

# GO WITH THE FLOW

**Added capabilities of modern flowmeters help chemical processors increase efficiency and uptime, and reduce costs**

According to experts in flow measurement, any chemical processors seeking to optimize its processes in an effort to offset the rising prices of natural gas, electricity and raw materials may want to look at improving measurement and control via the added capabilities of modern flow technologies. Increasing productivity and process optimization very often involves system automation, says Jens Goebel from Siemens Industry Automation Division of Siemens Corp. (New York, N.Y.). "Increased use of flowmeters can contribute significantly in reaching that goal, as flowmeters are of paramount importance when it comes to process control and monitoring," he says. "More specifically, flowmeters ensure improved accuracy, which contributes to an enhanced quality, minimized waste and costs for disposal. The great reliability of the measurements also results in improved billing ability."

Apparently more processors are following this advice by taking advantage of improvements in flow technologies. "We are seeing a switch from the practice of changing out flowmeters on an as needed basis to seeing plant managers moving toward advanced technologies in an effort to save energy, improve productivity and optimize the plant," says Thomas Swihart, director of industrial sales worldwide with McCrometer (Hemet, Calif.).

But what are they switching to? According to the experts, orifice plate, venturi tube and other traditional methods have been used in the chemical process industries (CPI) for what seems like eons, but advances in other flowmeter methodologies are sending processors on a quest for more modern technologies with advanced features.

Recently, many flowmetering techniques that were previously overlooked for chemical processes have received updates that make them more suitable for these applications. In addition to bringing the benefits of advanced technologies, such as increased accuracy and reliability, many of these techniques can help boost efficiency and productivity, while reducing costs for electricity, natural gas and other raw materials.

## Ultrasonics

Traditionally, the clamp-on attribute of ultrasonic measurement methods didn't perform as well as chemical processors required, so the industry as a whole often passed it by. However, in the last few years there's been a lot of advancement in the signal conditioning associated with taking a good reading in an application where you aren't directly in contact with the process, says Jack Roushey, global product manager for flow products with Honeywell Process Solutions (Phoenix, Ariz.). "The software advancements in ultrasonics have really allowed this type of meter to take more reliable measurements."

And, because the meter can be installed without having to cut into the pipeline, it saves processors time and money on installation. In addition, says Roushey, if a processor requires verification of the process line, they have to verify the process loop again when equipment is put directly into a line. "By clamping a meter to the outside, you aren't impacting the process line itself, so it can save a lot of paperwork in addition to the actual physical cost of installation."

Like other manufacturers of ultra-

sonics, Honeywell is giving its model a revamp. Its VersaFlow Sonic 1000 is an ultrasonic clamp-on flowmeter that can be mounted on the outside of a pipe to measure the flowrate of liquids. Installation takes only minutes and requires no special tools. Additionally, the converter is pre-installed on the rail at the factory, further reducing installation time. The unit's design includes robust industrial construction, is insensitive to corrosive materials and provides accurate measurements independent of conductivity, viscosity, temperature, density and pressure.

Inline ultrasonic flowmeters are also realizing major technological improvements. For instance, the Innova-Sonic In-Line from Sierra Instruments (Monterey, Calif.), a state-of-the-art digital correlation transit-time ultrasonic flowmeter, offers an order-of-magnitude improvement in transit-time measurement technology over typical units, enabling superior response to changes in flows, as well as impressive low flow detection. The advanced technology allows the ultrasonic transit time-of-flight to be measured in picoseconds ( $10^{-12}$  s) for high resolution and extreme low-flow detection rather than the typical nanoseconds ( $10^{-9}$  s).



**The Innova-Sonic inline ultrasonic flowmeter offers order-of-magnitude improvement in transit-time measurement technology to provide high resolution and extreme low-flow detection**

## THE CALIBRATION CRAZE

A flowmeter is only as good as its calibration. For this reason flowmeter manufacturers are devising all manners of ensuring calibration from models that can verify the calibration *in-situ* to opening global calibration centers.

"It's always been a problem in the industry that to validate calibration, you have to de-install the product and send it to the factory to have it checked out," says Randy Brown, marketing manager with Fluid Components International (FCI; San Marcos, Calif.). "The cost of de- and re-installing can be high and, often, it would be sent to the factory only to find out the calibration was okay after all. This leads to a lot of wasted time and money."

To eliminate this problem, flowmeter manufacturers like FCI are beginning to provide models that feature the ability to validate calibration while the unit is still installed. FCI's VeriCal *In-Situ* Calibration Verification System for the GF90 Air/Gas Flow meter is one example. It allows plant personnel to confirm flow measurement accuracy in minutes without removing the meter from the pipe or process, helping to meet process validation, safety and environmental regulations, while saving time and money.

The VeriCal System is a specially manufactured and plumbed GF90 flow element with additional electronics to feed and measure a precise flow of gas from a nitrogen source. To test a GF90 flowmeter, the nitrogen gas is flowed through the meter's flow element and measured at five pre-set measurement points across the meter's range. The *in-situ* flowmeter test data is then compared to original FCI laboratory calibration and installation benchmark test data for the meter.

In addition to calibration verification features on the flowmeters themselves, several flowmeter manufacturers are taking the calibration trend further and opening calibration centers that serve the global community.

For example, Endress+Hauser Flowtec AG recently opened a calibration facility in Reinach, Switzerland, that "sets worldwide standards." The facility produces measurements that deviate no more than  $\pm 0.015\%$  from the reference value, which is equivalent to about the content of one champagne glass in one thousand liters of water. A regimen of constant checks and controls ensures that the high requirements on calibration accuracy are reliably satisfied.

Similarly, Krohne has announced its HyCal calibration facility in Rotterdam, Netherlands, which will focus on innovative calibration systems for flowmeters used in oil production. Since oil has become expensive, says the company, it pays to calibrate mea-

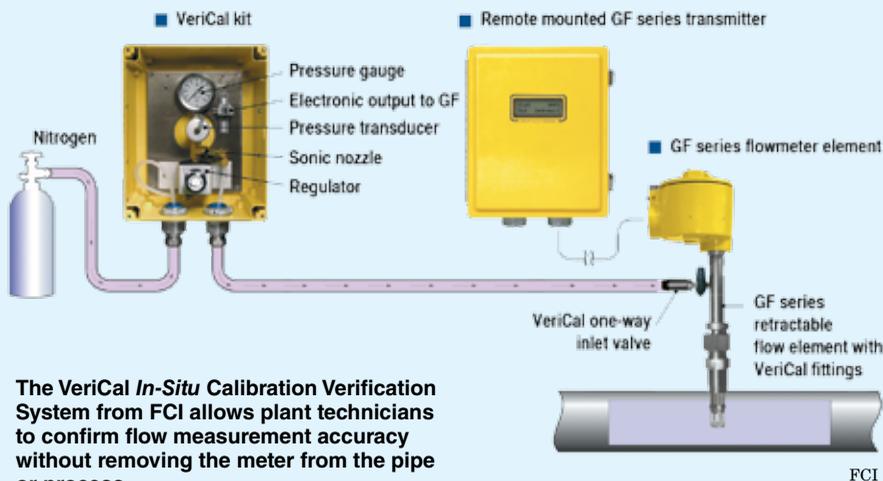


**A Micro Motion Elite flowmeter gets calibrated at Emerson's European Flow Center at Ede, Netherlands**

surements. An improvement in measurement accuracy in as little as five one hundredths of a percent make a difference of half a million dollars a week, says Krohne.

To that end, the new facility will perform various functions, including calibration, R&D and training sessions. Krohne says it is paying the tab for construction of the facility and will lease it to the Dutch Measuring Institute (NMI), which will autonomously perform flowmeter calibrations, R&D and possibly conduct the training sessions.

And, NMI recently granted certification to all three of Emerson Process Management's flow calibration test facilities at its European Flow Center. Emerson's European Flow Center was opened last year at Ede, Netherlands, and offers state-of-the-art test areas for different flow products and flow range calibrations. The Flow Center also offers product demonstrations and customer training areas. □



**The VeriCal *In-Situ* Calibration Verification System from FCI allows plant technicians to confirm flow measurement accuracy without removing the meter from the pipe or process**

### Coriolis meters

Tom O'Banion, director of global chemical industry marketing, with Micro Motion, a division of Emerson Process Management, (Boulder, Colo.) suggests that Coriolis meters are hitting "full stride" in the industry, as well, particularly for demanding applications with critical processes and high-value products. "Coriolis is a fascinating technology because from a single device, a user can receive three important process variables — flow (mass or volume, or both), density (concentration of acids or bases or purity of the product) and temperature," he says.

The two largest advancements in Coriolis technology from Micro Motion include a "dramatically improved ability to measure mass flow accurately while in two-phase flow conditions and the ability to check or verify the meter's calibration *in-situ*," says O'Banion.

The two-phase flow ability improves measurement during periods of continuous bubbles in liquid, as well as the ubiquitous situation in the CPI batching from empty. This is where users start with an empty pipe, fill the pipe while taking measurements and then end with a purge cycle. "In a typical process, a few additional on-

spec batches per year can represent literally millions of dollars in reduced re-work and increased productivity," says O'Banion.

Additionally, meter verification often produces a change in a plant's operating practices. "We have documented cases of over \$1 million/yr in reduced 'wet' calibrations, and much simpler, faster and less-expensive troubleshooting," he notes.

Seeing increased interest in Coriolis technologies, some flowmeter manufacturers are tweaking their Coriolis meters to meet the needs of specific sectors of the CPI, as well.

For example, Endress+Hauser (Indianapolis, Ind.) will soon offer the Promass P for pharmaceutical customers. The meter is an ASME-BPE-compliant, multi-variable Coriolis flowmeter designed specifically for the life sciences industry, which often requires a fully drainable, hygienic Coriolis meter with outstanding measurement performance in a single-tube design. Promass P offers 0.1% traceable calibration uncertainty, 0.0005 g/mL density measurement and accuracy during cleaning or periods of entrained gas. New ASME-BPE 2007 Standards for the life sciences industry will mandate changes regarding documentation requirements, designs for sterility and cleanability, welding and evaluation techniques and contact surface finishes. "Promass P guarantees customer compliance and provides unequalled measurement performance," says Craig McIntyre, chemical industry manager with Endress+Hauser.

### Vortex flowmeters

In an effort to reduce unnecessary waste and costs, a lot of processors are beginning to monitor process gases and steam flows through the plant. "Vortex flowmeters are perfect for these applications," notes Honeywell's Roushey. "Putting vortex meters on key locations allows users to measure and monitor BTU efficiency and determine if there are excessive losses of steam or gas. This goes a long way toward helping processors manage it in an effort to cut costs."

As a result, many flowmeter manufacturers are updating their models or introducing new ones. Honeywell now offers the VersaFlow Vortex 100, which provides integrated pressure and temperature compensation in a two-wire technology. It provides reliable measurement of standard volumetric and mass flow of both conductive and non-conductive liquids, gases and vapors, even with fluctuating pressures and temperatures.

In May, Siemens introduced its new vortex meter, the Sitrans F X Vortex, which combines a pressure and temperature sensor in one unit to provide



The family of Micro Motion Coriolis meters offers users tube geometry that is optimized for many applications in the chemical industry

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precision measurements of the flow of steam, gases and liquids. It is designed for applications that require reliable flow measurements independent of conductivity, viscosity, temperature, density and pressure. "It is the ideal choice for steam and saturated steam measurement, burner consumption measurement, boiler monitoring, control of compressor output, consumption measurement in compressed air systems and measurement of industrial gases," notes Goebel.

### Magnetic flowmeters

As processors continually tighten their belts, new loop-powered magnetic flowmeters (sometimes called mag) are also showing up as a cost-cutting alternative to other measurement methods in the CPI. "Traditionally, magnetic flowmeters were the choice if there were solids involved because the design is free of obstructions," explains Bob Harvey, director

of sales and marketing with Yamatake America Inc. (Phoenix, Ariz.). "But, being four wire devices, they were overlooked by chemical processors because of costly installation issues and hazard risks in chemical plants with explosive environments."

However, use of the loop-powered mag eliminates the need for the additional, and potentially hazardous, wiring. "In a new installation a loop-powered mag can have a dramatic savings in conduit costs over a four-wire mag," says Harvey. "When you can eliminate 50 ft of conduit times 10 m on a project, the savings really begin to snowball."

Thanks to the new two-wire models, magnetic flowmeters are now being considered as potential replacements in situations where more traditional metering devices were used. High accuracies and turndown capabilities of loop-powered magnetic flowmeters can lead to reduced costs and dramati-

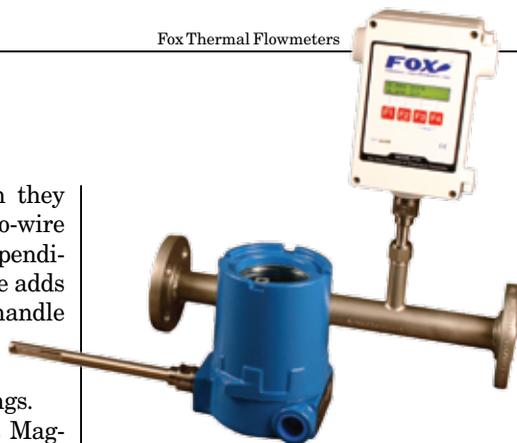
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cally increased uptime.

"Mag meters are free flowing, so there are no issues with solids coming down the line, which reduces maintenance costs associated with older style meters that seize when jammed by solids," says Harvey. "We have situations where people were spending \$200 to 300 a couple times a year rebuilding

turbine and other meters. Then they spend \$1,800 to \$2,100 on a two-wire mag, eliminate maintenance expenditures and the payback is fast." He adds that the accuracy, ability to handle solids, reduced mechanical wear and reduced need for calibration can quickly provide further savings.

Harvey notes that Yamatake's Mag-



**Fox Thermal Instruments' thermal mass flowmeters are suitable for measuring low and varying air and gas flowrates**

neW Two-Wire PLUS loop-powered electromagnetic flowmeter has become a very strong product because the explosion-proof installation allows it to be placed in a lot of CPI applications where traditional magmeters couldn't have been used.

### Differential pressure devices

Differential pressure devices, with their ability to avoid pressure losses, are also getting more attention as processors attempt to reduce energy-related costs. "Flowmeters have notorious pressure-loss problems, which often require purchasing more energy to keep the pressure up in the plant," says McCrometer's Swihart. "In order to combat this problem, users need a unit that not only provides accuracy, but can also control pressure."

This, he says, is where differential pressure devices take a starring role thanks to their inherent ability to minimize pressure loss across the meter. "Pressure is energy, and if the meter can contain the energy balance around the plant and not lose pressure, you are saving money on energy costs," he says.

For this reason, McCrometer provides the V-Cone, a differential pressure device that can best be described as an inside-out venturi tube. Instead of emerging through a restricted throat, the flow is conditioned by a cone-shaped body that is rigidly set in the middle of the line. The accuracy of the meter can be up to  $\pm 0.5\%$  of rate, and the throughput available is a 10:1 ratio, compared to the 3:1 ratio of a traditional venturi tube.

### Self-diagnostics

No matter the method of flow measurement, self-diagnostics are becoming a hugely popular feature at a time

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when processors are trying to reduce downtime and increase productivity. According to John Fiedler, product specialist with Krohne (Peabody, Mass.), flowmeter self-diagnostics have gone through several evolutionary stages. "First we went from pneumatic to analog; the next step was a smart flowmeter with a digital protocol. Today, we've expanded well beyond that scope to offer modern flowmeters that use microprocessors at the base. With that comes a lot of measurement and self-diagnostic potential," he says.

Microprocessor-based electronics make it simple to incorporate fundamental secondary measurements that were previously done manually via a multimeter, which saves time and money on labor. Additionally, it provides an alarming function that lets operators know if there's drift associated with malfunctions of the meter.

For this reason, many flowmeter manufacturers are diligently working to provide advanced self diagnostics, along with other updates. For instance, Fox Thermal Instruments (Marina, Calif.), has put much work into advancing the sensor technologies in its thermal mass flowmeters (photo) used for measuring low and varying air and gas flowrates. "We're committed to extending the sensor's range and making thermal measurement more suitable for challenging industrial applications," says Rich Cada, vice president of sales and marketing with Fox Thermal. "Our Power Pro sensor, for instance now operates at higher power level than competitive instruments, and provides faster response time and the ability to measure very-low velocity rates, as well as high velocity flowrates."

At the same time, Fox Thermal is working to incorporate self diagnostics with its advanced sensor technologies. The firm is currently developing a flowmeter with all-digital signal-processing circuitry that permits continuous diagnostics of the sensor and other flowmeter components. The specific benefits of this combination, says Cada, are improved accuracy, repeatability and longterm stability. "We expect this next-generation technology will help manufacturers reduce process downtime, improve product quality and deliver a range of facility- and process-optimization features."

Fiedler says the biggest savings provided by advanced self-diagnostics may be in the ability to bypass flowmeter troubleshooting all together. He says often there's a condition in the pipe itself, such as partially filled pipes, sediment or cavitation, that prevents the flowmeter from getting a good measurement, but the inclination

of operators and maintenance technicians is to spend time troubleshooting the device. "Krohne's advanced diagnostics can tell technicians that the meter is fine and that the problem is in the process," he says. "This really helps isolate the problem and gets it fixed as efficiently as possible." ■

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