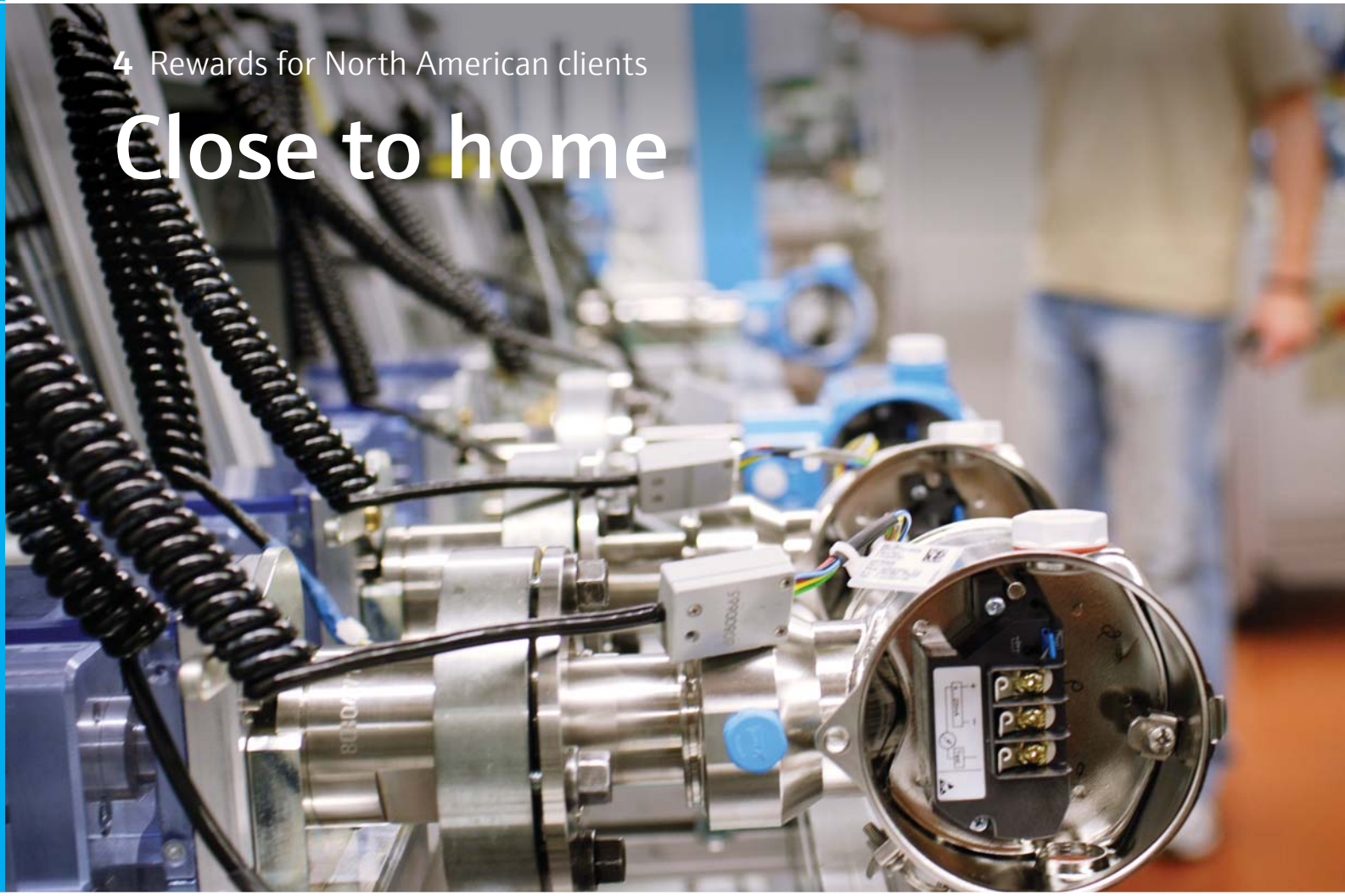
talkline



Close to home

Endress+Hauser
People for Process Automation

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Tradeshow Schedule 2014

September 22 to 26	Western Canada Water, Regina SK	www.wcwwa.ca
October 23 to 24	Northwestern Ontario Water & Wastewater Conference	www.nwowwc.com
November 5 to 6	SWWA Conference and Trade show	www.swwa.ca

Certified PROFIBUS Training for Process Automation

Endress+Hauser's Competence Centre

Fee

$3,600/person
Custom on-site training is also available.

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Who should attend?

- Engineers/Technologists who design Profibus networks
- System Integrators
- Electrical Instrumentation Contractors
- Control and Instrumentation Technicians

Prerequisites

Basic knowledge of computers, electronics and mathematics

Certification

Certified PROFIBUS PA Professional
Minimum 70% score to qualify for internationally recognized certification

Course description

An intensive four-day program that provides the trainee all the necessary skills and knowledge, theoretical and practical, to design, install and troubleshoot a Profibus network. The program finishes with a three-part exam: a series of multiple choice questions, a part on calculation and diagnostic interpretation, and a hands-on lab troubleshooting a Profibus network.

The successful trainee is able to perform accurate segment design, network calculations, and advanced bus diagnosis using PROFIBUS tools.

Our valued friends, customers and business partners

Dear Reader,

Here's the second issue of Talkline for 2014. Hopefully, you are reading this issue somewhere sunny and warm. After the winter we've experienced, I know all of us are eager to welcome back summer weather and temperatures.

So far, 2014 is proving to be another busy year filled with challenges and opportunities for all. We remain focused on working with you in a spirit of partnership and to doing our part in supporting the achievement of your goals. Don't hesitate to call on us to take a more in-depth look at where we can help you optimize your processes. The People for Process Automation have a lot more to offer and contribute than our highly accurate and reliable measurement instrumentation. We offer services, solutions and training that can also contribute tangible results to your bottom line.

Safety is also embedded into everything we do. Accurate and reliable measurement sets the basis for safe processes. At Endress+Hauser safety comes first. Each instrument we manufacture begins with the safe design and testing experience gained from over six decades of practical know-how, collaboration with customers and industry organizations. Count on us to help you optimize your safety critical applications.

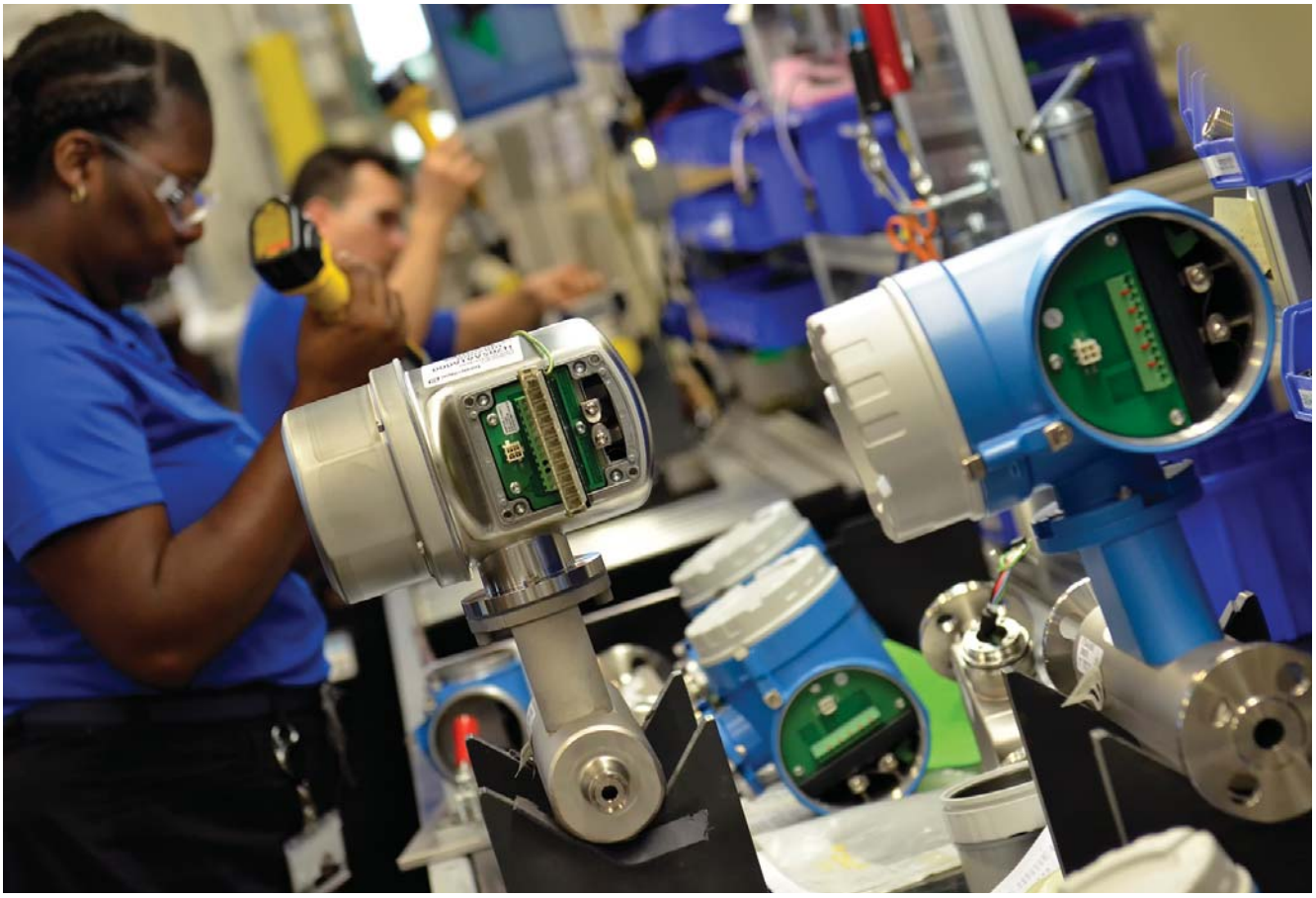
We are also proud of our ongoing investments in our North American manufacturing and service infrastructure. Now more than ever, Canadian customers can realize the inherent benefits of local manufacturing, research and development. You can uncover more on this in the pages that follow.

Wishing each and every one of you a safe, productive and rewarding summer season!

Sincerely,

Richard

Richard Lewandowski
CEO



Coriolis assembly within Endress+Hauser's Flowtec facility in Greenwood, Indiana.

Close to home

Founded in 1953, Endress+Hauser has spent the last 60-plus years establishing itself as a global authority in process automation. North American clients now stand to reap the rewards thanks to investments in stateside production facilities.

Endress+Hauser recently invited PROCESSWest *to its Greenwood campus just outside of Indianapolis, Indiana, for a first-hand look at its newly expanded manufacturing facilities. During this exclusive visit, the instrumentation and process automation company detailed a number of key solutions designed specifically for the North American oil and gas, chemical, mining, water and wastewater, biotech, and food and beverage industries. The newly expanded facilities offer Canadian customers a much closer and collaborative relationship with Endress+Hauser's production facilities and capabilities. Order turn-around time is but one of the many added value benefits resulting from this investment.*

In May 2013, storied international instrumentation and process automation specialists Endress+Hauser lifted the veil on arguably its most ambitious move ever in North America—a $40-million US investment at the company's campus in Greenwood, Ind.

Featuring new manufacturing and support capabilities, the expansion represented a hallmark moment for Endress+Hauser by giving the growing North American market better line of sight to the company's product solutions.

"Simply put, the expansion of production has given us more capabilities," Stefan Grotzer, general manager of Endress+Hauser's Flow Manufacturing, (Flowtec USA Division) says of the $40-million investment, $18 million of which was devoted to a new flowmeter plant.

"We are much closer to the customer—we are one of them, so to speak. It helps us understand their processes—their pains, their aches. With the expansion in North America, we've shown clients that we're in it for the long haul."

Endress+Hauser's upgraded flowmeter manufacturing facilities included the addition of an ISO9001- and ISO14001-certified 100,000-square-foot Coriolis, vortex, ultrasonic and thermal mass flowmeter plant to the existing electromagnetic flowmeter building—bringing its total size to 185,000 square feet.

The $40-million investment also included the addition of a 105,000-square-foot level and pressure manufacturing plant, which has enabled Endress+Hauser to facilitate improved logistics, as well as increase throughput to accommodate sales growth.

"Adding 200,000 square feet of manufacturing space to our campus allows us to be even more flexible and able to meet our customers' needs," says Grotzer.

From a level and instrumentation perspective, the expansion has allowed the Greenwood campus to bring in new products, says John Schnake, general manager of Automation Instrumentation for Endress+Hauser (USA).

"We didn't have a lot of room in the past, so we used a lot of lean thinking and lean practices," he says. "Now that we have space, we can separate our logistics and production."

The expansion also gave Endress+Hauser the ability to introduce new products specifically for the North American market.

"The additional production capacity, underneath it all, is helping to drive innovation," says Scott Whitehouse, marketing communications manager for Endress+Hauser Canada. "It's got us into the North American market with products that traditionally would never have been launched here. They would have be driven by Europe, launched and proven successful, and then filtered to the separate markets. But the closer we are to our customers, the more we're able to partner with them in addressing their needs and exploring the opportunities. Being closer to customers allows you the unique opportunity to better serve them."

Schnake cites the Deltabar FMD72 as an example. The electronic differential pressure transmitter was conceived and developed by engineers in the U.S. and Germany specifically for the North American chemical and oil and gas industries where customers are faced with cost disadvantages on raw materials and even higher labour costs compared to emerging markets. Chemical and oil and gas production facilities are investing in process efficiency, supply chain optimization, process reliability and process safety.

The FMD72 is used to measure the level, volume or mass of liquids in pressurized tanks. Featuring two pressure sensor modules connected electronically to a single transmitter, it avoids negative errors on the pressure measurement caused by different temperatures between the two capillaries due to differences in sunlight. It also offers a safer and more reliable solution compared to traditional measurement methods.

Would such issues have been resolved without the FMD72—and, by extension, the Greenwood campus?

"We're closing that loop between customer needs and development."

John Schnake, general manager, automation instrumentation, Endress+Hauser (USA)

10 things you need to know about Endress+Hauser's Greenwood campus

1. Endress+Hauser has carried out more than one million calibrations at its calibration laboratory facilities and on-site calibration rigs. It can calibrate third-party devices up to 48-inches in addition to its own products.
2. More than 80 per cent of all instruments ordered/shipped for North America are now manufactured in North America.
3. A new $16-million Customer Centre currently in construction will offer up to 66,000 square feet of new space .
4. Level instruments can be calibrated with a reference accuracy of 0.1 mm on the company radar test bench.
5. The Promass I Coriolis meter allows for simultaneous direct measurement of mass flow, density, temperature, viscosity.
6. Endress+Hauser invest an average of 10 per cent of its annual revenue in its manufacturing infrastructure.
7. While adding manufacturing space to its Greenwood campus, Endress+Hauser recycled 65 per cent of all materials used during construction.
8. The campus features a geothermal heating and cooling system that uses a pond 14 feet deep and maintaining a temperature of 55°F.
9. Through the "PremiumCal" calibration, Coriolis mass flow meters can be calibrated to an accuracy of ±0.05 per cent. This is equivalent to the contents of a single champagne glass per one thousand liters of water
10. Endress+Hauser's training program offers premium training at Process Training Units—full-scale, working process skids with online instrumentation and controls.

"Greenwood allowed us to develop the FMD72 even further and get (its) production closer to the customer," says Schnake. "We're closing that loop between customer needs and product development."

Further to the FMD72, Schnake notes its development falls in line with comments made recently by outgoing CEO Klaus Endress—that "the need for solutions that make life simpler is greater than ever before."

"It's a much more elegant solution, with greater accuracy than two diaphragm seals and 20-foot capillaries," says Schnake. "You connect two sensors up to the tank, electronic back to the calculator and a hard signal out. It covers a large majority of the applications, it's a much simpler solution … and much more accurate. It compensates for a lot of those temperature differences between sunlight on one capillary versus no sunlight on another."

Schnake further references noted American social scientist Herbert Simon, who, when commenting on the concept of attention economics, said, "… in an information-rich world, the wealth of information means a dearth of something else."

"It's the same as the engineers and the maintenance people in the plant," he says. "They have so much information that they just want to know the meter is of high quality and provides the most accurate and reliable measurement possible. That's what we're doing here. Ironically, it's also very difficult."

Grotzer sees similar "simple" solutions that solve complex needs, notably on-board web servers on Endress+Hauser's next generation products.

"You don't need any firmware anymore," he says of the on-board web servers. "On your laptop, you connect an Ethernet cable directly to the meter, which then communicates back to the laptop. You don't need to install any software—the web server is in the transmitter. It shows the parameters, you can configure, analyze failure codes and information like that.

"It's not so much a mechanical part—you can't touch and feel it—yet it's addressing the complexity of accessing instruments, in general, to program, commission, service or check."

Back to the future

Of course, Endress+Hauser's history in North America dates much farther back than 2013. Following the introduction of level measurement systems when it moved to Greenwood in 1973, Endress+Hauser added flow products to its North American portfolio in 1985, with local production beginning in 1987.

At the same time, construction was completed on a 6,000-square-foot flow lab that included a calibration

Automation Instrumentation

Founded in 1996 and incorporated in 2008, a $15-million investment in 2013 resulted in a new 105,000-square-foot plant—an increase of nearly 60,000 square feet. Focus is on machining, welding, assembly and calibration for level measurement and level limit detection, as well as pressure and differential pressure measurement.

Flowtec

Established in January 1996, the ISO 14001-certified 173,000-square-foot facility manufactures electromagnetic, Coriolis, vortex, ultrasonic and thermal mass measuring devices, as well as special products. Calibration services (ISO/IEC 17025) include seven production calibration rigs with capabilities from 1/12-inch through 48-inch (2 to 1,200 mm).

Customer Centre

Set to open in June 2014, the new 80,000-square-foot building consists of Endress+Hauser's Projects, CoC (Center of Competence), Solutions, Training, and Services teams. It will also include a new Process Training Unit where customers can simulate situations that may go wrong in their respective plants. The price tag is estimated at $16 million.

system—the continuation of a global movement by Endress+Hauser in an effort to be a recognized leader in in-house calibration services.

In 1990, manufacturing again expanded by adding an additional 46,000 square feet, followed in 1997 with the addition of a dedicated sales centre. Despite its 40-plus year history in North America, some of Endress+Hauser's largest investments have taken place within the past decade.

In 2007, Endress+Hauser opened a new electromagnetic flowmeter manufacturing facility that, among other features, housed what is still one of the largest flowmeter calibration rigs on this side of the Atlantic. The rig—capable of testing and calibrating flowmeters as small as three inches in diameter and up to 48 inches, utilizes a unique automated test section storage and retrieval system that reduces time and labour.

It also uses hydraulic fixtures, instead of bolts, to mount the meter, and is able to achieve a volumetric rig accuracy of ±0.051 per cent. There are other rigs available for calibrating down to two millimetres in diameter, in addition to mobile calibration rigs that can be deployed to customer sites.

In 2011, Endress+Hauser also opened a 12,000-square-foot temperature production facility in Greenwood. The manufacturing plant was designed to build temperature sensors, thermowells, transmitters, recorders, flow computers, safety barriers, displays and other instrumentation. The expansion also added an NIST traceable ISO17025-accredited temperature calibration laboratory.

In-house calibration

The recent investments in Greenwood come as Endress+Hauser, globally, looks inward as the company moves forward—focusing on what Grotzer and Schnake refer to as "optimizing in-house core competencies."

Grotzer specifically points to in-house calibration facilities for flowmeters—Coriolis, vortex, ultrasonic and electromagnetic—and how it has opened doors for Endress+Hauser that previously might have been closed.

In addition to the large calibration rig in Greenwood's electromagnetic facility, these ISO/IEC 17025-certified calibration rigs for flowmeters allow Endress+Hauser to verify the performance of measuring instruments using water in a test pipeline. They are also used to minimize measurement deviation.

"Customers already expect that we will deliver a high-quality product," says Grotzer. "It (in-house calibration capabilities), in turn, offers value. It is highly critical and a crucial process for our instruments. "For us, there is no place in the world where we can go and buy the calibration rig we need. So in-house calibration capabilities provide us the ability to offer this quality, and assure this quality in our products for years to come."

Grotzer notes the added benefit of having in-house calibration capabilities, coupled with existing knowledge surrounding flow, is Endress+Hauser can offer mobile calibration services to its clients—a growing trend.

"We have the knowledge that allows us to scale it down," says Grotzer.

Having the technology in-house, and the ability to continually develop it, also leads to new inventions such as steam and viscosity measurement.

"For example, we're the only one in the world with a single straight-tube Coriolis meter that can directly measure viscosity without going (down) the path of differential measurement," says Grotzer. "We were able to do so because we developed the rig to really make those measurements possible and to analyze the signal."

Adds Schnake: "Again, it comes down to core competencies. If we believe it brings value, and we believe it's something we want to grow and keep improving, it's something that we'll focus on. On the other hand, if we feel something isn't such a core competence—that it can be made somewhere else—and it's not critical, then it's fine. In this case, calibration is a core competence."

Standardization drives innovation

Both Schnake and Grotzer further argue that U.S. production and calibration facilities are also benefitting Canadian and North American clients through lessons learned from the parent company. Both general managers call this "standardization driving innovation."

Schnake refers to another quote from Klaus Endress: "Do the same things the same way."

"That means globally and within Endress+Hauser, we should do the same things the same way, whether it's in China, Europe, U.S. or Canada," he says. "It helps from an efficiency and product quality standpoint. Whether you're an international customer getting a product from the U.S. or a Canadian customer getting one from China, it should be exactly the same product."

Grotzer also refers to standardization driving innovation through the parent company's set of standards—customers benefit from common product platforms.

The two-wire platform, for example, was closely developed with level and flow products.

"There's a common platform—common modules. The housings look the same. The touch and feel to the customer is the same," says Grotzer. "Of course a two-wire Coriolis meter has different programming variables, but it looks the same and feels the same. If you understand one, you understand the other."

That's not to say customization does not play a large role in Endress+Hauser's North American operations—particularly in Indiana. While many of the 75,000 different instruments manufactured in Indiana might have a standard model number, there are also millions of different possible configurations.

"A customer may have a need that everyone's products cannot serve," says Schnake, noting it could be anything from different material for a flange to a part that does something different than what it was originally designed to do.

"Our engineers will look at it and find a way to adapt it and make it happen. They'll work with vendors to buy the right pieces, with production to make sure they can produce it, offer it at a competitive price and offer a technically special product (TSP). Sure, we'd prefer for everything to be standard. But that is not the reality of this market."

Grotzer adds that Endress+Hauser learns from TSPs. The company strives to adapt to changing industry needs and requirements. "Chemical is not the same as oil and gas, while wastewater has different requirements than pharmaceutical or food and beverage," he says.

As such, Endress+Hauser works to accommodate these different industries and, by extension, how individual customers want to differentiate themselves from their competition. For example, Grotzer notes not all filling processes in the food industry are the same. Just because one brewery does it one way doesn't mean the other will do it the same way.

"So there's constantly and consistently different requirements coming from our customers from an instrumentation standpoint," he says. "And at that point, you can't standardize any more. For us, that means we'll never get to that ideal situation of that one flowmeter or that one level product. The good news is we have the capabilities of never needing to get there either."

Fueling those capabilities is Endress+Hauser's mandate to reinvest 7.5 to 10 per cent of its net sales revenue back into research and development, and an additional 7.5 to 10 per cent toward manufacturing automation—which, in turn, manifests itself in the company's regional product centres and represents a benefit to its customers, notes Whitehouse.

"No one wants to get up and chip the same rock the same way every day for 30 years," he says. "We love what we're doing. We're learning and growing."

For more information
info@ca.endress.com

Inventory of critical devices in a pharmaceutical plant

Do you have a calibration plan?

Implementing a calibration plan can help increase profit

Many companies are now in the habit of calibrating their instruments once a year, although there is perhaps no need to pay the same degree of attention to every measuring point. In many cases, it is sufficient to focus on the instruments that play a critical role.

Endress+Hauser has helped customers implement a calibration plan on many occasions. What are the factors to bear in mind when defining which measuring points to include?

To start out, you should begin by noting every measuring instrument in the plant. Identify and make a list of all the equipment parts and all the instrument-related systems. This list should also include details such as description, local information, working range and history, and any other points that provide a better understanding of the part's function.

The first stage in any analysis of the data gathered is to identify which instruments are critical to the application, the production environment, and operator safety. This calls for teamwork. We will set up a meeting with the head of metrology (or quality), head of production—who has in-depth knowledge of the process and the related instruments—and head of maintenance. Besides generally being the person in charge of calibration, the head of maintenance will also be able to contribute what they know about the process environment, the condition of the installed instruments, the type of maintenance work carried out and, finally, any limitations imposed by the plant in terms of servicing.

With this working group, we will start from the finished product—and the tolerance permitted in relation to its quality—and go back through the various stages in the production process. At each stage, we will look at the instruments in place and ask ourselves: "Does this instrument have an impact on the quality of the product (or any intermediary product), on process functioning, or on operator safety?"

Why start with the finished product?

Users frequently define Maximum Permissible Errors (MPE) on the basis of the instruments they purchase, when what should be most important are the application specifications in relation to the quality of the finished

Magmeter manufacturing facility and calibration lab in Indiana

Calibration laboratory serving ship channel customers in Texas

product. Tolerances at all levels of the process should be defined in relation to desired results. In the context of instrumentation, MPEs express defined tolerances for the function being monitored. Taking it a step further, MPEs should provide a basis for deciding what instruments to install, not vice versa!

Let's take a simple example to illustrate this thinking: a good cookie should be baked to just the right degree, taste good and be the right size. The first thing to look at, then, is the cooking phase and the parameters impacting the result: essentially cooking time and oven temperature in this case. The next stage is to try to identify the elements likely to influence the quality of the pastry, e.g. quality and quantity of ingredients and adherence to the recipe.

The relative importance of some of these parameters will help identify measuring points that merit particular attention in relation to metrology. Having defined parameters in terms of their importance for the product, this step is repeated with regard to the process, and then with regard to operator safety. On completion of this first stage of analysis, the working group will have compiled a list of instruments ranked in order of critical importance, i.e. high, average, low, and a list of non-critical instruments.

The primary benefit of this work? Instruments classified as non-critical do not require any metrological monitoring in particular, hence there is no need to continue periodic calibration. As long as the user can prove to the auditor that these instruments have no impact whatsoever on the quality of the finished product, they are entirely at liberty to decide they no longer require calibration.

In many cases, the second benefit is a re-appraisal of the choice of instruments in the context of the application. A Ferrari is not the ideal car for an uphill race, and may even cause lots of problems. The same goes for the instruments you employ.

How to define the calibration frequency of instruments deemed critical?

The ideal calibration frequency should be "just what it takes" to guarantee the instrument specifications in the context of the production process. To achieve that, we will consider both the factors in favor of frequent calibration and those against it.

The key factor, of course, is the desired measuring precision—which is closely linked to the Maximum

If working around production schedules is a challenge, on-site calibration can be scheduled

Permissible Error tolerated in order to guarantee the quality of the final product. But decisions will also be influenced by the varying nature or condition of the product in contact with the instrument, the continuity (or discontinuity) of the process, the relative severity of the ambient conditions or the presence of Cleaning in Place (CIP). Similarly, considerations such as whether the instrument is used continuously or at intervals, time available for calibration, ease of disassembly and possibility of on-site calibration will also influence calibration plans. And an analysis of calibration history will obviously allow frequency to be adjusted in relation to any non-conformities that are identified.

A final parameter to consider when deciding whether to reduce the frequency of calibration is the risk associated with an excessively long period without calibration. It is useful at this point to remember that the purpose of calibration is to certify the quality of the products that have already been manufactured, not of those yet to be manufactured. Will non-conformities be detected if the instrument is not calibrated for a certain time? Will the production operator, wanting to compensate for a production non-conformity, add too much raw material or modify the process, thereby causing additional costs? This is why the interval between two calibrations rarely exceeds two or three years in the case of critical apparatus.

Why do companies tend to opt for a one-year interval?

It must be something to do with a natural biological rhythm that suits everyone, more or less, auditors included! Because there is rarely any mention of one-year intervals in any regulations. The only stipulation is that the calibration interval must be determined as a function of statistical factors. And as auditors are not necessarily calibration specialists, no one will ask any questions if you calibrate once a year. But if you opt for a longer interval, you will need arguments in support of your decision.


ilac-MRA A2LA American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

ENDRESS+HAUSER CANADA LTD.

Burlington, Ontario, CANADA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 2nd day of April 2014.

President & CEO
For the Accreditation Council
Certificate Number 3597.01
Valid to June 30, 2016

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.

Endress+Hauser's calibration and maintenance management software "CompuCal"

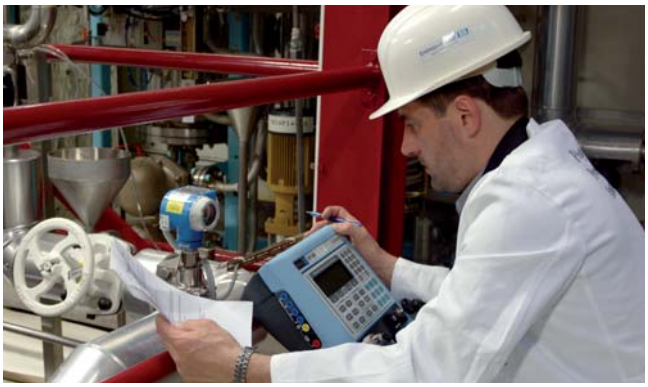
Four categories of critical importance

Instruments should be classified according to one of the four categories of critical importance below:

1. **Instruments critical for the product:** instruments that, if defective, may have a direct impact on product quality
2. **Instruments critical for the process/system:** instruments that, if defective, may have a direct impact on process or system performance, without affecting the quality of the final product, or safety
3. **Instruments critical for safety/the environment:** instruments that, if defective, may have a direct impact on operator safety, or the environment
4. **Non-critical instruments:** instruments that, if defective, are thought not to have any impact on product quality, process or system performance, safety, or the environment.

Endress+Hauser software solutions to serve metrological activities

- **CompuCal™** is a high performance system to efficiently maintain and calibrate your on-site instrumentation
  www.ca.endress.com/SCM100
- **W@M - Life Cycle Management** is an open and flexible information platform with on-site tools and services supporting you along the life cycle.
  www.ca.endress.com/WAM
- **Installed Base Analysis** is a service to audit and analyze your installed base of process instruments resulting in an effective calibration plan.
  www.ca.endress.com/installed-base-audit



Despite being the usual practice, one-year intervals are not necessarily a good thing. Whereas a flowmeter can go for two or even three years without calibration (depending on the application), a year is generally too long in the life of a pH measuring device.

What can Endress+Hauser do for companies with a metrology department?

As an instrument manufacturer, we apply our measuring systems' know-how to our client's application conditions. And we have tools to implement, in the initial phase, our method for drawing up a metrological plan, then for implementing the plan itself. We help our customers achieve dynamic management of their installed instruments, i.e. we ensure they are capable of planning, triggering and documenting maintenance and calibration operations.

At the operational level, we utilize our skills, mobile equipment and accredited laboratories in carrying out calibration, in combination with customers' own resources.

Finally, our contribution helps the head of metrology to emphasize the importance of process optimization to their team. For in many cases, metrology is still perceived as a burden, even if those in the life sciences or the food and beverage industry are more aware than others of its benefits in terms of process control. And with the current context making it more necessary than ever to economize raw materials, energy and water, an ever growing number of industry practitioners now have a better appreciation of the role of metrology in cost control.

Total calibration competence

Endress+Hauser performs instrument calibration across a variety of measuring principles—flow, pressure and temperature. Calibration can be performed at our calibration laboratories or at your facility via our mobile calibration labs. Endress+Hauser calibration laboratories are located at multiple locations in North America and around the globe. Due to new EPA regulations regarding greenhouse gas reporting, traceable calibration is more critical than ever before. Our network of highly trained service professionals, equipped with innovative mobile tools and software, is available to support your critical calibration requirements.

For more information
www.ca.endress.com/calibration

A spectacular recovery

The final cruise of the Costa Concordia unexpectedly ended in disaster. But the recovery of the wreck went according to plan, thanks to modern measurement technology.

The images were seen around the world. In January 2012, with more than 4,200 passengers and crew on board, the Costa Concordia struck a reef on the western coast of Italy, ripping a gaping hole in the side and leaving the ship half sunk in the water. 32 people lost their lives in the accident. Since then, the 290-meter-long wreck has rested on its side off the coast of the small vacation island of Giglio.

The salvage operation was just as spectacular as the accident. The objective was to raise the giant listing cruise liner in a single piece, thus preventing an environmental disaster and sparing the people of Giglio months of wrecking works taking place on shore. "Uprighting the ship was an extremely delicate operation," explains Antonio Festa from Endress+Hauser Italy. "To keep it from breaking apart, the ship had to be carefully and very evenly rotated." To carry out the operation, specialists deployed state-of-the-art level measurement technology.

The salvage plan and preparations were one and a half years in the making. The unprecedented project—a wreck of this size had never before been raised in one piece—was awarded to an American-Italian consortium that brought in specialists from across Europe. "Our on-site partner was an Italian engineering firm," explains Antonio Festa. "Endress+Hauser was then contracted by a Belgian company."

A crucial role in the salvage and refloating effort was played by the sponsons, air-filled chambers that can be filled with water and then emptied again. The sponsons attached to the Costa Concordia act like giant steel life vests to stabilize the wreck and provide buoyancy (see graphic). The water level in the chambers is measured with pressure sensors. 278 Waterpilot level probes register the slightest hydrostatic changes, while two additional Cerabar pressure transmitters supply reference values.

Strength in equilibrium

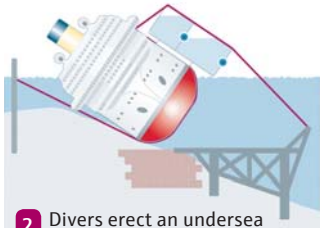
"A constantly reliable level measurement was necessary to keep the hull from buckling while the ship was rotated," adds Antonio Festa in explaining the mission. Apart from delivering precise measurements, the Waterpilot probes are extremely robust, withstanding even the harsh effects of salty sea water. "We also brought our entire range of expertise to the project," says the pressure measurement specialist. "We provided support from the engineering phase and even made suggestions for the cable glands and centering sleeves for an easy installation of the measurement instruments."

In the end the measurement technology passed its test with flying colors. In September 2013, specialists raised the crippled giant during a mammoth 19-hour operation. Additional sponsons have since been attached to the starboard side of the ship, facing land. This summer, the Costa Concordia will be towed on its very final journey to an Italian port where the former pride of the Mediterranean will be scrapped.

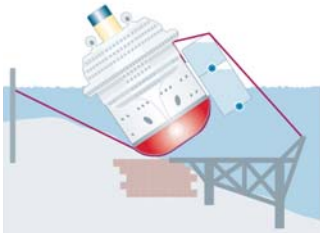
www.theparbucklingproject.com

The five stages of the salvage operation

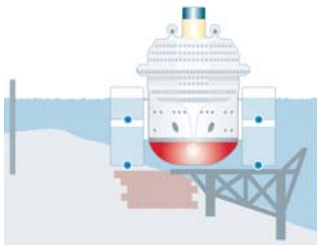
1 To keep it from slipping or sinking,the Costa Concordia wreck, which is listing in the water at 65 degrees, is secured with anchor blocks and chains.



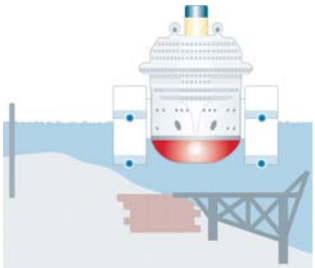
2 Divers erect an undersea platform, or so-called 'false bottom', on which the ship will rest after being rotated. Sponsons and steel cables are attached to the port side of the ship.



3 In a careful and deliberate operation, the Costa Concordia is horizontally rotated using hydraulic winches and by controlled filling of the sponsons.



4 Sponsons can now be attached to the starboard side of the ship, facing land.



5 Using air pressure, the seawater-filled sponsons are gradually emptied to give the wreck enough buoyancy to refloat.

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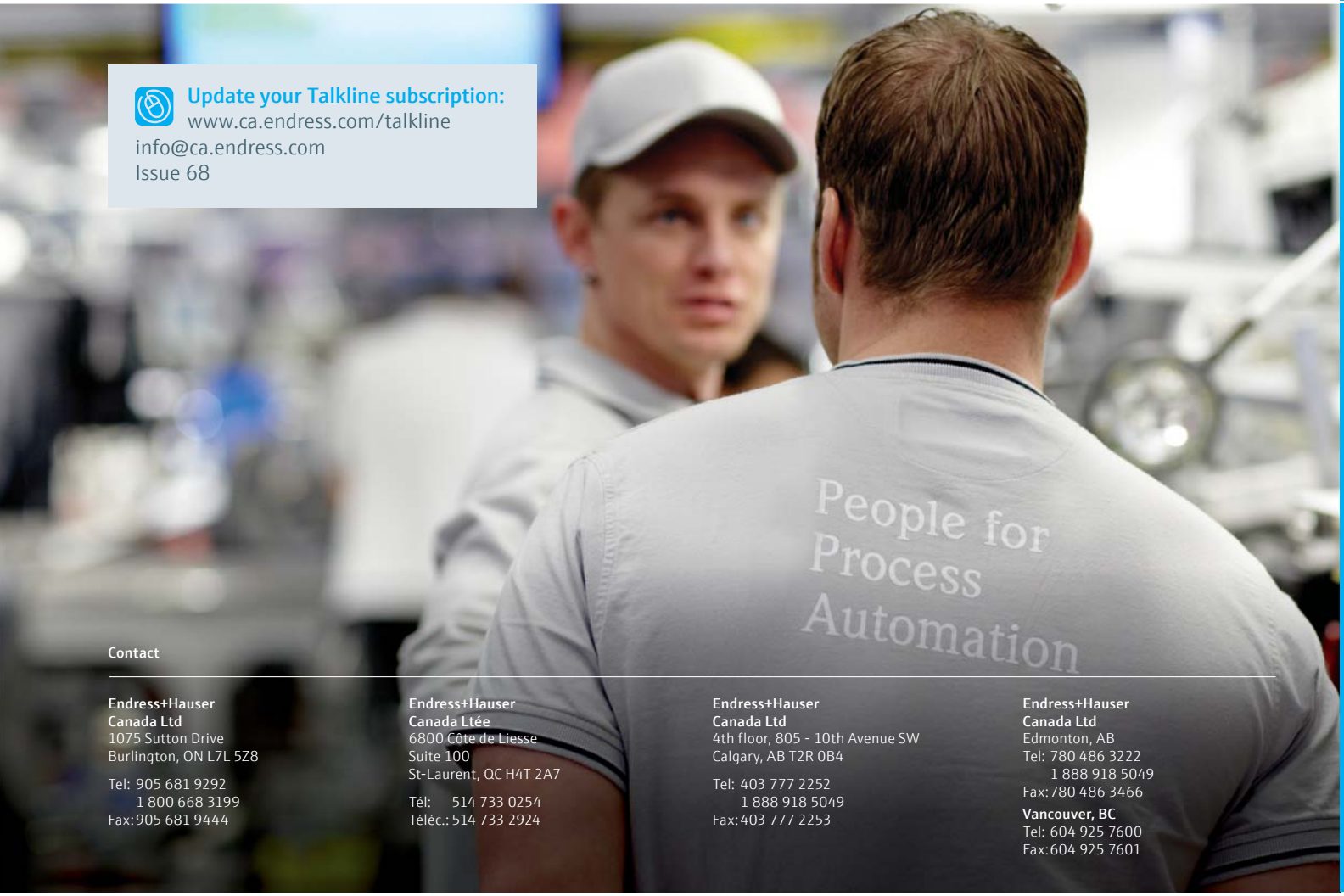

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