

MASS FLOWMETER SERIES

The World Market for Coriolis Flowmeters, 7th Edition

— OVERVIEW —



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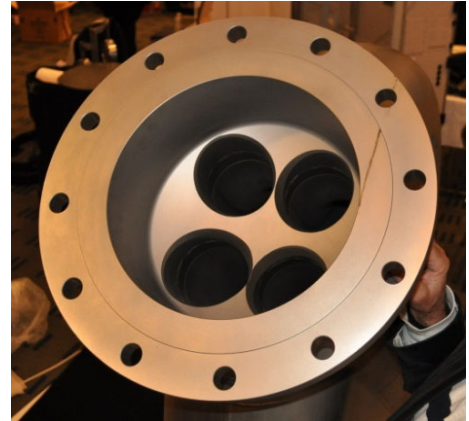
The World Market for Coriolis Flowmeters, 7th Edition

Flow Research is offering a new study on the worldwide Coriolis flowmeter market, one of the fastest growing flowmeter markets. The study, *The World Market for Coriolis Flowmeters, 7th Edition*, is part of a first-ever *Mass Flowmeter Series* that will also include *The World Market for Mass Flow Measurement (core study)*; *The World Market for Thermal Flowmeters, 3rd Edition*; and *The World Market for Mass Flow Controllers, 4th Edition*.

The Coriolis study reveals the size of the 2022 worldwide market, including the market shares of all major suppliers and forecasts for the market through 2027.

This study achieves multiple goals:

- Determine worldwide market size for the Coriolis flowmeter market in 2022
- Determine worldwide market shares for the Coriolis flowmeter market in 2022
- Forecast market growth for all types of Coriolis flowmeters through 2027
- 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 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



Rationale for Study

Our interactions with end users indicate that the interest in Coriolis flowmeters remains at a very high level, and that customer needs have become more complex and demanding.

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.

We believe that significant growth in the Coriolis market is due to growth in the oil & gas and other energy markets. When oil prices began dropping 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. More recently, Coriolis meters rebounded after the 2020 Corona virus pandemic slowdown. This study reveals just how much the Coriolis market is rising, especially in light of the war in Ukraine, sanctions on Russia, and changes in global oil and gas supplies. We expect that Coriolis flowmeters, which are industry-approved for custody transfer of both gas and liquids, will continue to experience strong market growth rates over the next five years.

Key issues we address

- Frontiers of research
- Coriolis force vs. Coriolis meters
- Growth in the popularity of low-cost Coriolis flowmeters to reduce sticker shock
- Relative merits of straight tube vs. bent tube meters
- Size of the 2-wire Coriolis market
- Growing use for gas flow, including custody transfer
- Why large line size Coriolis meters are becoming more feasible
- Technological improvements in Coriolis flowmeters

We also explore improvements in Coriolis technology 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. Some suppliers also offer two-wire, loop-powered meters for cost and energy savings and use in hazardous environments.

To sweeten the pot further, some suppliers have broken price barriers by offering Coriolis meters at considerably lower price points. Although the lower-cost flowmeters do not offer the same level of performance, they do provide many of the same technology benefits.

Flow Research published the sixth edition of our worldwide Coriolis flowmeter study in September 2020. We have continued to follow the Coriolis flowmeter market regularly since.

The World Market for Coriolis Flowmeters, 7th Edition analyzes overall market size and market growth forecasts in depth from 2022 to 2027, worldwide and regionally. We explore a range of growth factors as we research the market.

Background of the 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, 2016, and 2020. 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.

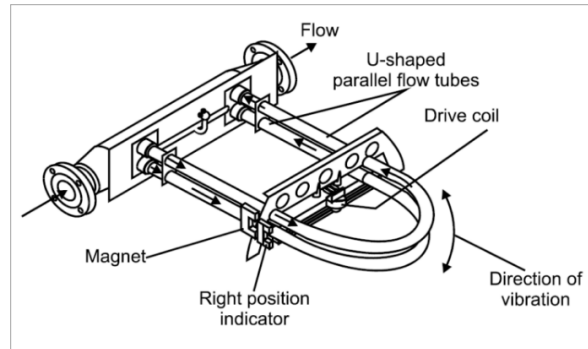
In conducting this study, we contacted all known manufacturers of Coriolis flowmeters worldwide to assemble a picture of the total Coriolis flowmeter market. We ask suppliers to provide detailed

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.

Introducing a New Chapter on History and Principles of Operation

Flow Research has expanded coverage of the history and principles of operation of Coriolis flowmeters, giving it its own whole chapter. Learn about how they came to be, important developments, and how they work.



Basic Coriolis flowmeter design

Segmentation

Geographic Segmentation

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

Shipments of Coriolis Flowmeters

Worldwide and by region
In dollars and units

Technology

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

Average Selling Prices by Technology

- Worldwide
- By 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
- Make more informed decisions

Fluid Type

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

Mounting Type

- Integral (compact)
- Remote

Sensor Tube Material

- Stainless Steel
- Hastelloy C[®]
- Titanium
- Duplex/Super Duplex
- Other

Gas Applications

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

Petroleum Liquids Applications:

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

Non-petroleum Liquids Applications:

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

Flow Research Gold Partner Program

Gold Partners make sure studies meet their needs by telling us what they think about our scope and segmentation. By becoming a Gold Partner in the early stages of a study, you can also enjoy a significant discount on the regular price of the study.

Being a Gold Partner requires making an early commitment to purchase the study, but you can make payments 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 more details, please contact Jesse Yoder at +1 781 245-3200, or jesse@flowresearch.com.



Beverage processing plant production line

Communication Protocol

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

Line Size

- <¼ inch (<6.35 mm)
- ½ inch (12.7 mm)
- ¾ inch (19.05 mm)
- 1 inch (25.4 mm)
- 2 inches (50.8 mm)
- 3 inches (76.2 mm)
- 4 inches (101.6 mm)
- 6 inches (152.4 mm)
- 8 – 10 inches (203.2 – 254 mm)
- >10 – 16 inches (>254 mm – 406.4 mm)

Temperature

- High Temperature (>200°C)
- Low Temperature (Cryogenic: <-50°C)
- All the rest (50°C – 200°C)

Accuracy Level by Fluid Type

Gas

- ≤ 0.15%
- > 0.15% – 0.5%
- > 0.5% – 1.0%
- > 1.0%

Liquids

- ≤ 0.15%
- > 0.15% – 0.5%
- > 0.5% – 1.0%
- > 1.0%

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 Coriolis meters for oil, gas, and other fluids. 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.

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 / Biopharmaceutical / Life Sciences
- Pulp & Paper
- Metals & Mining
- Power
- Water & Wastewater
- Marine
- Other

Distribution Channel

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

Customer Type

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

Market Shares of Coriolis Flowmeter Manufacturers

- Worldwide and for each geographic region

Strategies for Success

Based on Flow Research's many years of experience with the market and suppliers, this chapter includes a wealth of ideas to considering, including:

- 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
- And more.

Company Profiles

Business profiles of many suppliers of Coriolis flowmeters, with

- Histories
- Current organization
- Overall product line summaries

We are profiling these companies:

- ABB
- Alicat Scientific
- Badger Meter
- Beijing Sincerity Automatic Equipment Co., Ltd.
- Bopp & Reuther Messtechnik
- Bronkhorst High-Tech B.V.
- Emerson: Micro Motion
- Endress+Hauser
- ITW: Brooks Instrument
- Jiangsu BCST Group Co. Ltd
- KOBOLD: Heinrichs
- KROHNE
- OVAL Corporation
- Rheonik Messtechnik
- Schneider Electric: Foxboro
- Sensia
- Shanghai Yinuo Instrument
- Siemens
- TASI Group:
KEM Kùppers, AW-Lake
- Tokyo Keiso
- Walsn Limited
- Xi'an Dongfeng Machinery & Electronic
- Yokogawa

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Gustave Coriolis

Flow Research, Inc.

Flow Research is the only market research company that publishes studies on all nine flowmeter types and whose primary mission is to research process control instrumentation markets. In addition to studies on both new and conventional flowmeter types, we have researched pressure transmitters; temperature sensors and transmitters, infrared thermometers and thermal imagers; level devices; analytical instrumentation; and selected API-certified valves. We also publish studies on oil & gas and other major flowmeter markets. In addition, Flow Research started a working group on flowmeter calibration (FRWG.org) and published two studies on flowmeter calibration facilities, one each for liquids and gas.



Dr. Jesse Yoder, president and founder of Flow Research

Partnerships and Alliances

Flow Research helps flowmeter companies form alliances and partnerships to provide specific solutions or broaden their customer base and distribution channels. These partnerships can include manufacturers of valves, hoses, transmitters, or other flow-related products, as well as other flowmeter manufacturers.

Distributorships

Are you thinking about expanding your presence in the U.S.? We can help you find distributors for your flowmeters and other instrumentation.

Custom Projects

Companies commission us for custom projects when they want more detailed information on a specific subject than is possible in an off-the-shelf report. They may be evaluating the future or expansion of a product line, determining whether to acquire or merge with another company, or seeking to better understand their customer needs.

Consulting

We also work with companies individually to formulate strategies that help them succeed in an increasingly complex world. Dr. Yoder and his team have studied hundreds of companies and have advised most of the top flowmeter suppliers on market and product strategies.

Research Team Background

Dr. Jesse Yoder, the lead analyst for this study, is President of Flow Research Inc., which he founded in 1998. He has worked as a writer and analyst in process control and instrumentation since 1987 and has created market research studies since 1990. Since then he has written over 280 market research studies, most of them on flow and instrumentation, and over 300 articles on flow and instrumentation for trade journals. (See www.flowarticles.com.)

Dr. Yoder received a PhD in philosophy from the University of Massachusetts Amherst in 1984 and spent 10 years as an adjunct philosophy professor at the University of Massachusetts Lowell and Lafayette College. Dr. Yoder also worked 10 years as a technical writer, including for the

process control division of Siemens, and taught technical writing at Northeastern University and UMass Lowell.

Dr. Yoder has received two U.S. patents for the flowtube meter, a new dual tube/dual sensor method of measuring flow, in 2015 and 2017. This meter's two prototypes have been tested at CEESI in Nunn, Colorado.

CRC Press published Dr. Yoder's two-book set, *Advances in Flowmeter Technology*, on the history, operating principles, growth factors, representative companies, and frontiers of research for all 10 types of flowmeters. The first volume, *New-Technology Flowmeters*, published September 6, 2022, was followed by *Conventional Flowmeters* on December 15.

In 2015, ISA published Dr. Yoder's book, *The Tao of Measurement*, with Richard E. Morley as co-contributor. Topics included temperature, pressure, flow, time, length, and area.



Belinda Burum

Belinda Burum, Vice President, joined Flow Research in 2002. Since then, she has served as senior strategic advisor and been involved with most of our projects and publications. She has also worked as a writer and editor in journalism, advertising, and high tech marketing communications and customer references for 40+ years in the U.S. and Switzerland and is a published author and book editor. She has travelled extensively and enjoyed teaching English in Massachusetts, California, and Ecuador.

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 publication aspects of Flow Research studies.

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.

Kaleigh Flaherty, Director of Marketing, created social media posts for us starting in May 2021 before going back to school to finish her degree in marketing at Coastal Carolina University in Conway, South Carolina. She rejoined us in August 2022 to expand our social media presence and manage other outreach activities.



Kaleigh Flaherty

For more information on Flow Research, please visit our website at www.flowresearch.com. Please follow us on Facebook, LinkedIn, Twitter, and Instagram. We also invite you to join our Flow Research LinkedIn group.

Recent and Currently Scheduled Flow Research Studies

New-Technology Flowmeter Studies

Mass Flowmeter Series	www.massflows.com
The World Market for Mass Flow Measurement (Core Study)	
The World Market for Coriolis Flowmeters, 7 th Edition	www.flowcoriolis.com
The World Market for Thermal Flowmeters, 3 rd Edition	www.flowthermal.com
The World Market for Mass Flow Controllers, 4 th Edition	www.flowmfc.com
The World Market for Magnetic Flowmeters, 7 th Edition	www.flowmags.com
The World Market for Ultrasonic Flowmeters, 7 th Edition	www.flowultrasonic.com
The World Market for Vortex Flowmeters, 7 th Edition	www.flowvortex.com
The World Market Update for Mass Flow Controllers	www.flowmfc.com
The World Market for Multiphase Flowmeters, 2 nd Edition	www.flowmultiphase.com
Multiphase: Module A: The World Market for Watercut Meters	www.watercutmeters.com

Conventional Flowmeter Studies

The World Market for Pressure Transmitters, 5 th Edition	www.worldpressure.com
The World Market for Primary Elements, 2 nd Edition	www.flowplate.com
The World Market for Positive Displacement Flowmeters, 3 rd Edition	www.flowpd.com
The World Market for Turbine Flowmeters, 3 rd Edition	www.flowturbine.com
The World Market for Variable Area Flowmeters	www.flowva.com

Cross-Technology Flowmeter Studies

Volume X: The World Market for Flowmeters, 9 th Edition	www.flowvolumex.com
Volume X: Module A: Strategies, Industries, and Applications	www.flowvolumex.com
The World Market for Gas Flow Measurement, 4 th Edition	www.gasflows.com
Gas Module A: Applications and Strategies for Gas Flow Measurement	www.gasflows.com
Gas Module B: Natural Gas Production, Consumption, and Flow Measurement in the Oil & Gas Industry	www.gasflows.com
Flowmeters in the Oil & Gas Industry	www.oilflows.com

Flow Calibration Studies

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

Temperature

Market for Temperature Sensors in the Americas, 3 rd Edition	www.tempresearch.com
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Why Flow Research? Because we . . .

- Are the only company whose sole focus is the flowmeter instrumentation market
- Research all new-technology and conventional flowmeters
- Contact every known supplier
- Offer our studies in both electronic and color-printed hardcopy versions
- Draw on flowmeter data dating back to 1992, when we began actively following the market