacturers that sell into the Coriolis flowmeter market

Background of Study

Flow Research has been following the Coriolis flowmeter market since we published the first edition of our worldwide Coriolis flowmeter study in 2001. We published subsequent editions in 2003, 2008, 2013 and 2016. We also include the Coriolis market in every edition of *Volume X*: *The World Market for Flowmeters*, our market study that includes all types of flowmeters.

In conducting this study, we are contacting all known manufacturers of Coriolis flowmeters worldwide to assemble a picture of the total Coriolis flowmeter market. We ask suppliers to provide detailed information about geographic segmentation, industries sold into, types of

Coriolis flowmeters sold, and many other product segments. As a result, the study identifies where growth is occurring in the market, and the underlying factors driving that growth.

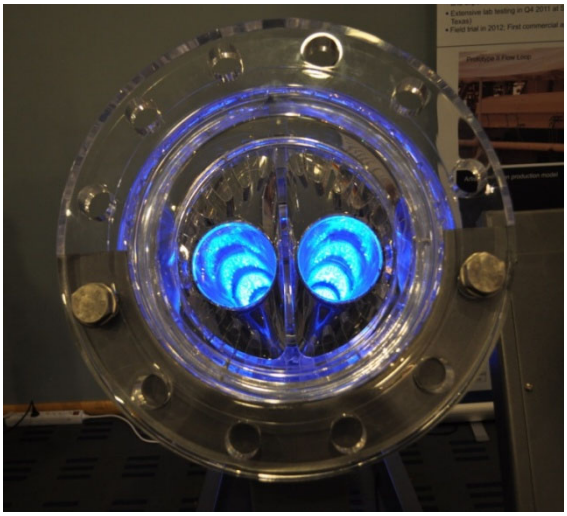
When analyzing target markets, Flow Research uses the perspective of all three segments – manufacturer, distributor/representative, and end user. We maintain regular communication with all three of these groups in order to be best positioned to note both subtle and significant shifts in technologies or buying patterns. We also use this steady flow of new information in support of our two Worldflow quarterly publications, *Market Barometer* and *Energy Monitor*.

We have held this study back so that we can assess the effects of COVID-19 on the market. While uncertainties remain, the forecasts take the expected 2020 downturn into account.

Segmentation

Geographic Segmentation

- North America (United States and Canada)
- Western Europe
- Eastern Europe/Former Soviet Union (FSU)
- Mideast/Africa
- Japan
- China
- Rest of Asia
- Latin America (Mexico, Central and South America)



Total Shipments of Coriolis Flowmeters Worldwide and by Region by Technology

- Single Bent Tube
- Dual Bent Tube
- Single Straight Tube
- Dual Straight Tube

This study provides Average Selling Prices for Coriolis Flowmeters by Technology

- Worldwide
- By Region

Shipments of Coriolis Flowmeters Worldwide and by Region by Fluid Type

Coriolis flowmeters are segmented in this study according to fluid type:

- Petroleum Liquids
- Non-petroleum Liquids
- Gas
- Steam

Shipments of Coriolis Flowmeters Worldwide and by Region by Mounting Type

- Integral (compact)
- Remote

Shipments of Coriolis Flowmeters Worldwide and by Region by Sensor Tube Material

- Stainless Steel
- Hastelloy C®
- Titanium
- Duplex/Super Duplex
- Zirconium
- Tantalum

Shipments of Coriolis Flowmeters for Gas Worldwide and by Region by Gas Applications

- Custody Transfer of Natural Gas
- Allocation Metering
- Process Measurement
- Industrial Gases (not in Process Measurement)
- CNG (Compressed Natural Gas)
- Hydrogen Dispensing
- Utility Metering
- Other

History and Application of Coriolis Flowmeters

Coriolis flowmeters are a relatively recent entrant into the market. In 1977, Micro Motion introduced a commercially viable Coriolis flowmeter for industrial applications. Since that time, a number of other suppliers have entered the market, including Endress+Hauser and KROHNE.

Coriolis suppliers have introduced a wide variety of models and types of Coriolis flowmeters in the past 40 years. Endress+Hauser, KROHNE, and Micro Motion have all introduced large four-tube Coriolis meter for oil, gas, and other fluids in the last several years. The use of Coriolis flowmeters in multiphase flow measurement is another recently developed application.

Coriolis suppliers differentiate themselves in a number of ways. One is by the proprietary design of the bent tubes in their Coriolis flowmeters. Another is by the different types of straight tube Coriolis flowmeters that they offer.

Suppliers also compete by bringing out Coriolis flowmeters for particular industries and applications, such as water, food & beverage, and pharmaceutical. Accuracy and other performance specifications are other areas of supplier differentiation.

Shipments of Coriolis Flowmeters for Petroleum Liquids Worldwide and by Region by the Following Applications:

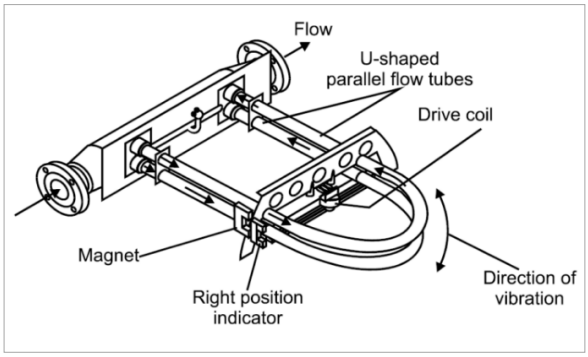
- Custody Transfer: Upstream/Mid-stream
- Custody Transfer: Downstream
- Allocation Metering
- LNG (Liquefied Natural Gas)
- Batch Filling
- In-Plant Process Measurement
- Other

Shipments of Coriolis Flowmeters for Non-petroleum Liquids Worldwide and by Region by the Following Applications:

- Custody Transfer of Non-petroleum Liquids
- Process Measurement
- Batch/Filling
- Other

Shipments of Coriolis Flowmeters Worldwide and by Region by Output and by Communication Protocol

- 4-20mA without HART
- 4-20mA with HART
- Ethernet IP
- Foundation Fieldbus™
- Modbus
- PROFINET®
- Profibus®DP
- Profibus®PA
- Proprietary digital
- Other



Basic Coriolis flowmeter design

Shipments of Coriolis Flowmeters by Line Size

- ≤ ⅛ inch
- > ⅛ – ¼ inch
- > ¼ – ½ inch
- > ½ inch – 1 inch
- >1 inch – 2 inches
- >2 – 4 inches
- >4 – 6 inches
- >6 – 10 inches
- >10 – 16 inches

Shipments of Coriolis Flowmeters by Accuracy Level by Fluid Type

For Gas	For Liquids
≤ .15%	≤ .15%
> .15% - .5%	> .15% - .5%
> .5% - 1.0%	> .5% - 1.0%
> 1.0%	> 1.0%

Shipments of Coriolis Flowmeters Worldwide and by Region by Industry

- Upstream Oil & Gas (exploration & production)
- Midstream Oil & Gas (from upstream to refining/processing facility
- Refining
- Downstream Oil & Gas (refined product transportation and distribution)
- Chemical
- Food & Beverage
- Pharmaceutical
- Pulp & Paper
- Metals & Mining
- Power
- Water/Wastewater
- Marine
- Other

Beverage processing plant production line

Shipments of Coriolis Flowmeters Worldwide and by Region by Distribution Channel

- Direct Sales
- Distributors
- Independent Representatives
- E-Business

Shipments of Coriolis flowmeters Worldwide and by Region by Customer Type

- End-users
- Original equipment manufacturers (OEMs)
- Systems integrators
- Engineering companies

Market Shares of Coriolis Flowmeter Manufacturers

- Worldwide
- Each geographic region

What's in this for my company?

- See the emerging applications and where the growth is.
- Understand world and regional markets.
- Get to know your real competition.
- Learn what other suppliers manufacture, where, and for whom.
- The best information creates the best decisions.

Strategies for Success

- Competitive points of product emphasis
- Strategies for being competitive in the Coriolis flowmeter market
- Pursuing new applications
- Customer education and other market strategies and tactics

Company Profiles

- Business profiles of the main suppliers of Coriolis flowmeters
- Histories, current organization, overall product line summaries
- Coriolis flowmeter product line descriptions
- Company strategies

The following is a partial list of the Coriolis suppliers profiled in this study:

- ABB
- Bronkhorst High-Tech B.V.
- Brooks Instrument
- Emerson Process Management – Micro Motion
- Endress+Hauser
- KROHNE, Inc.
- OVAL Corporation
- Rheonik
- Schneider Electric – Foxboro
- Shanghai Yinuo Instrument Co., Ltd
- Siemens AG
- TASI Group – KEM Kueppers
- Yokogawa

Publication Date: The target date for publication of this study is Q3 2020.

Flow Research, Inc.

Flow Research is the only market research company whose primary mission is to research process control instrumentation markets. Flow Research market research studies can be purchased by anyone interested in the topics. We create these studies through interviews with suppliers, distributors, and end-users. Topics include all of the flowmeter technologies – both new and traditional – as well as pressure transmitters; temperature sensors and transmitters, infrared thermometers and thermal imagers; level devices; analytical instrumentation; selected API-certified valves; and studies specifically focused on certain major markets for flowmeters such as the oil and gas markets. Flow Research also started a working group focusing on flowmeter calibration (FRWG.org) and has completed two studies on flowmeter calibration facilities: one for liquids and one for gas.

Further information on studies, links for articles and more can be found by visiting the Flow Research website at www.flowresearch.com or by calling us at +1 781-245-3200.

Research Team Background

Dr. Jesse Yoder is President of Flow Research Inc., a company he founded in 1998. Dr. Yoder has 32 years of experience as a writer and as an analyst in process control and instrumentation beginning as president and founder of Idea Network. He is the lead analyst for this study.

Since 1990, he has written over 250 market research studies, most of them regarding flow and instrumentation. Dr. Yoder has also written over 300 articles on flow and instrumentation for trade journals. Many can be found at www.flowarticles.com.

In addition to the years he has spent writing market studies, Dr. Yoder spent 10 years as a technical writer. Almost four years of this were spent writing technical manuals and training guides for the process control division of Siemens. He also taught technical writing at the graduate level at Northeastern University and the University of Massachusetts Lowell. Dr. Yoder spent 10 years as an adjunct philosophy professor at the University of Massachusetts Lowell and Lafayette College.

Dr. Yoder has received two US patents for the flowtube meter, a new dual tube/dual sensor method of measuring flow, in 2015 and 2017. This meter has two prototypes built and is under test at CEESI in Nunn, Colorado.

His latest book, *The Tao of Measurement*, with Richard E. Morley as co-contributor, was published in 2015 by the ISA. Topics covered include temperature, pressure, flow, time, length, and area. He is currently working on a two-volume set of books, *Advances in Flowmeter Technology*, to be published in 2021 by CRC Press. These two books cover the entire flowmeter market, including the origin, history, development, principles of operation, and applications of each flowmeter type.

Belinda Burum, Vice President, worked in journalism and advertising before entering high tech 18 years ago as a writer, marketing communications manager, and customer references

consultant. She joined Flow Research in 2002 and has been involved with many Flow Research projects and publications since. She has made notable contributions to our many websites and has written extensively for Flowtimes and for our press releases.

Norm Weeks, Senior Market Analyst, joined Flow Research in 2004 after a 24-year stint with Verizon. At Verizon, Norm specialized in creating innovative solutions for national and international enterprises, introducing new products and lifecycle management. At Flow Research, his contributions in development, research, and writing are appreciably significant to studies, White Papers, and other publications. Custom projects are a specialty.

Leslie Buchanan, Research and Publication Production Associate, joined Flow Research in 2010 with skills from work and life experiences here and abroad. She assists with research and writing, and handles many aspects of Flow Research studies and publications production.

Vicki Tuck, Administrative Assistant, joined Flow Research in 2012 with experience in both the fast-paced law firms of Boston, and in various nonprofit organizations. She assists with administrative tasks, including database and collecting news for the Worldflow publications.

Gabriella DeCologero, Director of Marketing, joined Flow Research in June 2019. She is in charge of our social media outreach, and has brought her graphic design talents to our marketing efforts. Gabriella is also assisting in our customer contacts and outreach.

Flow Research studies contribute to an ongoing view of the flowmeter market

Listed below is a summary of recent and upcoming Flow Research studies in the area of process control instrumentation. These studies are further described at www.FlowStudies.com.

Recent and Currently Scheduled Flow Research Studies	*Websites*
New-Technology Flowmeter Studies	
The World Market for Coriolis Flowmeters, 6th Edition	*www.flowcoriolis.com*
The World Market for Magnetic Flowmeters, 6th Edition	*www.flowmags.com*
The World Market for Ultrasonic Flowmeters, 6th Edition	*www.flowultrasonic.com*
The World Market for Vortex Flowmeters, 6th Edition	*www.flowvortex.com*
The World Market for Thermal Flowmeters, 2nd Edition	*www.flowthermal.com*
Traditional Technology Flowmeter Studies	
The World Market for Pressure Transmitters, 5th Edition	*www.pressureresearch.com*
The World Market for Positive Displacement Flowmeters, 3rd Edition	*www.flowpd.com*
The World Market for Turbine Flowmeters, 3rd Edition	*www.flowturbine.comm*
Emerging Technology	
The World Market for Multiphase Flowmeters, 2nd Edition	*www.flowmultiphase.com*
Multiphase: Module A: The World Market for Watercut Meters	*www.watercutmeters.com*
Mass Flow Controllers	
The World Market for Mass Flow Controllers, 3rd Edition	*www.flowmfc.com*

The World Market Update for Mass Flow Controllers	*www.flowmfc.com*

Cross-Technology Flowmeter Studies

Volume X: The World Market for Flowmeters, 7th Edition	*www.flowvolumex.com*
Volume X Module A: Strategies, Industries, and Applications, 7th Edition	*www.flowvolumex.com*
The World Market for Gas Flow Measurement, 4th Edition	*www.gasflows.com*
Gas Module A: Oil & Gas Industry Flowmeters, Gas Applications, and Strategies	*www.gasflows.com*
The World Market for Oil and Oil Flow Measurement	*www.oilflows.com*

Calibration

Core Study: Worldwide Gas Flow Calibration Facilities and Markets	*www.flowcalibration.org*
Module A: Worldwide Liquid Flow Calibration Facilities and Markets	*www.flowcalibration.org*

Besides studies of this type, Flow Research specializes in custom projects and also conducts user surveys that include a detailed analysis of customer perceptions.

Custom Projects

Custom reports are often commissioned by companies who want more detailed information on a specific subject. Perhaps they are evaluating the future of a product line or expansion of their product line, determining whether to make an acquisition or merge with another company, seeking to understand their customer needs better, or other specific needs. In most cases, the type of information required in a custom project is too specific and narrow to be available in an off-the-shelf report. We also work with companies individually to formulate strategies that help them succeed in an increasingly complex world. Dr. Yoder has been working in process control since 1986 and creating market research studies since 1990. He and his team have studied hundreds of companies during this time and have advised most of the top flowmeter suppliers on market and product strategies.

Worldflow Monitoring Service

Flow Research also provides quarterly updates on the flow and energy industries in our Worldflow Monitoring Service publications the *Market Barometer* and the *Energy Monitor*. **Market Barometer** analyzes the current state of the flowmeter markets, and covers related topics such as other instrumentation and flow calibration. **Energy Monitor** analyzes the current state of the oil & gas, refining, power, and renewables industries, and the implications for instrumentation suppliers. More details are available at www.worldflow.com.

For more information on Flow Research, please visit our website at www.flowresearch.com.
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Gustave Coriolis

The Flow Research Gold Partner Program

To produce studies that most closely match our clients' needs, Flow Research has instituted the Gold Partner Program. This program enables companies who wish to participate at a high level in a study's research to influence its scope and segmentation. In addition, Gold Partners receive regular updates from Flow Research on study progress, and receive a significant discount on the regular price of the study.

Procedure: Early in the planning phase of a study, Gold Partners receive a proposal that includes the proposed segmentation. Gold Partners can propose additional segmentation, and can also suggest changes to the proposed segmentation. While the decision to adopt particular segmentation ultimately lies with Flow Research, and is based on input from all contributors, we do our best to accommodate the specific needs of each of our clients.

During the research phase of a study, Flow Research issues regular reports that provide updates on the progress of the research. These reports are sent to Gold Partners, who are then invited to provide any additional input or comments into the study.

Being a Gold Partner requires making an early commitment to purchase the study. However, in return, Gold Partners receive a significant discount off the regular price of the study. Payment can be made either in one amount at the beginning of the study, or split into two, with the second payment due upon delivery of the study.

For additional details, or to find out how the Gold Partner Program applies to any particular study, please contact Flow Research. We look forward to working with you!

For answers to any question you may have regarding the above, please contact Norm Weeks at +1 781 245-3200, or norm@flowresearch.com.

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Why Flow Research?

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- We research both new-technology and traditional technology flowmeters.
- We contact every known supplier for each study.
- We have data on the flowmeter market going back to 1992 and have been actively following it since then.
- We offer our studies in both electronic and color-printed hardcopy format.