FlowTimes – July 2026

Your strategic update on flow, temperature, and pressure measurement from Flow Research

Executive Editor: Dr. Jesse Yoder. Volume 27, Number 1 – ISSN 1350-7204

Welcome to our high-velocity summer

As usual, there is a lot going on here at Flow Research. In addition to churning out studies as fast as we can – with help from your data – we are taking a fresh look at how we present our information.

The 10th Anniversary Edition of our flagship *Volume X* is in the final stages. In addition to looking at how we can make this huge study a little more concise, we are developing graphics that present an integrated view of the various flowmeter technologies used in specific applications – custody transfer, flare gas, and large and small line size, for example. Also, for the first time, we're evaluating the current market for every flow technology in light of its history so that we can tell you where the market has been, where it is today, and where it's headed.

Jesse and Belinda in front of the Alamo

Also for the first time ever, we are also working on an exciting new companion study called *Forces and Dynamics* that puts together 33 years of data in a way that will help you understand currents and ride trends better than ever before. We think it's inspired, and firmly believe everyone should own a copy.

We started the year by publishing our latest editions on vortex flowmeters (in January) and magnetic flowmeters (in March). Our three-part ultrasonic study is due at the end of the summer.

We invite you to check out these studies and place your orders soon!

Ultrasonic conference

In June, Flow Research travelled to the 2026 CEESI Gas Ultrasonic Meter User's Conference in San Antonio, Texas and came back full of inspiration not only for our ultrasonic study, but for the flowmeter market as a whole. Here are some of the topics that stood out to us:

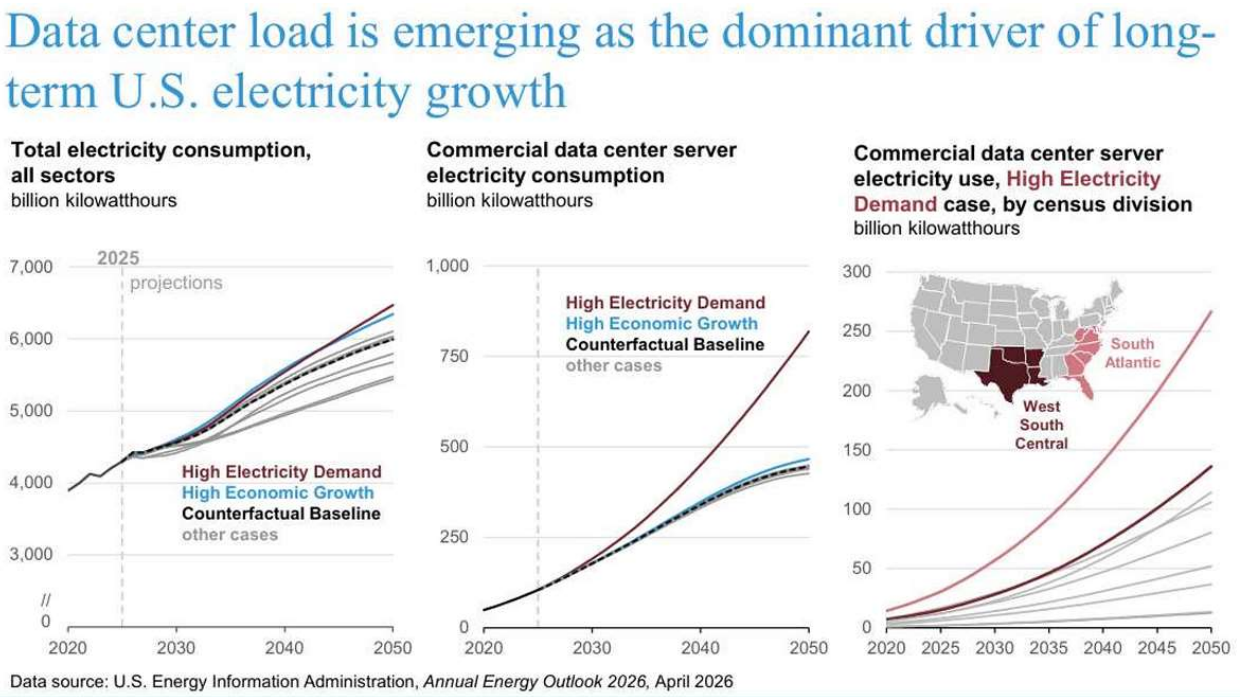
San Antonio Riverwalk

Artificial intelligence and flowmeter demand. As we all know, AI is taking

data harvesting to new levels, and this applies to flowmeter data. AI is already becoming part of diagnostics and process control systems. Stay tuned for more advances in the way customers use AI to leverage data from flowmeters and other instrumentation to optimize their businesses.

But the current – almost urgent – opportunity for flowmeters is how AI is creating unprecedented power demand. AI data centers require massive, continuous electricity and AI's future depends on the natural gas infrastructure, according to Dan Haley, CEESI keynote speaker and executive director of Coloradans for Responsible Energy Development.

Data center load is emerging as the dominant driver of U.S. electricity growth, and AI could drive a natural gas boom to supply that electricity, Haley said. **AI data centers are expected to add about 323 terawatt hours of demand in the U.S. by 2030. Gas demand for power generation is projected to rise 10–20% by 2035.**



To meet the power demand and avoid power delivery delays, developers are beginning to look at on-site generation through natural gas-fired turbines and generators. Consequently, data centers are co-locating near gas infrastructure, and states with streamlined permitting are attracting AI investment.

Diagnostics – beyond alerts. As usual, one of the predominant themes at CEESI was diagnostics and the many challenges of figuring out what's happening in the field. But the talks went considerably beyond alert-based monitoring or prevention understanding changing conditions as they happen, or even well before.

Ernie Hauser from C-SMART, for instance, discussed how to get more out of existing instrumentation assets through condition-based and predictive maintenance. He explained how automated agents can produce maintenance actions based on standard volume measurement, data integrity, and historical context.

Stormy Phillips from TMCO urged the industry to broaden its approach to performance. By focusing only on a meter's flowrate, users are leaving a lot of useful information on the table. No single diagnostic explains measurement quality, and users would learn more by looking for patterns across the entire ecosystem and multiple domains – e.g., timing, transducer performance, velocity profile, velocity integration. That way they can use data to actually understand what is happening in process conditions and production. Wet gas, for instance, which is often blamed, rarely changes only one diagnostic. The true "fingerprint" emerges when multiple diagnostics change together.

Other talks mentioned some of the realities of flow measurement in the field including bad transducers, black oil buildup over time, temperature transmitters out of tolerance, improper transducer installation, chromatograph contamination, RTD length issues, and blockages from cardboard and a variety of other debris.

Wet gas standards update. Wet gas measurement is still one of the most challenging flowmeter applications. The amount of oil, water, dirt, dust, and mechanical particles vary from point to point and field to field, even within an organization. A team of flowmeter professionals, including Duane Harris of E&H, is currently working through comments and hoping to publish updates to the standard in 2026. The official name is Proposed Tentative Standard Update - GPA WG77 / GPA 8126, Multi-Path Ultrasonic Metering of Gas at or Near Dew Point.

Speak now or forever hold your peace. ISO 17089-1, the international standard for ultrasonic gas measurement used for custody transfer and allocation measurement is currently being updated. All USM subject matter specialists are invited to comment through their national standards body, especially when the standards go out for industry comment – probably in 2027. Although AGA 9 governs the US industry, both AGA 9 and ISO 17089 share citations across the world. Consequently, global USM manufacturers must comply with both. The standards under discussion include certainty, calibration, and diagnostics.

Forces and Dynamics of the Fl owmeter Market (1992-2025): Predict the future from the past

A must-have, one-of-a-kind guide for any flowmeter supplier

We are so excited about this first-time, one-time study that we believe everyone in the flowmeter market should have it.

Where else can you get 33 years of high-level data correlated with a timeline of global events that shaped the economy – financial crises, dot.com crash, China-led global expansion, Covid-19, and more? Who else could show you how these global forces shaped flowmeter demand? And help you understand how at the same time the internal dynamics – new products, mergers, standards, and more – determined the course of the flowmeter market?

This detailed data – all in one place and depicted clearly in graphs and charts – can help you more accurately predict how global disruption and technological changes might affect your flowmeter business.

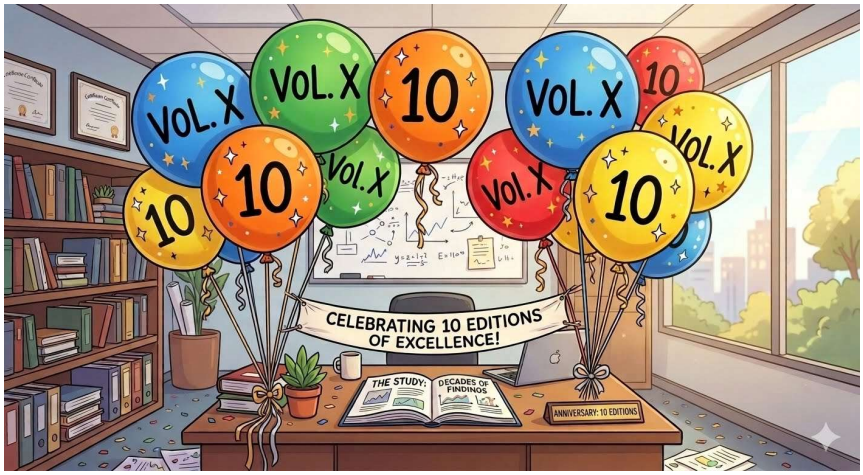
The idea to put all of this data in one place and tie it to global forces and internal dynamics emerged when we were starting to work on our 10th Anniversary Edition of *Volume X: The World Market for Flowmeters*. We were looking back at reports to see how the market has changed over the years and realized what a gold mine of data we have at our fingertips.

Flow Research has been dedicated to the flowmeter market for three decades. We have studied it and documented it as it evolved. We have lived through market changes. So we are not exaggerating when we say that Flow Research is the only company able to offer this one-of-a-kind study.

Forces and Dynamics of the Flowmeter Market (1992-2025): Predict the future from the past, available this month, complements ***Volume X: The World Market for Flowmeters, 10th Anniversary Edition***, and its companion study, ***Module A: Strategies, Industries, & Applications***, published in June.

Happy Xth Anniversary to Volume X and congrats to market-leading magmeters

We have always been proud of our flagship study, Volume X, cleverly so named – at least we've always thought so – for the 10 flowmeter technologies we research all at the same time. It's always been a significant undertaking, but well worth the effort. This year we celebrate our 10th, or should we say Xth, edition!



In *Volume X: The World Market for Flowmeters, 10th Anniversary Edition*, published in June, we found that magnetic flowmeters generated more revenues and sold more units worldwide than any other type of flowmeter in sales to the process industries in 2025.

Coriolis flowmeters trailed magmeters slightly in revenue and considerably in units. Magmeters also lead in revenues from conventional flowmeters. Magmeters also had an edge over conventional meters in terms of unit sales, even though large numbers of DP and variable area flowmeters are sold every year.

This latest edition is a culmination of more than three decades of research. Jesse, who founded Flow Research in 1998, wrote his first worldwide flowmeter study in 1994 for Find/SVP, later authoring the first official Flow Research worldwide flowmeter study as Volume X in 2003.

The companion volume, *Module A: Strategies, Industries, & Applications*, provides tactical and strategic recommendations for suppliers in each market segment and forecasts best areas for future growth. Order your studies now at www.flowresearch.com/volumex.

SLB now home to Sensia's technologies

The Sensia joint venture formed in by Rockwell Automation and Schlumberger (now SLB) in 2019 is now fully part of SLB. On April 1, the two companies announced the completion of the joint venture's dissolution. Rockwell assumed 100% ownership of the Process Automation Business that it originally contributed to the joint venture, and SLB again fully owns the parts they contributed, including Measurements Products and Solutions, which includes flowmeters. Sensia is also transitioning Lift Control Systems, Digital Production, and Digital Platforms and Software to SLB.

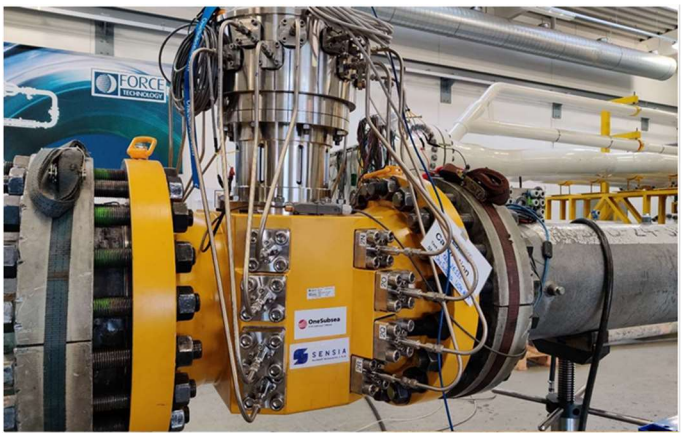
Since its formation, Sensia claims it has helped energy and industrial operators improve efficiency, strengthen safety, and unlock greater value from their assets. SLB says that the dissolution of the joint venture is the "next strategic step" toward strengthening capabilities, expanding reach, and accelerating innovation.

Schlumberger acquired Cameron in 2016 to combine its reservoir and well expertise with Cameron's wellhead and surface equipment, flow control, and processing technology. Today, SLB/Sensia measurement's oil and gas measurement technologies, instrumentation, and digital solutions still encompass a large installed base of flowmeter and other technology from Cameron's CALDON, Jiskoot, BARTON, and NUFLO™ brands, including ultrasonic, Coriolis, positive displacement, differential pressure, and turbine flowmeters.

In 2022, Schlumberger changed its name to SLB to mark what it said was its transformation from the world's largest oilfield services company to a global technology company focused on driving energy innovation.

SLB's new subsea custody transfer meter

Development of a subsea ultrasonic flowmeter for natural gas and CO_2 is now in the final stages of commercialization, according to Dr. Gregor Brown, PhD, Sensia Fellow at SLB. In a talk at CEESI he explained that the project – funded by a partnership of SLB OneSubsea, Equinor and Gassco, in cooperation with SLB/Sensia measurement – was initially driven by the need for subsea custody transfer metering to enable Equinor's



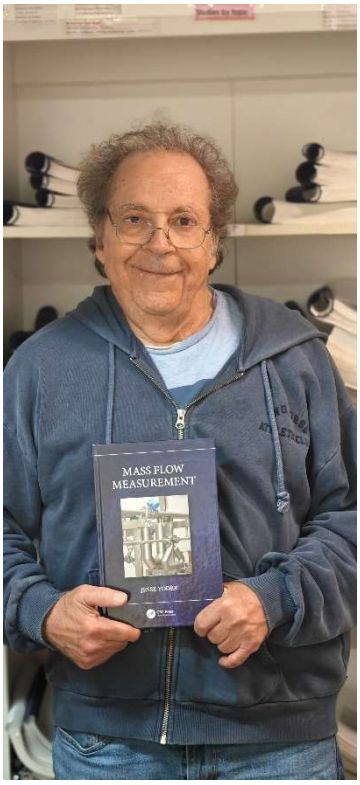
"subsea factory" concept. The project scope was later expanded to include subsea measurement of CO_2 with financial support from the Research Council of Norway.

(Equinor ASA, formerly known as Statoil, is a Norwegian multinational energy company headquartered in Stavanger, Norway. Gassco, a Norwegian state-owned company, is responsible for transporting Norwegian gas to continental Europe and the UK through its pipelines. SLB OneSubsea is a joint venture between SLB (70%), Aker Solutions (20%), and Subsea7 (10%). Headquartered in Oslo and Houston.)

The new meter's technology features high accuracy and turndown ratio, advanced diagnostics, and transducers designed to meet the stringent sealing requirements of subsea applications. The designers met the transducer challenge by welding a transducer module seal in the housing tip, gold plated c-ring seals, and a stem design optimized to impede noise transmission. The dual redundant electronics of the subsea meter can handle 16 paths, which opens up the possibility of adding quantitative self-verification to the product line.

The meter builds on more than 50 years of development of CALDON ultrasonic technology and the more than 1000 OneSubsea multiphase meters delivered since 1990.

Check out Jesse's latest book: *Mass Flow Measurement*



We are excited to announce that Jesse Yoder's latest book, *Mass Flow Measurement*, is now available on Amazon in hard copy and Kindle. Published June 26 by CRC Press, Taylor & Francis Group, this book talks about mass flow in concept and as it pertains to Coriolis flowmeters, thermal flowmeters, mass flow controllers, and multivariable flowmeters.

Jesse has written extensively over the years about mass flow, volumetric flow, and mass flowmeters. Yet the book gave him the impetus to dig deeper. As he says: "I find mass to be both an intuitive and an elusive concept. Mass seems obvious, and yet it is not. In writing this book, I really wanted to understand what mass is, and it led me down the proverbial rabbit hole to the depths of subatomic particles."

The book is a labor of love, a reason to write about philosophical and technical questions Jesse had thought about for decades. In addition to understanding mass more deeply, Jesse explores the problem with Euclidian geometry, an alternative inertial mass theory for how Coriolis meters work, the limitations of using π to measure the area of a pipe, "finite point" geometry, and where Zeno (of Zeno's paradox) goes wrong.

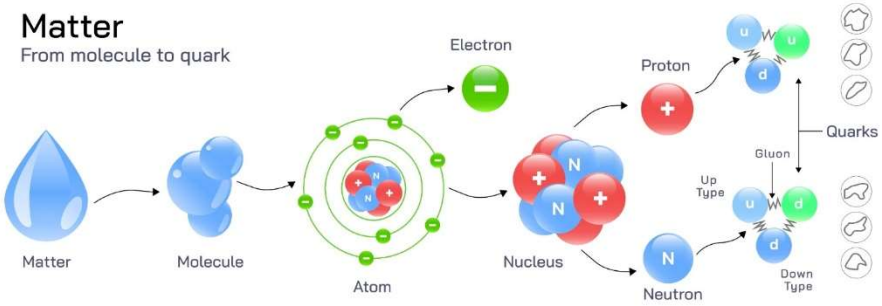
Mass Flow Measurement also includes photos from many of our flowmeter manufacturing friends, as well as an interview with Dr. John Olin, founder of Sierra Instruments. The book is designed for professionals involved with flowmeters and instrumentation, including product and marketing managers, strategic planners, application engineers, and distributors.

Jesse has written four other books. His first book, *Shades of Experience*, published in 2001, is a book on philosophy, experience and language. His second book, *The Tao of Measurement, A Philosophical View of Flow and Sensors*, with Richard E. Morley as co-contributor, was published in January of 2015 by the International Society of Automation (ISA). Topics covered include temperature, pressure, flow, time, length, and area.

In 2023, CRC Press published Jesse's two-book set on *Advances in Flowmeter Technology*. The first volume, *New-Technology Flowmeters*, and the second volume *Conventional Flowmeters*, share the history, operating principles, growth factors, representative companies, and frontiers of research for all 10 major types of flowmeters.

What is mass?

The following is an excerpt from Jesse's monthly column in Control Global on March 10, 2025. Click here to read the whole article.



The concept of mass plays an important role in flow measurement. Some flowmeters, such as Coriolis and thermal, are considered mass flowmeters. Others, such as positive displacement and variable area, are volumetric flowmeters. Most people in the flowmeter world understand that mass flowmeters measure mass, while volumetric flowmeters measure volume. However, understanding mass is a little more complicated.

According to the Cambridge English dictionary, the term "mass" means "the amount of matter in any solid object or in any liquid or gas." The most important aspect of this definition is that mass is "the amount of matter." The definition of matter in the same dictionary is "physical substance in the universe."

Putting the above definitions together, and staying with solid objects for now, we can define mass as the amount of physical substance in a solid object, with the physical being the most important term. When Descartes defined body as "an extended thing," he referred to the idea that a body occupies space. It is three-dimensional. Today, we say that it has length, width, and height. Physical objects are all around us in the form of rocks, trees, houses, cars and even our human bodies. As Bertrand Russell says, "The world is not as it seems."

Physical has many meanings

We established that the term “physical” has multiple meanings. One meaning is the physical objects around us like rocks and houses that everyone can perceive. A second meaning refers to the scientific view of these objects from the perspective of chemistry and physics, according to which these objects are composed of atoms and molecules in constant motion. They only appear solid to us because of the speed with which molecules are moving. This is what Bertrand Russell meant by saying of a physical object “to science the matter comprising it is continually changing.”

The particle hierarchy

In “the world is not as it seems” we identified a particle hierarchy. Matter, meaning the physical objects of our experience, is at the top level. Underneath in descending order as the particles get smaller are:

- molecules
- atoms
- nucleus with electrons
- protons and neutrons
- quarks, leptons, gluons, and other subatomic particles

Understanding this hierarchy is the key to understanding mass. Mass is derived from the near-lightspeed motion of subatomic particles such as quarks and gluons.

Before exploring the relationship between this hierarchy of particles and mass, however, it is important to explain mass as we experience it in matter or physical objects. There are several definitions of two types of mass: inertial mass and gravitational mass.

Inertial mass

Inertial mass can be derived by rearranging Newton’s second law of motion: $F = ma$ to read $m = F/a$. This reads that mass is equal to the ratio of force over acceleration.

Gravitational mass

Gravitational mass is a measure of how much an object is affected by a gravitational field.

Inertial mass quantifies an object's inertia, or its resistance to changes in motion. If the same force is applied to two objects and one accelerates less than the other, the one with less acceleration has more mass. Higher mass means less acceleration for the same force. Lower mass means more acceleration for the same force.

This reading of Newton’s Second Law coincides with our own experience. Someone who tries to push a car becomes aware of the great amount of force required to achieve even the slightest amount of acceleration. A car has a great deal of mass. If the same person tries to push a chair, he or she will find that this is a relatively easy task, due to the reduced amount of mass that the chair has. This is how we experience mass in real life. The term ‘massive’ comes from “mass,” and can be applied to objects having a lot of mass. A car is a massive object when compared to a chair.

The more mass the better?

We have produced studies on Coriolis flowmeters (August 2025), mass flow controllers (January 2025), and thermal flowmeters (July 2023).

Now, for the first time, we are offering a first-ever, executive-level mass flow study that paints a comprehensive picture of the entire mass flow market.

The World Market for Mass Flow Measurement is based on 2025 data on mass flow controllers and Coriolis, thermal, vortex, and differential pressure (DP) flowmeters, including multivariable technologies. It explores the reasons for measuring mass flow, and then looks at the advantages and disadvantages of Coriolis, thermal, and multivariable flowmeters. It forecasts market growth through 2030.

For more information, please visit www.flowresearch.com/massflow

Water needs and aging water infrastructure drive magmeter sales

The water & wastewater industry remains the dominant industry segment for magmeters, surpassing food & beverage and chemical in total sales worldwide, according to *The World Market for Magnetic Flowmeters, 8th Edition*, published in March.

The growing need for clean water and expansion of water infrastructure is one of the most important long-term drivers of the magnetic flowmeter market. Global demand for clean water continues to rise due to population growth, climate change, urbanization, and industrial water demand. Many countries are investing heavily in irrigation systems, water reuse facilities, drinking water systems, and wastewater treatment plants.

Aging water infrastructure is also an important driver of the magnetic flowmeter market, particularly in North America, Europe, and Japan, where most municipal water systems were built decades ago. Many water systems were built between the 1960s and 1990s, and much of the instrumentation installed then is now obsolete. Older meters include mechanical meters, differential pressure meters, and early magmeters with analog electronics. As a replacement,

magnetic flowmeters offer higher reliability, better diagnostics, lower maintenance, and digital communications. Water infrastructure built between the 1960s and 1990s is undergoing replacement and modernization, creating substantial demand for magnetic flowmeters. In these applications, much of the growth in magmeters comes not from new systems but from replacement, upgrading, and better monitoring of existing networks.

Aging water distribution infrastructure is also creating demand for magnetic flowmeters. In many municipalities, as much as 14 percent of treated water is lost before reaching customers. Utilities increasingly use magnetic flowmeters to establish district metered areas, allowing them to monitor flows throughout the distribution network and identify leaks more quickly.

Please visit www.flowresearch.com/mag to learn more.

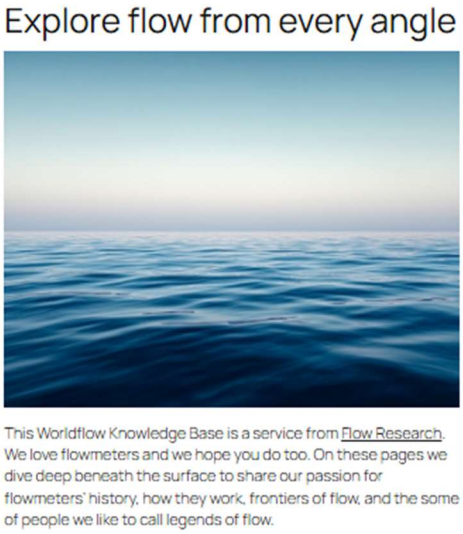
Share your wisdom in our Worldflow Knowledge Base

Worldflow Knowledge Base

We are proud to announce our new Worldflow Knowledge website, worldflow.com/wp, a non-commercial resource where we share our passion for flowmeters. We invite you to browse our pages and to contribute your insights on history, growth, operations, and other topics.

Highlights to date:

- Flowmeter history, operations, and technology
- The first-ever English translation of Coriolis' seminal work: "Memoir: On the equations of relative motion of systems of bodies" and the French original
- Jesse's writings on the geometry of flow
- 32 historical emails with Dr. John Conway of Princeton University and others on the Geometry Research Forum discussing, Do Points Have Area?
- 11 emails on the Geometry Research Forum about different types of coordinate systems.



One of our favorite sections is Legends of Flow, where we share interviews or information on nine people who have made important contributions to flow: Bob Deane and Mac McQueen, FCI; G.F. Fischer, Instromet Group; František Zýka, ELIS PLZEN; Ken Ball; Floyd McCall, McCrometer co-founder; Dr. John Olin, Sierra Instruments; Richard W. Miller; and Dick Morley.

Our Movers and Shakers of Flow – people and decision makers in flow who play or have played an important role today in flow measurement and instrumentation – include Matt Olin, Dan McQueen, Pascal van Putten, Steve Walton, John Harris, and Mike Wasson. In our Pioneers of Instrumentation section we share short bios by birthday month of 29 historical figures who contributed in some way to flow, from Isaac Newton in January 1643 to James Prescott Joule in December 1818.

Still time to get these 2026 (and late 2025) studies

Here's what we are delivering this year:

- *The World Market for Vortex Flowmeters, 8th Edition* (January 2026) found that despite slow growth in the vortex flowmeter market, there are signs that this flowmeter is breaking out of its slump. www.flowresearch.com/vortex
- *The World Market for Magnetic Flowmeters, 8th Edition* (March 2026) based on 2025 data, covers one of the most revenue-generating flowmeters on the market. www.flowresearch.com/mag
- *Volume X: The World Market for Flowmeters, 10th Edition* and *Module A: Strategies, Industries, and Applications* (June 2026), our flagship study, covers market share, market size, growth factors, industries, and more for all 10 flowmeter technologies. www.flowresearch.com/volumex
- *The World Market for Ultrasonic Flowmeters, 8th Edition: Core Study: The World Market for Ultrasonic Flowmeters; Module A: The World Market for Inline Ultrasonic Flowmeters; Module B: The World Market for Clamp-on and Insertion Ultrasonic Flowmeters.* (Q3 2026) www.flowresearch.com/ultrasonic
- *The World Market for Gas Flow Measurement, 5th Edition* covers the fast-growing gas flow market, including conventional gas, industrial gas, hydrogen, CCUS, and renewable natural gas. (Q4 2026) www.flowrsearch.com/gasflow
- *The World Market for Coriolis Flowmeters, 8th Edition,* a new study on the worldwide one of the fastest growing flowmeter markets (August 2025) www.flowresearch.com/coriolis

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