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A Calibration Test Stand at VSL in Delft, the Netherlands

(Photo by Flow Research)

Q2 2015

Focus this Issue:

- **MFCs Shine in Industrial Applications**
- **Flowmeter Recalibration Working Group**
- **Spirax Sarco ceases flowmeter production at Longmont, CO facility**
- **Company Korner: Three Major Flow Calibration Labs**

Flowtime Wall Clock

A Worldflow publication

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___ The World Market for Oil and Oil Flow Measurement	*www.oilflows.com*
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Boulder Canyon, Boulder, Colorado Photo by Flow Research

Market Barometer is part of the Worldflow Monitoring Service. Other publications in this service include the **Energy Monitor** and **Flash Reports**. The **Living Database** provides more in-depth information and analysis about the instrumentation business.

Here is the **Worldflow** publication schedule for the next few quarters:

Q3 2015
Market Barometer — September 2015
Energy Monitor — October 2015

Q4 2015
Market Barometer — November 2015
Energy Monitor — December 2015

Q1 2016
Market Barometer — January 2016
Energy Monitor — February 2016

State of the Industry Report: Q2 2015

Mass Flow Controllers Shine in Industrial Applications

By Jesse Yoder, PhD, Flow Research

Jesse Yoder in Sydney, Australia

Mass flow controllers (MFCs) are unique among flowmeters in that they both measure the flow and also control it. Most MFCs include a control valve that is capable of modulating the flow, although some are shipped without the control function. It is because they have a control function that they are called flow controllers rather than flowmeters, even though they also measure the flow. This also explains why they are not always included in the total flowmeter market.

Most mass flow controllers employ a thermal principle. However, they are not considered to be thermal dispersion flowmeters, like the insertion meters that are used for flue stack and exhaust gas flow measurement. Instead, MFCs measure flow in small line sizes, usually two inches and less, and the large majority of them are used to measure gas flow. A small minority, however, are used to measure liquid flows.

MFCs operate by diverting the flow through a capillary tube. This tube gives them an inverted U appearance. Rather than measuring the entire flow as it passes through the meter body, a portion of the fluid is diverted through a capillary tube that travels in an inverted U path around the top of the meter. The flow is diverted by creating a small pressure drop in the flow line, which can be done by a laminar flow element. The fluid is measured as it passes through this small capillary tube, and then it rejoins the main flowstream.

To measure the flow at the top of the inverted U, two heated resistance temperature detectors (RTDs) are wrapped around the outside of the capillary tube. When there is no flow, both RTDs have the same signal. When fluid passes through the tube, a difference in temperature is created between the upstream and the downstream RTDs. This temperature difference is proportional to flowrate. The flowmeter senses this difference in temperature, and uses it to create an output signal representing flow.

Exxon Sparked the Development of Early Thermal Air Probes

Mass flow controllers were first developed out of a need to measure the flow of gases through a flare stack. In the fall of 1954, Charlie Hawk from Hastings (now Teledyne Hastings) was approached by someone from Exxon at a trade show. He needed an instrument to measure how much waste gas was flowing in a flare stock so he could determine how efficient his process was.

In response, in 1955 Hastings introduced what it called a “thermal air probe” that placed small

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thermocouples in the flowstream. These thermocouples measured the rate of cooling. However, this device became covered with dirt and could not withstand the heat of the fluid, so it was withdrawn from the market.

Charlie Hawk and his colleagues made a more successful attempt in the early 1970s. By diverting the fluid through a capillary tube with temperature sensors on the outside, the company avoided the problems with its earlier design. This new design was more successful than the earlier one. When the tubes became plugged, they were purged with a source of air. Other companies were also working on mass flow controllers during the same period. Some sources credit Tylan General with introducing capillary tubes in the 1960s.

Mass Flow Controllers Have Broadened Their Scope since the 1970s

Mass flow controllers have evolved significantly since the early 1970s. In the 1980s, the semiconductor industry became the largest consumer of MFCs. In the 1990s, MFCs came to tolerate higher flowrates, and more ruggedized packaging was developed for industrial uses. In the early 2000s, digital bus protocols were introduced, along with MFCs that could measure multiple types of gases.

A number of new companies have entered the field in the past 30 years, though not all have survived. In the 1980s, Unit Instruments developed a line of MFCs aimed at the semiconductor market. Tylan General continued to be a force in the market. Other companies that became important in this market include Mykrolis, Millipore, Celerity, and Aera. In a major act of consolidation, Brooks Instrument acquired Celerity in 2009. This acquisition included all the MFCs that previously went under the names of Unit Instruments, Tylan, Mykrolis, Millipore, and Celerity. In 2010, Advance Energy Industries (AEI) sold its Aera mass flow controller division to Hitachi Metals. Some of the leading companies today include Horiba STEC, Brooks Instrument, Hitachi Metals, and Bronkhorst.

MFCs Used for Many Applications in the Semiconductor Industry

Mass flow controllers are used in the semiconductor industry to measure and control many of the gases used in the semiconductor chip making process. This includes controlling reactive gases in chemical vapor deposition (CVD), plasma etching processes, backside water cooling, and many other applications. Semiconductor manufacturing often requires measuring small amounts of pure gases at very low flowrates. The semiconductor industry accounts for more than 50 percent of the mass flow controllers sold worldwide. It is still the dominant application for mass flow controllers.

Many Industrial Markets Ride the Wave of Renewable Energy

Despite the dominance of the semiconductor industry, some MFC companies have brought out multiple products designed to address the industrial markets. One reason for this is the cyclical nature of the semiconductor industry. The semiconductor industry seems to be subject to peaks and valleys of production and demand, more so than many other industries. Furthermore, these cycles can be hard to predict. By diversifying into industrial markets, MFC companies help to insulate themselves from the ups and downs of the semiconductor industry.

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State of the Industry Report: Q2 2015

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Some of the leading industrial applications for mass flow controllers include chemical/petrochemical, metals processing, gas analyzers, and solar/photovoltaic. Other important applications include biotech/pharmaceutical, fuel cells, LED lighting, and fiber optics/glass. Mass flow controllers are used in a wide variety of industrial manufacturing processes outside of the semiconductor industry, and these applications are providing greater stability for those companies that choose to address them.

Many applications on the industrial side involve renewable energy. These include fuel cells, LED lighting, and solar/photovoltaic, among others. These applications can also be subject to ups and downs, compared to applications in, for example, the chemical industry, which are more constant. There are several reasons for the fluctuations in the alternative energy applications. One is that many of them depend on how much research & development money is allocated to them. Even though most people would accept the idea that renewable energy is likely to win out as a long-term solution to the world's energy needs, the enthusiasm and commitment to renewable energy varies with multiple factors.

When gas and oil prices are relatively low, as they are now, there is less short-term commitment to solar and hydrogen fuel as alternative energy sources. This can affect the demand for mass flow controllers in solar/photovoltaic and fuel cell applications. However, the United States, Germany, and other countries have made commitments to reduce dependence on fossil fuels and to rely on renewable energy sources increasingly over time. As a result, renewable energy applications will grow significantly over time, even if they experience short-term downturns. This is likely to benefit companies that invest in these industries.

Mass Flow Controller for High Flow Industrial Applications – Flow Ranges up to 8,000 SLM
photo courtesy of Teledyne Hastings Instruments

Some of the companies that have invested significantly in industrial MFC markets include Brooks Instrument, Horiba STEC, and MKS. While all these companies sell into the semiconductor market, they have also chosen to develop products for industrial markets. This is also true of a number of smaller MFC suppliers. Even though

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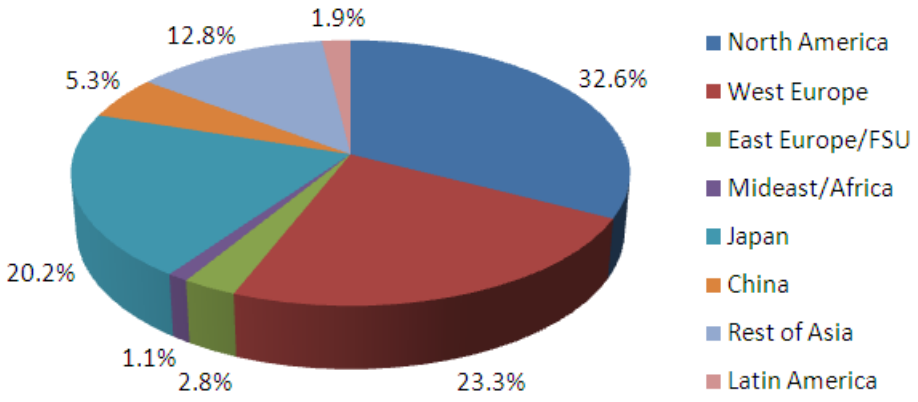
these companies will continue to service the semiconductor market, their presence in industrial markets gives them a hedge against the ups and downs of the semiconductor market. This decision to diversify is likely to be a plus for these companies over time.

Of course, not all industrial markets are equally promising. Any MFC company that wants to enter these markets should select those that fit in well with its product line and that also shows promise of growth. The automotive and aerospace markets have gone through difficult times but are now recovering. The fuel cell and biotech/pharmaceutical markets show great promise. The chemical and food & beverage markets are likely to show moderate but steady growth over time. Power is an area that seems to always be expanding, as more countries industrialize and populations increase.

China, India, and Other Emerging Markets Provide Demand

The economies of China, India, and other emerging markets in Asia and elsewhere are continuing to grow at a rapid pace. Even if these economies are affected by a slowdown, their continued population growth will result in demand growth in a variety of industrial segments including energy consumption, food/beverage, automotive, power, and other segments. China and India will also be a source for continued demand for computers and semiconductor products. All these forces will work towards increased use of mass flow controllers in the long term.

Shipments of Mass Flow Controllers for Industrial Applications by Region in 2014



In July 2015, Flow Research published a market study called
The World Market Update for Mass Flow Controllers.
This study updates the market to 2014.
For more information, go to *www.flowmfc.com*.

Market Research: FRWG

Flow Research forms Flowmeter Recalibration Working Group (FRWG)

By Jesse Yoder

The purpose of this group is to arrive at a group of criteria that end-users can employ to determine if their flowmeters need to be recalibrated. This does not necessarily equate to a specific time interval. Instead, the goal is to have some tests, programs, or criteria that can be run to determine when a flowmeter needs to be recalibrated.

The idea for this group came out of a series of in-person interviews I did with end-users of flowmeters in the Middle East in 2009. I interviewed 15 companies from Oman, Saudi Arabia, Qatar, and the UAE about their use of flowmeters. Many of them expressed frustration that there was no generally agreed upon interval when their ultrasonic flowmeters need to be recalibrated. There was also the fact that at that time there was no recalibration facility in the Middle East. These people asked me if I could help them arrive at a standard. I said that I would do what I could.

Since that time I have spoken to the AGA, which seems to have no interest in taking on this subject. One positive development is that Emerson Process has built a flow calibration facility in Abu Dhabi, but it is currently limited to four inch liquid recalibrations. Some countries have instituted their own rules about calibration frequency, but these periods vary and seem to differ on a country by country basis.

The series of six studies that Flow Research did in 2012 on gas flow measurement grew out of the Middle East interviews. We are now researching a new edition of this series. Currently, Flow Research is conducting a worldwide study of the calibration facilities for liquid and gas recalibration. So far we have identified 125 such facilities. We have completed a questionnaire that we plan to send to them. The study will include a description of the capabilities of the various facilities worldwide. We also plan to cover flowmeter manufacturers that recalibrate flowmeters, and also mobile calibration facilities. We are doing separate studies on liquid and gas recalibration. I think that these studies should be a valuable database of information for our committee work. You can find a description of these studies at www.flowcalibration.org.

This committee is strictly a volunteer effort, and so far has no official sanction. However, my hope is that if we do succeed in coming up with a usable set of recalibration guidelines, we can approach some of the organizations like AGA and API for approval of the guidelines. Short of this, we can publish our report and circulate it among interested manufacturers and end-users. Since, to my knowledge, no one has attempted this before, I think the results will be met with quite a lot of interest.

After a flowmeter is put into service, it needs to be recalibrated periodically to insure that is it still operating within the proper specifications. There are a number of different methods used for recalibrating a flowmeter, or at least checking it for proper performance. These include the following:

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Market Research: FRWG

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- Running diagnostic software to determine if it is operating within acceptable parameters
- Using a check meter to monitor the performance of the flowmeter
- Running a "dry calibration" to check that the components are working according to specifications. This method is often used with ultrasonic flowmeters.
- Having a service company come out and calibrate the meter onsite
- Pulling the flowmeter out of service and sending it to a flowmeter calibration facility to be recalibrated.

While the FRWG has recently begun operation, some preliminary results can be expected in 2016.

So far, the following people have volunteered to be on this committee:

Dr. Jesse Yoder (Flow Research)
Dr. Tom Kegel (CEESI)
Dr. Gregor Brown (Cameron)
Peter Brand (NMi Euroloop)
Terry Cousins (CEESI Measurement Solutions)
John Lansing (CEESI)
Tom Ballard (GE Measurement)
Tom Kemme (Magnetrol)
Dr. Aaron Johnson (NIST)
Bob Carrell (Hoffer Flow Controls)
Tom O'Banion (Emerson Process Management, Micro Motion)
Dean Standiford (Emerson Process Management, Micro Motion)
Dick Laan (KROHNE)

The first task of the committee will be to formulate criteria for determining when an inline multipath ultrasonic custody transfer needs to be recalibrated. This may include running a software program, using a check meter, running diagnostics, doing dry calibration, or any other method that may be effective. I would like to then address other types of ultrasonic flowmeters, as well as other flowmeter types such as turbine, differential pressure with different primary elements, vortex, magnetic, and thermal.

Spirax Sarco ceases flowmeter production at Longmont, CO facility

Flow Research Worldflow Flash Report

Wakefield, MA; July 1, 2015 — Spirax Sarco announced on June 12, 2015, that it is ceasing production of its flowmeters at its location in Longmont, Colorado. (See official press release on next page.) The company has been a supplier of vortex, ultrasonic, magnetic, target variable area, thermal mass, turbine, and differential pressure flowmeters. Formerly known as EMCO Flow Systems, EMCO was acquired by Spirax Sarco in 2005.

Facts about Spirax Sarco Engineering

Headquarters: Cheltenham, UK

Revenue: US$1.06 billion (2014)

No. of employees: 4,750 (2014)

Year founded: 1888

Ownership: Public

In 2006, Spirax Sarco also acquired Advanced Flow Technology Company (AFTCO) from AMJ Equipment in Lakeland, Florida. AFTCO's main product was the Unimag Series of magnetic flowmeters, which employed AC technology. Spirax moved the manufacturing of the Unimag Series to Longmont, Colorado.

According to Steve Gow, Director of Marketing for Spirax USA, "Spirax Sarco will continue to make its flowmeters available, utilitizing the worldwide manufacturing capabilities of Spirax Sarco." No other details are publicly available at this time.

What It Means

Flow Research is always sorry to see a flowmeter manufacturer close down manufacturing operations. We only learned about this because we visited the company in Longmont, Colorado the first week of June. At that time, no public announcement had been made.

Today's flowmeter market, while constantly expanding, is a fluid one. New products are coming to market, and new technology flowmeters are replacing traditional meters for some applications. This is bringing about changes in companies and technologies. EMCO Flow Systems was itself acquired by Spirax Sarco in 2005.

While it is good to know that Spirax Sarco's flowmeters will still be available, especially for those customers who rely on these products, the company has not elaborated on how it plans to implement this availability. No doubt this information will be forthcoming as manufacturing operations in Longmont are closed down.

EMCO Flow had a long history in the flowmeter business. In the past, the company had a mutual resale agreement with Danfoss in Denmark. This arrangement ended a number of years ago. Since its acquisition of EMCO Flow, Spirax has utililized its worldwide distribution network as an outlet for its flowmeters.

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Market Research: Spirax Sarco

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Spirax Sarco's specialty is steam. It manufactures steam traps, boiler controls, strainers, and other steam related products. Spirax Sarco is based in the United Kingdom, and its main flowmeter product there is its target variable area flowmeter. The products formerly manufactured in Longmont are more in tune with today's flowmeter market than Spirax's target variable area meter. It remains to be seen whether Spirax intends to de-emphasize its flowmeter business in order to focus more on its core steam business, or whether it will use this opportunity to expand its varied flowmeter line. We hope it is the latter and not the former course that the company selects.

Analysts:
Jesse Yoder (jesse@flowresearch.com)
Norm Weeks (norm@flowresearch.com)

Spirax Sarco's office in Longmont, Colorado (Photo by Flow Research)

The press release from Spirax Sarco:

Spirax Sarco Longmont, CO facility is heading into a new direction — Energy Monitoring and Management

Blythewood, SC; June 19, 2015 – Spirax Sarco, the leader in products and services for steam system solutions, has released that they are changing the focus and direction of their Longmont, Colorado facility to expand the application engineering and solution support for Energy Monitoring and Management for the USA. Spirax Sarco has chosen to cease the manufacturing of metering products at this location but the full range of metering solutions will remain integral to the Spirax Sarco portfolio and will be manufactured elsewhere.

Lorraine Wiseman, President and General Manager of Spirax Sarco stated, "With the growing demand for metering these changes will allow us to service our customers' needs better through Energy Monitoring and Management solutions."

Spirax Sarco is now focusing on expanding their application engineering support within their Longmont Colorado facility. In the future, Spirax Sarco may be looking for a more suitable facility for Energy Monitoring and Management application engineering, high tech training, and labs but will look to remain in the Longmont area.

www.spiraxsarco.com

Sensus opens new meter manufacturing and assembly unit in China

Raleigh, NC; April 20, 2015 — Sensus has opened a new meter manufacturing and assembly facility in Fuzhou, Fujian Province, the People's Republic of China. The facility, with capacity to produce 150,000 meters annually, will meet the growing demand for advanced meters in China, Southeast Asia and other markets.

“Quality is the way we set ourselves apart from the competition,” said Sensus President Randy Bays, who was on hand for the ribbon-cutting ceremony. "“This factory builds upon that strength, adding significantly to both the superiority and breadth of our solutions.”

The manufacturing and assembling facility, which went into operation in February this year, is where the WPD, WSD, MeiTwin and 420PC meters are now produced.

“We are extremely proud to have a new, state-of-the-art facility with the most efficient processes in China,” said Dr Jianing Zha, General Manager, Sensus China. “Along with our existing expertise and strong interest in the China market, this will open a new chapter for Sensus' growth plans in the Asia Pacific Region.”

The Fuzhou facility will meet demand for Sensus meters in Asia – including China, Indonesia, Korea, Malaysia, the Philippines and Vietnam – as well as Oceania, South America and Europe. *http://sensus.com*

Badger Meter outlines metering technologies California water suppliers can implement now to comply with state-mandated actions

Milwaukee, WI; April 28, 2015 — Badger Meter, a leading global innovator and manufacturer of flow measurement and control solutions, today released recommendations on the latest metering technologies California municipalities, utilities and other water suppliers can begin using immediately to comply with state-mandated actions. Following Governor Jerry Brown’s historic April 1 statewide mandatory water restrictions calling for a 25 percent reduction in water usage through February 2016, Badger Meter outlines the new technologies that are making water usage visible in California.

BEACON® AMA helps California water suppliers immediately and cost-effectively respond to urgent water restrictions

As part of the new mandates, Section 17 specifically calls for the implementation of water-use monitoring and software technology. The newest Badger Meter offering, BEACON® Advanced Metering Analytics (AMA), gives water suppliers the opportunity to immediately and cost-effectively respond to state-mandated actions through the use of cloud-based software and cellular metering technology. To date, over 30 California water suppliers have added the BEACON AMA Starter Kit pilot program to their systems. Without the need to purchase servers or traditional fixed network infrastructure, pilot programs can be installed as soon as cellular radio endpoints are deployed.

BEACON AMA achieves immediate water-saving results at the University of California Merced

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One example of BEACON AMA's ability to help water suppliers quickly identify leaks and easily report on results comes from the University of California Merced. As part of the campus' overall plan to dramatically cut water, energy and gas usage per student every year, the university turned to BEACON AMA to meet its water conservation initiatives.

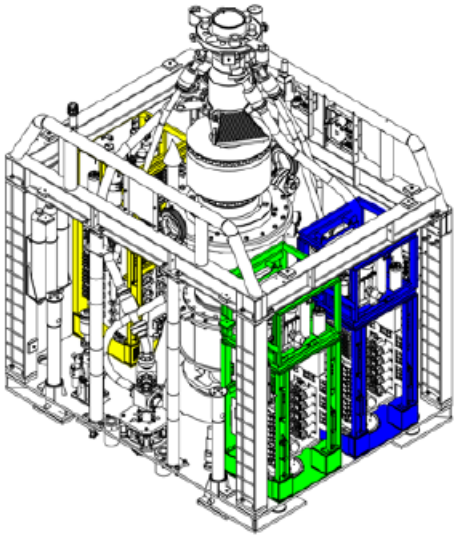
In the first year of the university's water conservation challenge, the campus dorms reduced their water consumption by 14 percent, saving 79,000 gallons of water. They also saved 1.4 million gallons of water from 16 water leaks detected by the near real-time data. For example, the system discovered five toilets that were leaking a total of 150 gallons per hour. Because of BEACON AMA, the leaks were identified and fixed in seven days, with estimated savings of over one million gallons of water per year.

www.badgermeter.com

Cameron and OneSubsea win OTC Spotlight on New Technology awards

Houston, TX; May 5, 2015 — Cameron and OneSubsea®, a Cameron and Schlumberger company, have won Spotlight on New Technology Awards at the Offshore Technology Conference (OTC) by meeting the criteria for new, innovative, proven products of broad interest that have significant impact.

Cameron won an award for its Mark IV High Availability (HA) Control System for Blowout Preventers (BPs).



Cameron's Mark IV HA control system is the industry's first three-POD control system. The new system allows drillers to continue operating when one POD becomes unavailable. Because of this configuration, the Mark IV HA BOP control system improves operational availability to as much as 98% and reduces the likelihood of a POD-related stack pull by up to 73%. This system builds on the success of the Mark III control system by streamlining the POD design, making it smaller and lighter as well as increasing functionality.

OneSubsea is an award recipient of the 2015 OTC Spotlight on New Technology Award for the industry's first true subsea multiphase compressor.

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The OneSubsea Multiphase Compressor, delivered to Statoil in March, is capable of handling compression of the unprocessed wellstream without any need for pre-processing and no requirements for an upstream separation facility or an anti-surge system, which greatly simplifies the subsea system requirements.

www.c-a-m.com

Yokogawa Corp. of America appoints Daniel L. Duncan as Chief Executive Officer

Yokogawa Corporation of America announces that effective April 1, 2015, Daniel L. Duncan has been named President and Chief Executive Officer of Yokogawa's North American operations. In this position, Mr. Duncan is responsible for all day-to-day operations in North America.

Daniel L. Duncan

Mr. Duncan began his professional career as an engineer with Georgia Power Company. Then he led a systems integration firm focused on both discrete and process automation projects. This was followed by roles in industrial distribution and at Honeywell Industrial Automation and Control. Mr. Duncan joined Siemens Energy & Automation in 1997 holding various management roles in automation marketing, regional and national sales. Mr. Duncan's most recent responsibilities were as VP and General Manager of the Oil & Gas Division of Siemens Energy, Inc. based in Houston, TX and responsible for the Americas region. His divisional portfolio included power generation, compression, conceptual engineering, real-time data intelligence solutions, process safety engineering, water treatment solutions, integrated electrical solutions and subsea products. Mr. Duncan earned a Bachelor of Science in Electrical Engineering from the Georgia Institute of Technology.

www.yokogawa.com

Upcoming Trade Shows

2015 ISA Water/Wastewater and Automatic Controls Symposium
August 4–6, 2015
Wyndham Lake Buena Vista Resort
Orlando, Florida, USA
http://isawwsymposium.com
Focused on challenges in automation and instrumentation for water and wastewater.

The 5th Annual LNG Global Congress
23– 24 September, 2015
Radisson Blu Portman Hotel London
London, UK
www.lnggc.com
Shaping the future of LNG: pricing, markets, infrastructure & supply chain.

WEFTEC 2015 — 88th Annual Technical Exhibition & Conference
September 26–30, 2015
McCormick Place
Chicago, Illinois, USA
www.weftec.org
Largest annual water quality exhibition. Buyers and representatives of the foremost water and wastewater companies around the world.

North Sea Flow Measurement Workshop
October 20–23, 2015
Quality Hotel Tønsberg
Tønsberg, Norway
www.tekna.no

FLNG USA Conference 2015: Moving Forward Into FLNG Delivery
November 2–5, 2015
Houston, TX, USA
Doubletree by Hilton Hotel, Greenway Plaza
Houston, Texas, USA
www.icbi-events.com

The World LNG Fuels 2014
February 2–4, 2016
George R. Brown Convention Center
Houston, TX, USA
www.worldlngfuels.com
The World LNG Fuels 2016 will showcase market trends, environmental benefits, and economic opportunities in trucking, marine, rail & heavy industry, and drilling & fracking. See website for additional information and pre-conference meetings.

The 5th Annual LNGgc Asia Pacific 2016
March 1–4, 2016
Singapore
www.lnggc-asia.com

South East Asia Flow Measurement Conference 2016
March 16–17, 2016
Kuala Lumpur, Malaysia
www.tuvnel.com

4th Edition European Flow Measurement Workshop: Ultrasonic and Coriolis
March 29–31, 2016
Grand Hotel Huis ter Duin
Noordwijk, The Netherlands
www.ceesi.com and *www.vsl.nl*

2016 MCAA Industry Forum
April 17–19, 2016
Loews Vanderbilt Hotel
Nashville, Tennessee, USA
www.measure.org

Offshore Technology Conference 2016
May 2–5, 2016
Houston, Texas, USA
www.otcnet.org

2016 MCAA Industry Forum
May 17–19, 2016
Loews Vanderbilt Hotel
Nashville, TN, USA
www.measure.org

North American Custody Transfer Measurement Conference
June 21–23, 2016, USA
San Antonio, TX, USA
www.ceesi.com/SanAntonio2016
All types of custody transfer measurement in addition to ultrasonic measurement. Speakers will discuss a wide variety of fluid measurement issues and potential solutions.

Three Major Flow Calibration Labs

CEESI

While CEESI was formed as a private company in 1986, its history goes back to 1951, when it began as the Engineering Experiment Station, Inc., a program of the College of Engineering at the University of Colorado in Boulder. The purpose of the operation at that time was to test small rockets for the Naval Ordinance Test Station. The Station also tested turbine meters in the 1950s, which were being used to measure fuel gas in airplanes.

In 1986, the facility was purchased by Steve Caldwell and Wald Seidl, who renamed it the Colorado Engineering Experiment Station. From this time on, facilities began to expand. Several new test stands were added, including a piston prover system and a high air flow test stand. CEESI helped improve its calibration capabilities by cooperating in measurement comparisons with other American laboratories, and with the calibration facilities of eight other countries. During this time, the Iowa high speed natural gas flow calibration facility was constructed. This facility opened in 1999.

The Iowa calibration facility is located in Garner. Unlike Euroloop, which relies on gas compressors to generate its high speed gas flows, the CEESI facility in Iowa taps into a large natural gas line from Trans Canada Pipeline. The Iowa facility can calibrate a wide variety of flowmeters with diameters of 4 - 36 inches. It relies on a bank of nine turbine flowmeters as its reference meters for calibration purposes. It has recently opened a new low flow loop for calibrating flowmeters at low flowrates. The flow loop incorporates multiple ultrasonic meters as transfer standards as well as check meters.

The headquarters facility in Nunn, Colorado does a wide variety of calibrations, including calibrations of flowmeters for liquid and gas flow measurement. It can handle calibrations of very large meters, such as large Venturi tubes used with differential pressure transmitters for flow measurement purposes. During the past few years, CEESI has upgraded its facilities and capabilities in multiple ways, including the formation of CEESMART, building a water in oil test facility, and upgrading the wet gas/multiphase facility to handle custom liquids.

As part of its program to facilitate communication and knowledge within the industry, CEESI sponsors several important annual flowmeter conferences, and gives many training courses. These include courses on fundamentals of flow measurement and measurement uncertainty. In June 2016, the North American Custody Transfer Conference will be held in San Antonio, Texas. This conference began as a conference on ultrasonic flowmeters, then was expanded to include Coriolis meters, and now is focusing on custody transfer as its main theme.

NMi Euroloop

NMi Euroloop is located in Rotterdam, the Netherlands. It is the successor of two earlier flow calibration facilities; one located in Bergum and the other located in Westerbork, the Netherlands. NMi Euroloop has consolidated and replaced the capabilities of these two earlier facilities, which have now closed down for calibrations.

A number of prominent flowmeter companies cooperated to make NMi Euroloop possible. These include SICK, Honeywell, Emerson Daniel, KROHNE, and Elster. The facility is located in Rotterdam, the Netherlands, and was opened in March 2010.

The gas calibration facility at NMI Euroloop is a closed loop facility. The gas used for calibration is generated internally from two tanks

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Company Korner: Three Major Flow Calibration Labs

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with a capacity of 7000 cubic meters. Three high pressure piston compressors are installed to pressurize the system. Seven turbine meters are used as master meters. These seven turbine meters are monitored by seven ultrasonic meters. NMi Euroloop uses the master meter method based on the mass conservation principle. A gas chromatograph determines the gas composition of the high-calorific gas.

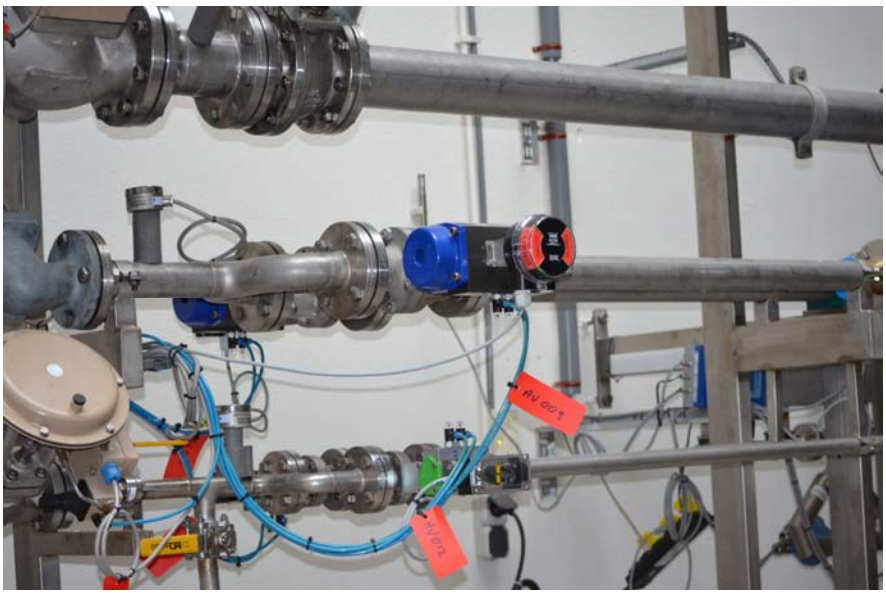
The availability of NMi Euroloop has significantly increased the flow calibration capability available in Europe, although this facility also calibrates meters from the Middle East and other regions of the world. The need for high pressure gas calibrations is increasing each year as the installed base of ultrasonic and turbine meters increases. There is also an increased emphasis on custody transfer measurement, as the production and demand for natural gas increases. Custody transfer meters are among the ones most likely to be pulled out of service for recalibration, due to the high accuracy requirements for custody transfer operations.

VSL

VSL stands for Van Swinden Laboratory. It is named after Jean Henri van Swinden, who lived from 1746-1823, and was a lecturer in Amsterdam. Van Swinden was part of an international committee to define the meter, and worked to get the metric system introduced into the Netherlands. He also was the first person to introduce a platinum rod as the standard for the meter, which he did in 1799. VSL is located in Delft, the Netherlands.

VSL is owned by TNO Companies. One of its main tasks is to develop and maintain the national measurement standards, by commission of the Dutch Government. In addition the organization maintains both gas and liquid flowmeter calibration facilities. The methods of proving used by VSL for liquid calibrations include master meters, piston provers, gravimetric methods, and proving tanks.

VSL is building a flow calibration facility for liquefied natural gas (LNG) that is scheduled to open in 2016. This facility is being built in Russia. There is currently no flow calibration facility for LNG in existence. The need for LNG flowmeter calibrations is growing as the number of LNG liquefaction and regasification projects continues to grow, and as the demand for LNG continues to expand, especially in Asian countries.



A calibration test stand at VSL (Photo by Flow Research)

Emerson expands high pressure measurement capabilities with new Coriolis flowmeters for high pressure offshore chemical injection applications

Boulder, CO; May 7, 2015 — Emerson Process Management introduces the Micro Motion F100P and HPC010P Coriolis flowmeters to measure accurate flow rates for wellbore chemicals injected at high pressure conditions. Both meters are designed for demanding offshore applications that require robust performance with low maintenance needs. These meters will allow operators to confidently monitor chemical injection to ensure long term asset reliability and flow assurance.

The F100P is a 1-inch meter with a maximum pressure rating of 6250 psi (431 bar) that targets measurement for higher flow rates typical for hydrate inhibitors.

The HPC010P is the first ultra-high pressure Coriolis meter developed by Emerson, and will have a maximum operating pressure of 15,000 psi (1034 bar) to address offshore chemical injection measurement for chemicals such as corrosion, scale and asphaltene inhibitors.

"These meters are breaking boundaries for Coriolis meters in high pressure applications where positive displacement meters are today's legacy practice. Coriolis meters deliver new value to our customers through more accurate measurement and reduced maintenance over traditional PD technology," said Michelle Marceny, specialty products business manager for Emerson's Micro Motion business. "Coupled with Smart Meter Verification (online verification of meter performance), these meters provide safe, reliable and highly repeatable performance with reduced maintenance in the toughest applications."

"The new flowmeters will help owner-operators and service companies overcome many challenges of chemical injection applications and reduce chemical costs while increasing operational efficiency and system reliability," said Inderpreet Shoker, analyst for the ARC Advisory Group.

These flowmeters will be available starting late 2015, and are the newest addition to Emerson's chemical injection solution capabilities which include Tescom flow control technology, Micro Motion mass flowmeters, and Rosemount® pressure and temperature transmitters.
www2.emersonprocess.com

Emerson's Coriolis and vortex flowmeters certified for ASME B31.1 Power Piping design standard

See press release in Vortex section.

Entrained gas management EGM now available for twin straight tube Coriolis flowmeters from KROHNE

June 10, 2015 — KROHNE introduces the OPTIMASS 1400 and OPTIMASS 2400 with the new signal converter MFC 400. Thereby, the Entrained Gas Management EGM feature is now available for the twin straight tube sensors, providing no loss of measurement with gas entrainment up to 100%.

In the past, gas entrainments in liquid media presented a huge challenge for mass flowmeters because the relative movement between gas and fluid dampens the amplitude of the measuring tube. This dampening leads to inconsistent sensor amplitudes, which interfere with the electronics' capability to determine the actual resonant frequency. While other mass flowmeters simply "freeze" their last stable reading to cover this "loss of measurement", OPTIMASS flowmeters with EGM are able to follow and correct for the varying amplitudes. This is achieved for entrained gas up to 100% of volume and continues to present an actual measured reading, together with an indication or configurable alarm for the user. This indication can be very helpful to improve processes by identifying transient gas entrainments. The EGM feature is mainly relying on the fast, completely digital, signal processing of the MFC 400 signal converter. The MFC 400 also provides enhanced diagnostic and status indications according to NAMUR NE 107.

OPTIMASS 1400 is a universal coriolis mass flowmeter for standard applications with liquids and gases. With its stainless steel twin straight tube design, it can be drained and cleaned easily, and presents a cost effective solution for accurate measurement of mass or volume flow, density and temperature in a variety of applications up to 130°C / 266°F. OPTIMASS 1400 features an optimised flow divider for minimum pressure loss. Next to standard flange process connections DN15…80 / ½...3″, it supports a wide range of industry standard hygienic connections.

OPTIMASS 2400 is a coriolis mass flowmeter for bulk mass and volume flow of liquids and gases. Originally developed to meet custody transfer applications in the oil and gas industry, it suits bulk, storage/loading/unloading and high volume measurement of products like syrup, molasses and raw chemicals as well. For flow rates up to 2,300,000 kg/h / 84,510 lbs/min, OPTIMASS 2400 is available in sizes DN100…300 / 4…12″ with NACE compliant stainless steel measuring tubes. The Super Duplex option offers a maximum operating pressure of 180 barg / 2,600 psi. For bulk measurement in the food and beverage industry, hygienic connections are available (DN100 / 4″ only).

http://krohne.com

KROHNE's twin straight tube Coriolis flowmeters OPTIMASS 1400 and OPTIMASS 2400 now available with Entrained Gas Management EGM: no loss of measurement with gas entrainment up to 100%