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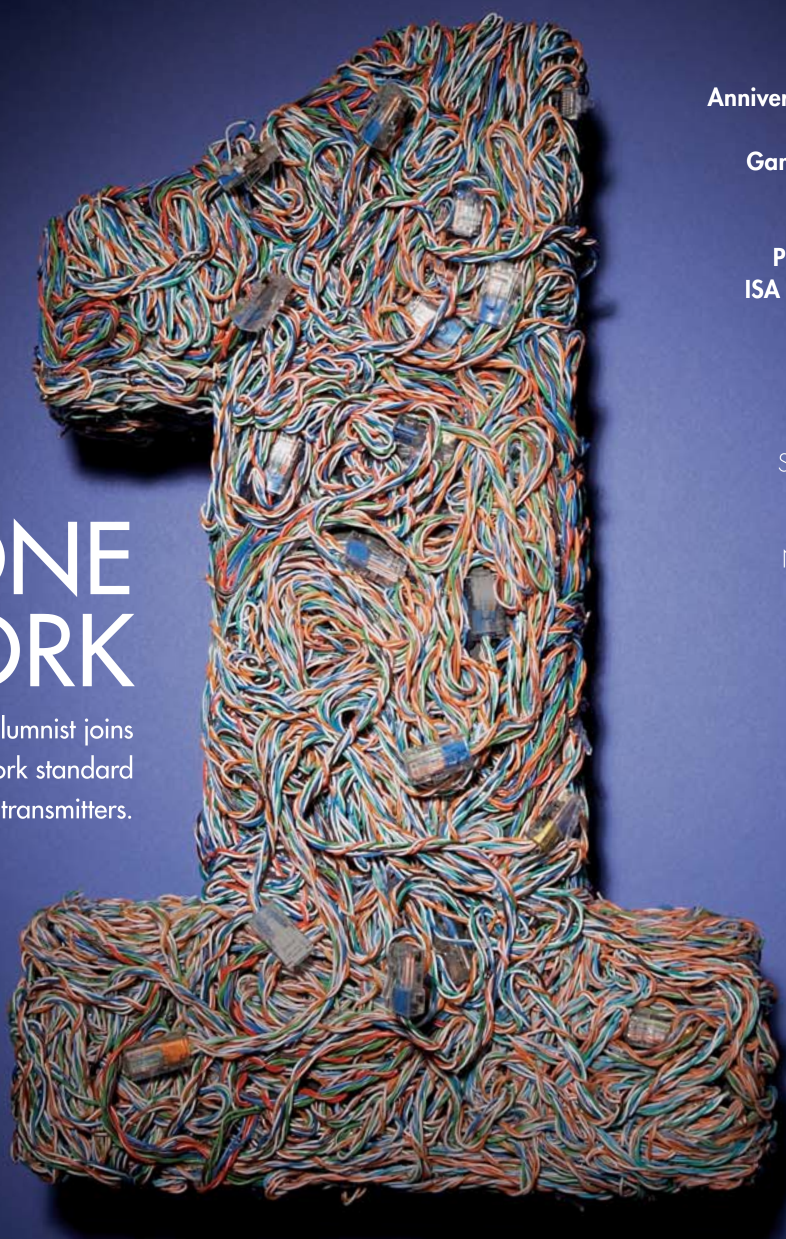
Andrew Bond's News from Europe



THE ONE NETWORK

Our intrepid 'On the Bus' columnist joins the search for the single network standard for digitally integrated transmitters.

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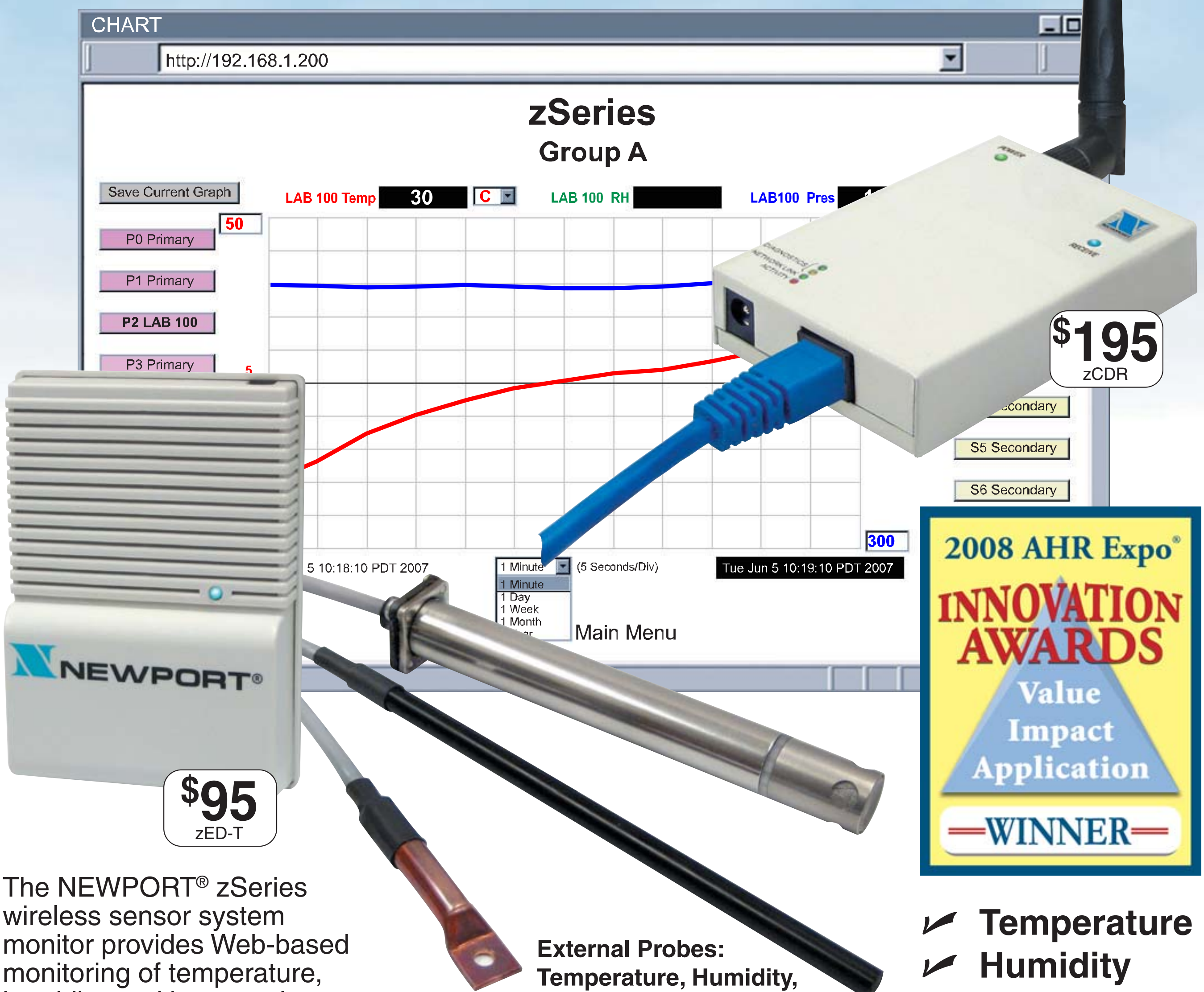

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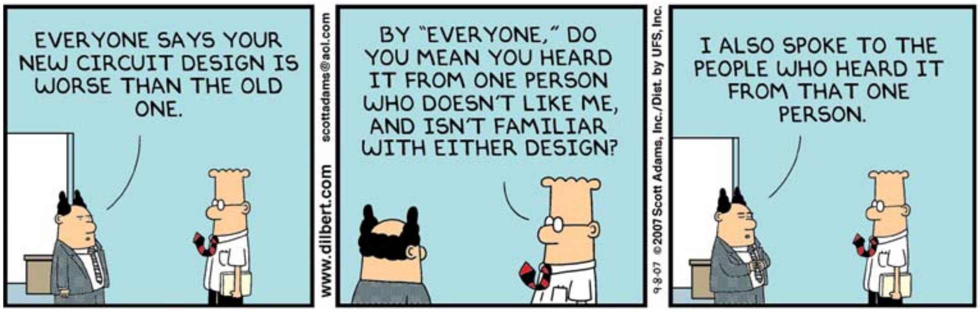

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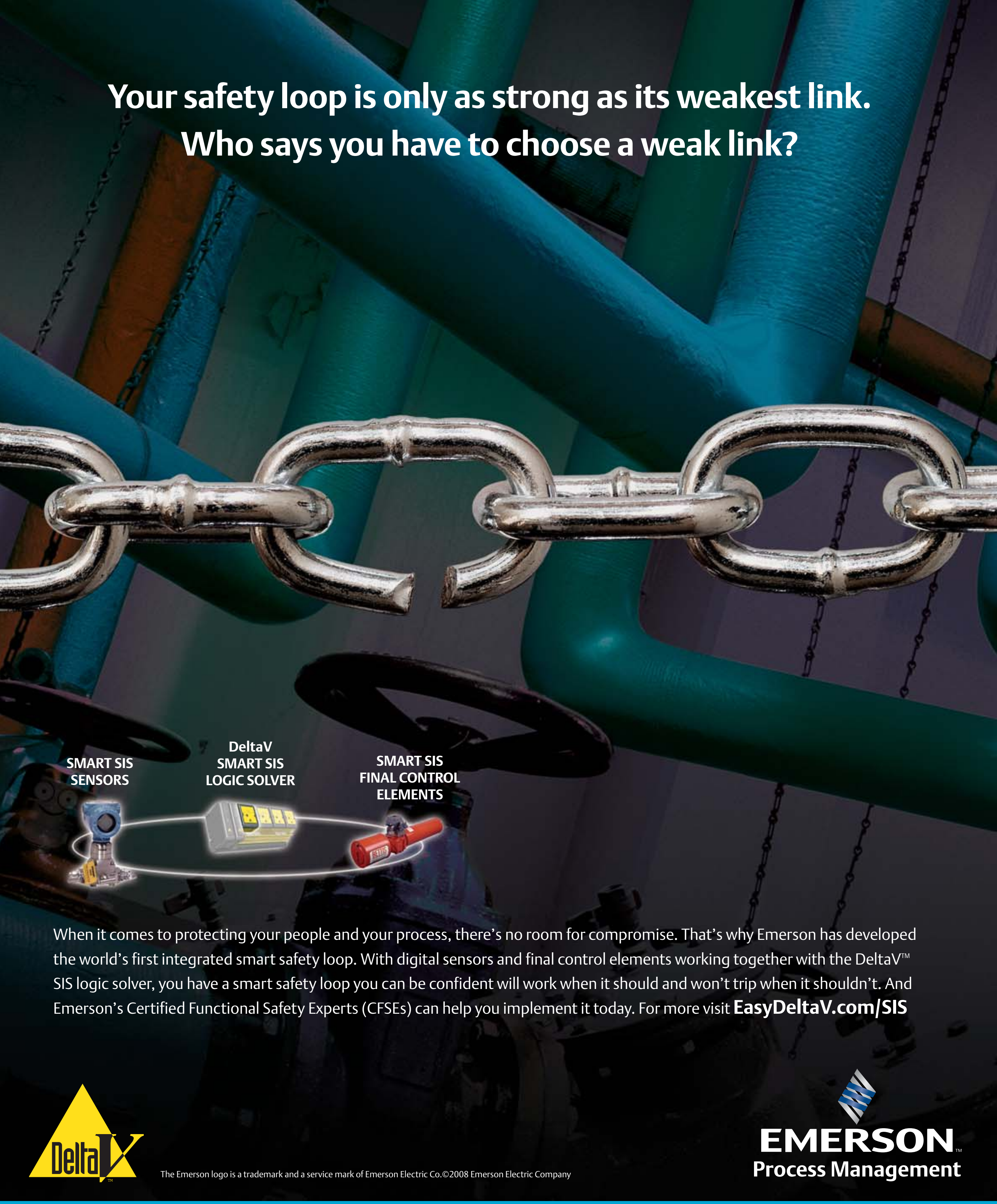
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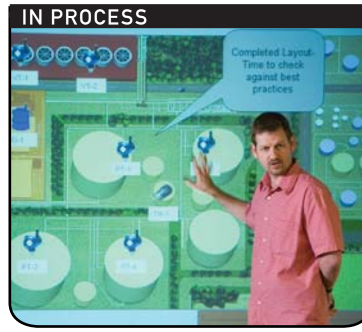
October 2008 • Volume XXI • Number 10

CONTENTS

DEPARTMENTS

IN PROCESS



FIELD TEST

Users tell all about using MTS Sensors' Level Plus transmitters in the field.

WEB EXCLUSIVES

Andrew Bond covers processing in Europe
www.controlglobal.com/bond.html

Jeff Harrow talks innovation
www.controlglobal.com/harrow.html

CIRCULATION AUDITED JUNE/2007

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Food & Kindred Products	15,336	Stone, Clay, Glass & Concrete products	2,340
Paper & Allied Products	4,077	Textile Mill Products	1,782
Primary Metal Industries	5,160	Petroleum Refining & Related Industries	2,890
Electric, Gas & Sanitary Services	2,323	Tobacco Products	149
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RS-485, MODBUS RTU/ASCII	Yes	Yes	Yes	Yes
Two Separate Event Inputs	No	No	Yes	Yes
Dual Outputs for heat & cooling	Yes	Yes	Yes	Yes
Available Alarms Groups	1	3	3	3
Auto tuning Capability	Yes	Yes	Yes	Yes
Universal Inputs (T/C, RTD, mV & mA)	Yes	Yes	Yes	Yes

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ISA100.11a: Half Baked to a Schedule

WALT BOYES
EDITOR IN CHIEF
wboyes@putman.net

When you are baking bread, and it isn't done when the timer goes off, you leave it in the oven 'til it is. ● The same thing happens with standards, through the comment and review process. For example, ISA99 just released for ballot Part 2 of the ISA99 standard, nearly a year after the last set of comments was provided for review. That's a good time frame for a complex standard, what with the many comments that have to be integrated into the document in a consensus framework. It takes time, and the process cannot be hurried, just like you can't hurry baking bread.

The first draft of the ISA100.11a standard ballot closed on June 2. There was a very close vote in favor, since the committee rules say you can vote "Yes, with comments." Most standards bodies do not allow that kind of vote. Technical comments mean that the standard is not quite done and needs to go back into the oven for more baking. You are supposed to vote "No, with comments."

2,075 comments were received. A revised draft was published for internal comment and review by the committee late in the evening of Sept. 10.

I find it difficult to imagine that the editorial group could possibly have integrated and responded to 2075 comments in just a little more than 90 calendar days. I have just barely had time to completely review the new draft, which is 725 pages long. By comparison, Eric Cosman, co-chair of ISA99 noted, "In the case of ISA99 Part 1 (a document of just under 100 pages), the standard went through four drafts, each consisting of multiple edits...All told, the document was revised and reissued over 20 times over a period of three years, with only three of these revisions going to full committee vote. The first vote was in early 2006, and the standard was approved in late 2007."

Yet on Sept.12, ISA released the "revised" standard for a second, and potentially final, ballot. Why on earth would they do that? The ballot ends on Oct. 11, just in time for ISA to announce an "approved ISA100.11a standard" at the ISA Expo, which begins on Oct. 14.

Recently, a Formal Appeal was made over inconsistencies in the way previous votes were handled. The Appeal Board found that the inconsistencies had in fact taken place, and ruled that no votes should be taken until the Standards and Practices Board voted on its new rules. That vote was taken on Sept. 9.

"The change in procedures that has the most immediate impact on ISA100," as the ISA100 co-chairs note in the new ballot itself, "calls for a roster of voting members to be established for any committee subgroup (such as a subcommittee or working group) that will conduct ballots on documents. The main committee must approve the subgroup roster of voting members."

The ISA100 co-chairs go on, "The immediate impact on our committee is that while WG3 had planned to issue the draft for another round of voting within the working group, to do so under these new procedures would add at least a one-month wait to approve the roster of the working group, taking the ballot beyond our meetings of Oct. 14-17 at ISA Expo in Houston."

And this would of course eliminate the ability of ISA to announce an "approved standard" in Houston in October.

So, despite the fact that the new draft is 750-odd pages long, and despite the fact that even the editors felt they were just circulating a draft for comment unofficially, ISA has declared the bread loaf baked.

It isn't enough to write a standard that excludes WirelessHART. There must be a standard, any standard, whether it works or not. If that's what we do, shame on us. ■

There must be a standard, any standard, whether it works or not. If that's what we do, shame on us.

KATHERINE BONFANTE
MANAGING EDITOR, DIGITAL MEDIA
kbonfante@putman.net

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Over the past years, *Control* has grown from a print-only publication to a print-and-Web publication. Now we have refined our Web approach and moved our multimedia resources to center stage.

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Are you watching us? You should be, because if you haven't checked out our multimedia resources, you are missing out on valuable and in-depth process automation technology information.

We have created pages where you can find all this information, such as our *Control*/ARC Podcast Series (ⓘ www.controlglobal.com/extras/ARC_Control_Podcasts.html). Here you can listen to audio interviews with some of the biggest names in the industry. On our Exclusive Video Page (ⓘ www.controlglobal.com/extras/exclusivevideos.html), we have Back to the Basics, Market Intelligence Reports and FutureCast videos, where our editors revisit the basics of automation, report on market research and make video-based prognostications.

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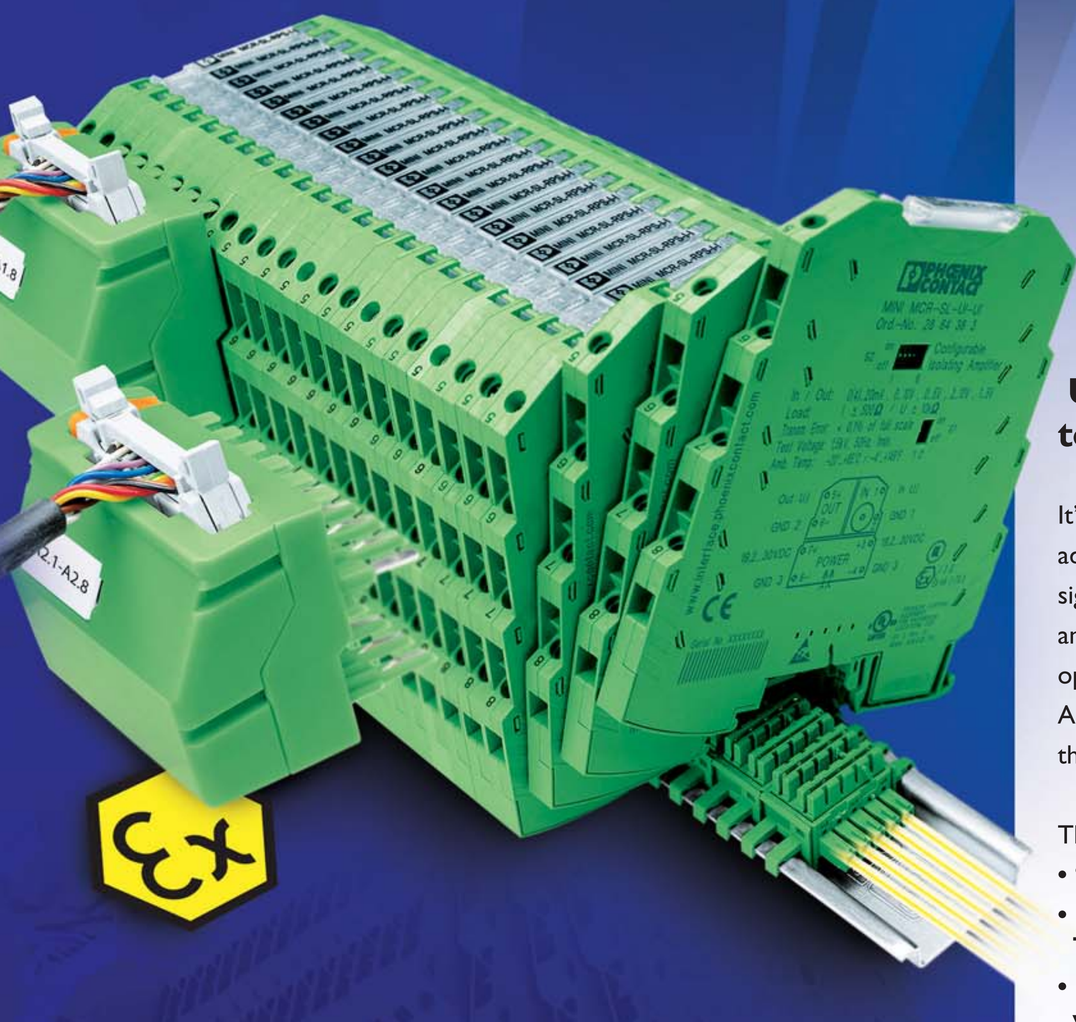
Mr. T-BUS says, "Don't be a fool"



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Documenting Wireless

I read your article about wireless transmitter with great interest. I agree the wireless systems are coming, but your article also brought up the subject of documenting the wireless objects.

I am the leader of the expert group that maintain the NORSOK standard I-005 System Control diagram. We also discuss these days how to visualise this, and any conclusion within ISA would be very interesting for us.

This SCD standard was born back in the early 1990s as a consequence of not wanting to fill the P&IDs with instrument application software details.

Now this method is widely used in the Norwegian offshore sector, and we are discussing how the expand it to document even distributed control functions, such as Fieldbus Foundation, how to indicate SIL requirements, different communication to field sensors such as wireless, context-based alarm suppression and other aspect of control functions.

The standard has of two parts. The first defines a set of extended functions blocks to which now all the major suppliers in Norway comply.

The second part is the diagram, which looks like a process-flow diagram where the control application logic is included.

We discuss the visualisation of the wireless communication onto the diagrams because it should be considered designing the control application. An open question for us at the moment: Can it be trusted as can a conventional wired transmitter with regards to response and accuracy?

The standard is free for download and available at www.standard.no/imaker.exe?id=10045

See also www.standard.no/tmp/petroleum/Petroleum_ONS2006incl_speach.pps.zip.

IDAR PE INGEBRIGTSEN
ipi@statoilhydro.com

Teaching the Kids

I read your recent comments about engineering curriculum in schools with great interest. (August 2008, pg. 15) After 15 years as an applications engineer, I decided to eliminate some stress in my life and move into sales management. I still have good relations with my former employer and watched as they spent over a year trying to find a qualified replacement. At least in this part of the country, an experienced automation engineer is very hard to find.

But there is help on the horizon, and I hope my daughter will be part of the solution. She is in seventh grade and enrolled in a magnet school that is offering Project Lead The Way to select students. Project Lead The Way (www.pltw.org) is a program that "makes math and science relevant for students. By engaging in hands-on, real-world projects, students understand how the skills they are learning in the classroom can be applied in everyday life." (www.pltw.org/curriculum-philosophy/curriculum-philosophy.cfm) At her particular school, the topics for this year will include CAD/CAM, automation and robotics, among other topics.

I hope that PLTW, along with other programs such as STEM, will rekindle an interest into the exciting field of engineering and ensure that our future is in good hands.

My daughter's school is Hanes Middle School in Winston Salem, N.C. (www.hanesms.org.) Their site is a little difficult to navigate, so here are some relevant links:

Teacher's Page:

http://wsfcs.k12.nc.us/education/staff/staff.php?sectionid=7470&sc_id=1216741244.

Information about the Engineering Magnet Program :

www.hanesmiddleschool.org/magnet/magnet_gallery.htm.

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What's Interoperability and Why Is It Important?

There are many evolving industrial information models based on national, international, and industrial interoperability standards. The object models and XML schemas based on these standards are generally freely available and applied widely; however, there is currently no compliance certification agency verifying vendor software or end users' specifications and applications as compliant with the definitions. With the help of many others, I am currently forming the Industrial Interoperability Compliance Institute (IICI) to provide certification services to fill this large market need. The IICI is part of the Automation Standards Compliance Institute (ASCI), a not-for-profit company affiliated with ISA. Late in 2007, we formed a 12-company Technical Advisory Board with input from the OPC Foundation and the WBF to produce a business plan and membership prospectus, which was released at the WBF Conference in March of this year. Since that time, we have been signing up founding members who understand the rewards and risks.

I am not kidding myself or anyone that getting such an organization off the ground will be easy. It will require real market and cultural change in the form of vendors, integrators, end users and government working together to grow the global economy through configurable adaptive manufacturing.

> Getting such an organization off the ground will require change in the form of vendors, integrators, end users and government working together.

The IICI is a developing industry consortium that establishes an ISA interoperability designation to identify and promote interoperability standards and compliant products and systems. The IICI vision ensures interoperability between enterprise, supply chain and plant operations systems. The IICI members and contributors believe industrial interoperability standards allow manufacturers to build Lean operations IT systems through common definitions of data and processes.

It must be understood that information models, processes and their associated transaction are not 100% interoperable cross-plant and plant-to-enterprise. Even a 50% to 70% match enables a very high degree of adaptability and throughput.

To accelerate membership growth, the ASCI has retained WBF experts to develop the first IICI product—the Business to Manufacturing Markup Language (B2MML) Compliance Program. The B2MML Compliance Program will be released in 2009 and will cover the integration of business and manufacturing systems, following the ISA95 data exchange and transaction definitions using the WBF's B2MML Data Exchange Schema standard.

The B2MML and the other evolving MOM standards are the foundation for Lean operations IT systems because they establish common "standard work" definitions of data, operations processes and associated transaction across all plants. I believe that only through the use of such definitions can companies create the adaptive interoperability needed to support configurable manufacturing operations and their necessary configurable business processes, interfaces, reports and metrics. Twenty-first century global markets require this manufacturing form to be successful.

I have talked to over 150 end-user, vendor and system integrator companies. Many of them are among the top 100 global manufacturers. Yet some simply do not understand that they are paying unnecessarily large amounts of money for custom interfaces and reports and dissimilar, disparate systems.

Some management teams tell me that they view the IICI as a vendor-driven organization. Their belief that compliance is just a vendor task is frankly wrong and works against their own business interests. Without a standards-based information model containing transactions to represent their standard business processes, their businesses have to create and maintain custom, monolithic transaction models to interface with their suppliers, customers and plants across


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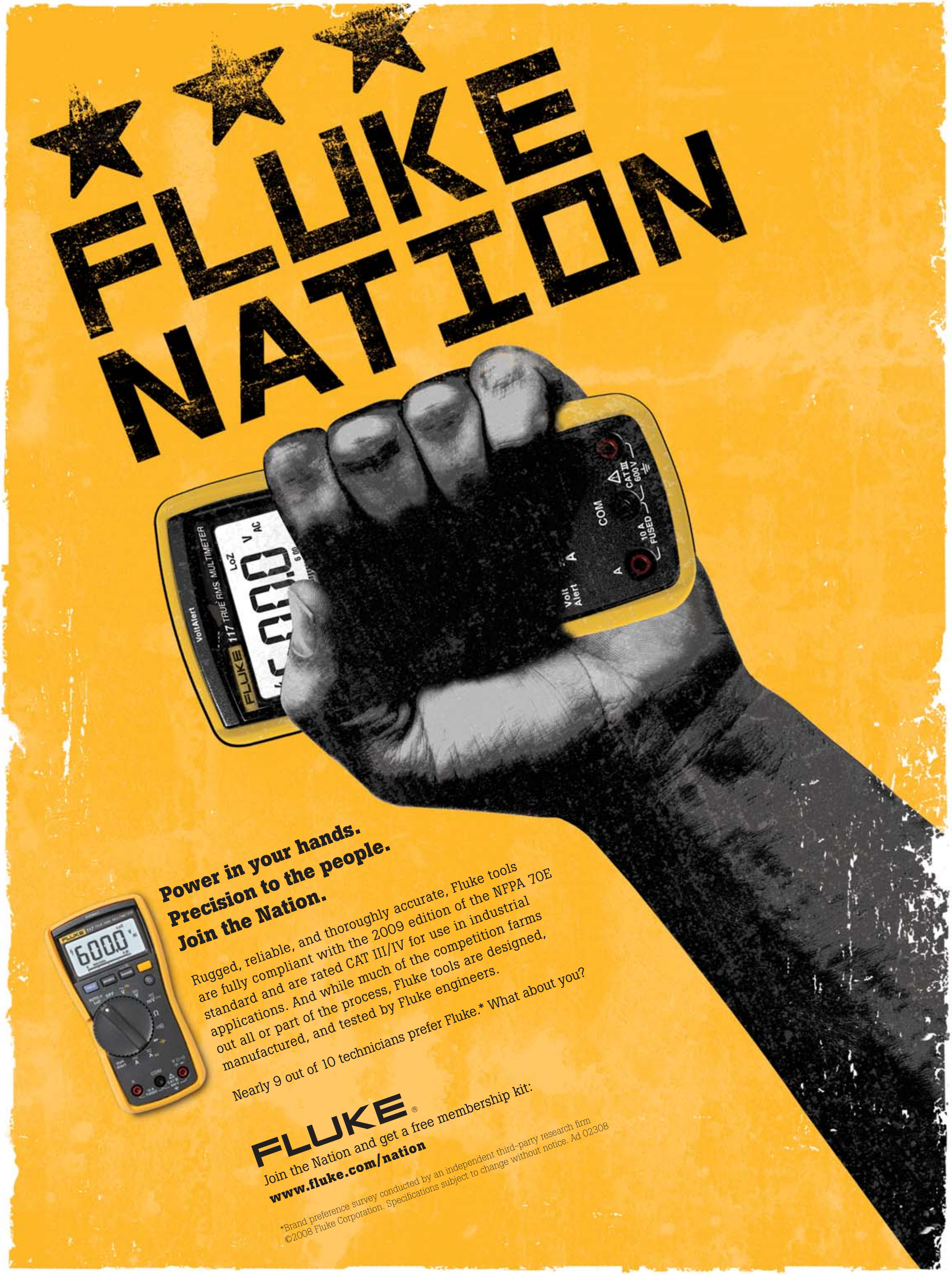
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their ever-expanding supply chains. End-user companies are simply not allowing their manufacturing and supply chain systems to strategically enable their business to be adaptive and configurable to market change. Consequently, their competiveness and profit are directly affected.

The current approach to integrated systems seriously constrains business and does not enable Lean practices or global market growth. Current business models do not flex to change rapidly enough to provide the market advantage required or desired.

The compliance favored by IICI is not a vendor task. In fact, it is quite the opposite. In doing over $25 million in MOM systems worldwide, I have witnessed that the highest life-cycle cost for integrated manufacturing systems is the custom interfaces, reports and analytics. For manufacturers' IT costs to go down and their competitive market response to increase, they must be leaders in this IICI effort.

As companies transform their linear, primarily continental supply chains to globally distributed supply networks and exchanges, they see that their IT infrastructure must change. Designing these new systems based on standards-based, service-oriented architectures (SOA) begins by designing the business process for the current and evolving markets in a business process management (BPM) system. Then design systems and interfaces to support end-to-end business processes, not department-focused systems based on individual information models.

> i For ISO definitions of integration and interoperability and more on ICII, go to www.controlglobal.com/ICII.html.

We have been developing manufacturing operations standards for over 15 years, but with little cross-industry and no government coordination. We ALL need coordination to move forward the global economy forward. Manufacturing companies led by government organizations such as the National Institute of Standards and Technology (NIST) need to map out the standard business and operations processes and the associated transactions that use the OPEN Operations and Maintenance Standards (ISA88, ISA95, ISA99, OPC, MIMOSA, OMAC and OAGIS) as the single information model for data definition and hierarchy. The current available solutions simply cost too much for the 250,000 North American small manufacturers below $500,000 in size.These companies survival in the global market depend on driving towards a common manufacturing language. ■


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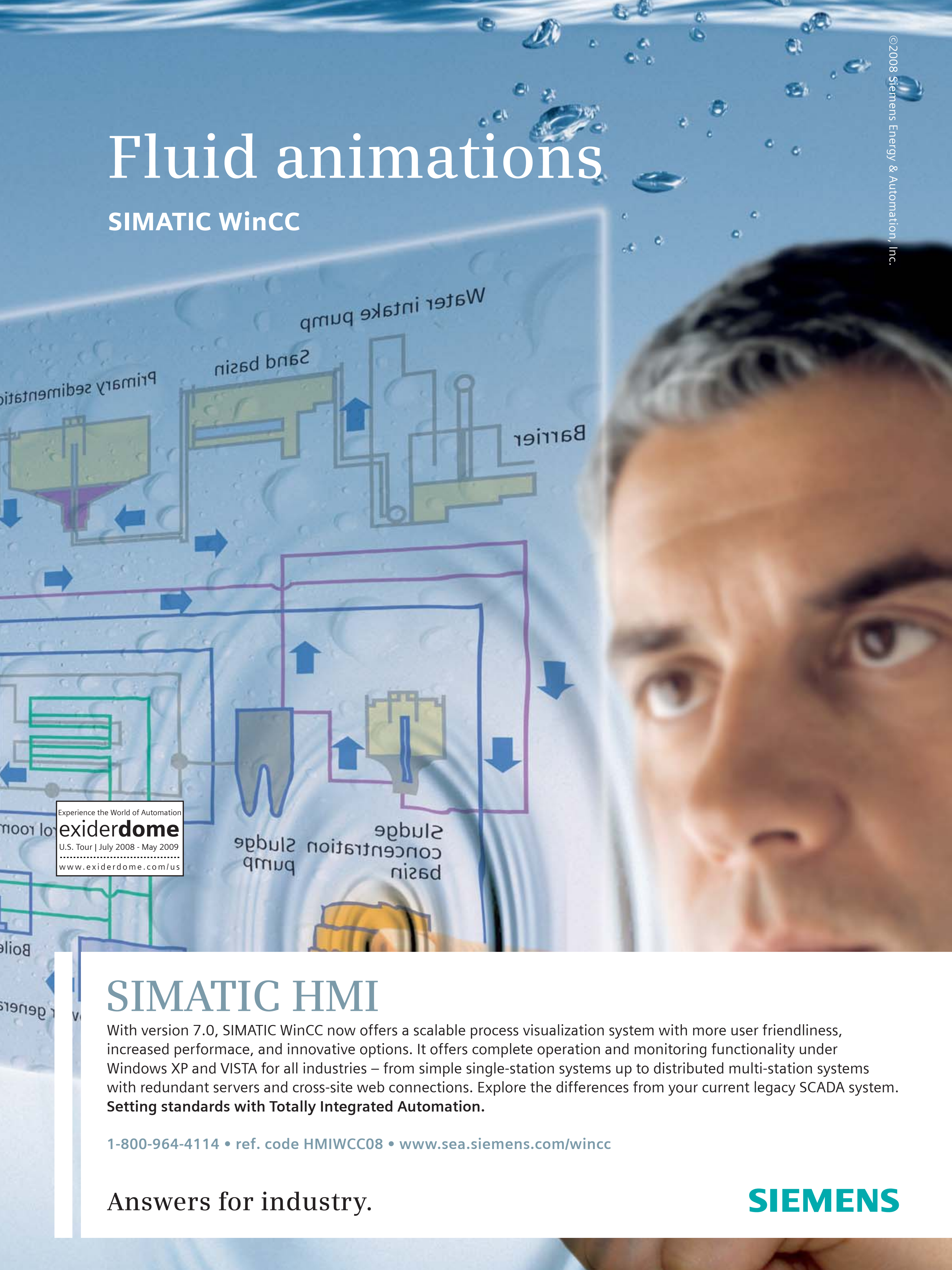
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Using Fieldbus in your HMI

JOHN REZABEK
CONTRIBUTING EDITOR
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Fieldbus brings an enormous amount of new information into the host system. Most of the time, we think in terms of its usefulness in asset (I&C) management and instrument/device diagnostics. But some of the new information available through digitally integrated field devices is useful to your operators who are managing the process 24/7.

It is important to have an idea of what variables those might be before embarking on a large project. What comes "canned" from your systems vendor or HMI supplier may be too much of "all things for all people." For example, the stock faceplate for my DCS layers the same piece of data a half-dozen times, each with the decimal point in a different place, and turns on visibility based on the "decimal point" attribute of that piece of data. We chose to do without that query (where's the decimal point?) entirely, and show all PID outputs to one significant figure (xxx.x). This saves a little processing time and allows us to choose a more interesting piece of data to bring in.

One piece of data your operators are almost sure to like, is the "readback" value of a control valve's AO block. This represents the actual position of the valve stem (0%-100%, to as many decimal places as you like) as seen by the valve's smart positioner. We show this value for every fieldbus or HART-capable control valve in the plant.

We show the "requested" position (the output of the PID block) as well as the "actual" position on controller faceplates. This makes it easy for operators to spot a sticky or sluggish valve or overzealous positioner tuning. Many times, an operator wants to make fine adjustments, and this "readback" signal lets her see if a move of a few tenths of a percent actually translates to valve steam movement.

You can use the option "Use PV for BKCAL_OUT" in Foundation fieldbus AO blocks, which makes the sensed stem position a "published" or deterministic variable.

Every Foundation fieldbus function block and transducer block has a "mode," which must be set correctly for a loop or even an indication to function, and every block mode has an attributes "target" (where someone/something asked the block to be) as well as an "actual" (the mode it's "actually" in). If all is well, blocks go to their target mode within a scan.

In most transducer blocks, the "manual" or out-of-service mode will result in the associated function block going to "IMAN" or "Initialization Manual." In the case of an input, this might cause its AI (analog input) to stay in "OOS" or out-of-service, and the PID function block to be stuck in manual. An output block or "AO" mode of anything but "cascade" will cause its upstream PID also to go to "IMAN." For this reason, we equip fieldbus controller faceplates with an alert that says, "check target mode" whenever the "actual" mode is stuck somewhere other than the "target" set by the operator.

It may not take much effort to set up one's subpictures to display the main categories of "uncertain" and "bad." We do this for variables coming from FF devices and default to a "blank" status indication if the measurement status is "good." There is a great deal of "granularity" in the status message, and distilling that information can be worthwhile. For example, some transmitters set the measurement status to a specific "uncertain" status if they have detected a plugged impulse line.

Finally, some innovative end users have figured out how to depict all their fieldbus segments on HMI graphics, and display some of the key measurements (e.g., case temperature) and communication statistics in real time. In this way, they have done away with "paper" loop diagrams. The graphics are useful to the instrument tech who can easily see what other devices are on a given segment, or to operators when they have concerns about the "health" of a segment.

Email me if you've found some cool and useful fieldbus data to help your operators. ■

Some users can depict their fieldbus segments on HMI graphics and display key measurements in real time.

Emerson's Newest DeltaV

Control's editors get a sneak peak at DeltaV version 10.3's incremental upgrades and XP SP3 and Vista readiness.

"A step change in value may be achieved if it is readily recognizable, it is easily shared, there is no extra work to get the value, behavioral changes to get the value are trivial, there is little risk, and the price point is right."

With those words, Duncan Schleiss, vice president for systems at Emerson Process Management introduced *Control*'s Walt Boyes and Keith Larson to a sneak peek at the new DeltaV version 10.3…and beyond.

Schleiss and his team of presenters began by introducing Boyes and Larson to "Homer," "Gunther" and "Ian." These fictional users are the results of a detailed study Emerson has done to define who the users of DeltaV are, what they do and what they want DeltaV to become. Homer, for example, is an operator, who keeps the plant running, manages upsets and is not very motivated to change anything. His buddy Gunther, also an operator, is very motivated to improve production. Ian, an instrument technician, operates under direction, installs, configures, troubleshoots and replaces devices and is familiar with the plant and specific devices. Emerson's "stakeholder map" includes 19 or 20 such composite characters, including one sort of yellow, bald-headed guy also named Homer.

Make It Easy, DeltaV

Emerson believes that this research will enable the company to improve the structure and features of DeltaV for future generations. Developers have begun to apply some of the results of this research in the design of new features for DeltaV. "We are big proponents making it easy for the instrument technicians," Schleiss said.

DeltaV version 10.3 is not the huge makeover of DeltaV that industry pundits have been calling "DeltaX." That, whatever form it takes, is still some distance away. But with past versions of DeltaV, version 10.3 contains some major new features and advances over previous versions. DeltaV version 10.3 is designed to take advantage of both WindowsXP SP3 (just released) and Windows Vista SP1.

Emerson's Terry Blevins shows Control's Walt Boyes (center) and Keith Larson some of the ins and outs of DeltaV version 10.3.

Keith Bellville and Randy Balentine, product marketing managers, described the ways DeltaV 10.3 has been improved with easy configuration tools.

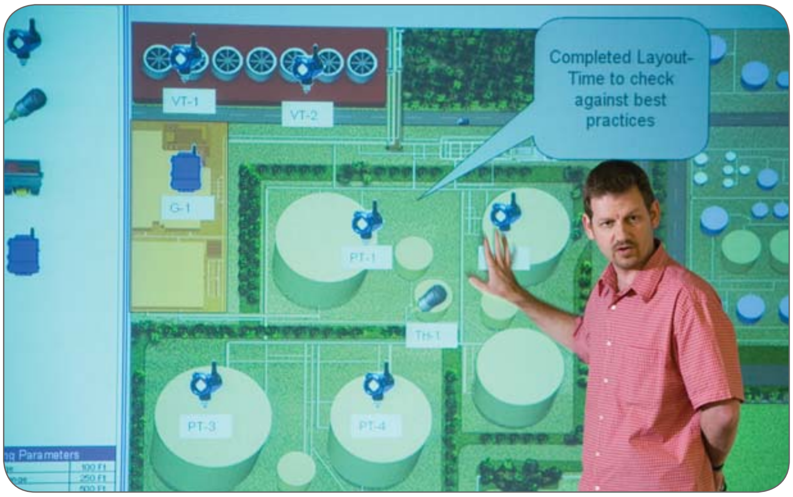
The first steps are a simple, intuitive DeltaV-to-Intergraph SmartPlant Instrumentation (SPI) database interface, new ease-of-use in DeltaV Foundation fieldbus (FF) tools and a wholesale transition of DeltaV engineering tools to a fluent, task-based, human-centered design.

"This will increase engineering efficiency and performance," says Balentine. Data exchange between SPI and DeltaV is bidirectional, and data published from SPI creates and configures all these items inside the DeltaV system. Data created and published in DeltaV populates the SPI database automatically.

DeltaV Plant Explorer has been redesigned with a new user interface and for speed. DeltaV Control Studio, Recipe Studio, Expression Editor and Graphics Studio have also been redesigned with the same kind of "ribbon toolbar" made popular by Microsoft Office 2007. DeltaV Diagnostics provides new automated processes for FF device commissioning and replacement.

"FF-specific knowledge is not required," Bellville said. "This is device replacement with a wrench!"

"We are leading the way in easy-to-use software," Balentine said. "We're not focused on adding more features. We're focused on delivering ease-of-



Emerson's AMS now includes a snap-on that helps users design WirelessHART networks and provides operating health information information in real time.

use and value with less effort and on operations and delivering optimal results quicker, with less risk and maximum security."

DeltaV Cybersecurity in Version 10.3

Bob Huba, Emerson's cybersecurity guru and DeltaV product manager, introduced what he referred to as "security in the age of COTS (commercial off-the-shelf) devices." According to Huba, security has been integrated into this version of DeltaV. "Network and security devices become DeltaV devices," he said. There is also is easy configuration by DeltaV administrators. Security alerts and diagnostics are integrated into DeltaV and appear as would any other process alarms and alerts.

"We've also provided a controller firewall," Huba said, referring to the device Emerson private-labels from Innominate. The major challenge, he noted, was maintaining the traditional DCS openness in the age of enterprise integration. DeltaV has a new SOA (services-oriented architecture) based on the ISA95 data model, with secure Web services. "Every service has its own port," Huba said, cracking, "We're not just opening up Port 80."

Emerson is producing its own line of network switches with patented features only available from Emerson, including "one-click port lockdown." These smart switches are purpose-built for process control, Huba said. Emerson is also doing security testing with its own Achilles box in its own internal test lab.

DeltaV version 10.3 includes hardened workstations with more secure user access, and two-factor authentication.

Emerson's SureService program manager, Kim Van Camp, introduced the new "Guardian support service." This subscription-based service is essential for cybersecurity with DeltaV. Guardian sends patches to the server in the plant DMZ, and files are pulled down by the DeltaV node. DeltaV distributes updates using WSUS and systematic application.

DeltaV Safety in Version 10.3

"With over 11.5 million hours in

operation," says Mike Boudreaux, Emerson's DeltaV SIS product manager, "there have been no incidents to report." Boudreaux went on to say that the largest installed DeltaV SIS system has 2,000 points, and the largest system in progress of installation has 3,000.

Version 10.3 extends the PlantWeb architecture to SIS and enables advanced function blocks for both SIS and non-SIS controllers. In keeping with the new emphasis on security in version 10.3, secure communications have been provided between logic solvers and the new version doubles the bandwidth between logic solvers.

Boudreaux also announced the availability for DeltaV SIS in version 10.3 of DeltaV Simulate.

DeltaV Batch

Dawn Marruchella, batch product marketing manager, claimed "batch leadership" for DeltaV and noted that the new version of Batch Product Manager should really be called Agile Manufacturing Product Manager. She noted that ever since version 8.0, DeltaV has had a robust batch executive, and that in version 10, Emerson introduced a single environment for batch operations.

New features in version 10.3 include a bigger, faster "MX" batch controller, with 2.5 to 3 times the performance and twice the memory. There's a new historian, too, but Marruchella firmly proclaimed support for Emerson's version of the embedded PI historian and noted that with version 10.3 Enterprise PI can be installed on a DeltaV application station. The new historian, she noted, "is designed for non-DeltaV users."

Batch campaign management and recipe exchange are also enabled, as well as support for OPC XML-DA.

Emerson's acquisition of DMI last year has borne fruit in version 10.3 as well. Product manager Bob Lenich showed *Control*'s editors DeltaV Compliance Suite, which, he says, "closes the loop in batch manufacturing." Compliance Suite is an SOA- and .NET-compliant application designed to work in ISA95 levels 1, 2 and 3.

All This and Wireless Too

DeltaV version 10.3 includes native support for WirelessHART instrumentation and gateways. Emerson's AMS asset management system will include a new wireless snap-on that allows users to design their networks graphically, and then monitor network health directly in AMS. DeltaV 10.3 includes full support for Cisco/Smart Wireless applications as well, including a nifty implementation of the new Panasonic U1 wireless palm-held computer as a complete DeltaV workstation.

DeltaV version 10.3 was introduced at Emerson Exchange 2008 last month.

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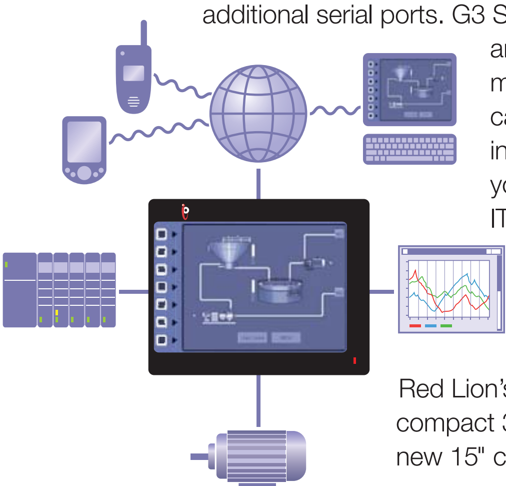

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New Direction, Structure at Invensys Process Systems

On the occasion of the 2008 Invensys Process Systems (IPS) Client Conference, held in early September in Dallas, IPS CEO Paulett Eberhart outlined the company's ongoing transformation from "a company of siloed brands to an integrated solutions company."

Since Eberhart took the reins last year, the company has undertaken an ambitious reorganization to build a single sales, delivery and consulting organization from what were once seven different sales and five different delivery entities "with essentially no focus on consulting," Eberhart said. The company's venerable process automation brands, including Foxboro (which this year marks its 100th anniversary), Triconex, SimSci-Esscor and Avantis, will persist, not as separate companies, but as brands within a broad portfolio of products, services and solutions. "IPS is the glue that brings all that technology together into one solution," Eberhart explained.

Eberhart further confirmed that the company's new focus on consulting and services is intended to build on, not replace, its strong technology heritage. "We'll continue to invest in our products. We have the ability to invest, and we will," she said.

Meanwhile, the company's Global Consulting group has grown to more than 400 industry experts since its formation a year ago, Eberhart reported. "By uniting and delivering thought leadership, cutting-edge technology and innovative solutions, our global consultants are helping clients discover hidden potential in their production assets," Eberhart said. "Working with our clients, we have helped them reduce energy and supply chain costs, manage safety and regulatory constraints and realize improvement in operating efficiency—all to the benefit of their customers, shareholders and employees."

"The conversation is now about business performance," added Steve Blair, president of IPS in North America, in his comments to the 575 end-user delegates from more than 170 companies attending the IPS Client Conference. "It's not about what we have to offer, but what do you need?"

UMass Lowell Opens New BioManufacturing Pilot Plant

UMass Lowell in Lowell, Mass., has opened a fully automated biomanufacturing pilot plant made possible through equipment and services donated to the university by three main corporate partners: Invensys Process Systems (IPS), Wyeth Biotech and Dakota Systems. Equipment to be donated by Millipore will be used in an adjoining lab that works in tandem with the pilot plant. Together, the four companies' contributions are worth $600,000, UMass Lowell officials said.

The new pilot plant and lab will help Massachusetts biomanufacturing companies bring new biopharmaceuticals closer to commercial production.

"This pilot lab is a great example of how the university, state and private corporations can partner to advance technology, expose students to the latest industry trends and bring ideas to market quicker," said UMass Lowell Chancellor Marty Meehan. "Biotechnology is an important driver of the state's economy, and this partnership addresses several critical challenges facing the industry. We thank IPS, Wyeth, Dakota and Millipore for their generous donations."

IPS, a global technology, software and consulting firm, has installed its InFusion Enterprise Control System on a bioreactor donated by Wyeth. Dakota Systems and 12 of its suppliers donated a wide range of services, including fabrication of the frame, integration of the control panel, the orbital welding all of the piping, installation of all electrical devices and instrumentation and completion of cGMP functionality testing.

The automation element of the plant is exciting, according to Prof. Carl Lawton, director of the Massachusetts BioManufacturing Center at UMass Lowell. "The biotechnology companies that use this plant, and, just as importantly, students who train there, will learn about process automation and optimization using the latest technology," said Lawton. "Our students will graduate with advanced knowledge that they can use immediately."

The Massachusetts BioManufacturing Center at UMass Lowell is an interdisciplinary research, development and education center that assists biotechnology companies in developing procedures leading to industry-compliant manufacturing processes. Through education, applied research and process development, the center offers solutions that improve productivity, quality and cost of biomanufacturing operations.

Millipore Corporation, a Billerica-based life science company which provides technologies, tools and services for bioscience research and biopharmaceutical manufacturing, will donate up to $200,000 in equipment and services to the adjacent process development lab. The Millipore Corporation Process Development Laboratory will be used for downstream purification and training for students and industrial professionals.

Kevin Roach to Leave Rockwell Software

Kevin Roach, VP/GM of Rockwell Software, has accepted a position as executive vice president with Activant Solutions Inc., a private-equity funded software company that is in a

different industry from Rockwell Automation. As of September 26, Brian Van Horn, director of finance, took on the VP/GM position on an interim basis until a long-term replacement is named.

"It is our intent to identify a successor quickly, and we have already begun the process to move forward," said Steve Eisenbrown, senior vice president, Rockwell Automation Architecture & Software. "We are committed to identifying a successor who will stay the course in terms of the current vision and strategy. The Information Solutions business will continue to be a key part of our growth strategy," Eisenbrown emphasized.

Iconics and OPCTI Collaborate on OPC Training

Iconics is collaborating with the OPC Training Institute (OPCTI), headquartered in Alberta, Canada, in its OPC training courses.

OPCTI is the largest OPC training company in the world, offering hands-on classes both in person and online. OPCTI is an active member and strong supporter of the OPC Foundation (www.opcfoundation.org) and counts Iconics among its industry partners and uses Iconics solutions as part of its training offerings.

Iconics' OPC-integrated solutions feature key technologies such as OPC tunneling—connecting any remote OPC server to a client in a robust manner, allowing for real-time data to be redirected to more than one location.

Chinese Demand for Industrial Valves Balloons

Demand for industrial valves in China will rise 11.5% per year through 2011 to 79 billion yuan, predict analysts at The Freedonia Group, a Cleveland-based research firm. Driving this demand are rapid growth in process manufacturing, public utilities construction and general construction activity overall, as China continues its process of industrialization and urbanization.

China is a net importer of industrial valve products, with a trade deficit of 950 million yuan, and gross imports representing 30% of demand in 2006, reflecting high domestic demand and the relatively low standards of valve manufacturing technology in China. These and other trends are presented in Freedonia's report, "Industrial Valves in China."

Demand for standard valves will continue to account for the larger share of total sales, exceeding 50 billion yuan in 2011, reflecting their widespread application in Chinese industrial processes. However, advances will be faster in the automatic valve segment, where annual sales growth of 12.5% will be driven by a shift from manual to automated processes in key manufacturing and utilities construction markets.

Steel and steel alloys will remain the dominant valve materials, benefiting from their durability, versatility and good performance in high temperature and stress applications.

Original equipment demand comprised over three-fifths of the total Chinese valve market in 2006, and will be supported by a positive outlook for gross fixed capital formation.

The process manufacturing industries (particularly chemical production and petroleum refining) and public utilities (especially electric power generation) will continue to be the leading markets for industrial valves. The process manufacturing market is projected to see the fastest gains through 2011, rising 12.6% annually to over 34 billion yuan. Gains will be stimulated by substantial growth in chemical, refined petroleum, and pulp and paper output. The public utilities market will experience average growth, with valve demand reaching 27.3 billion yuan in 2011. Advances will be driven by the expansion in electric power generation as China continues to industrialize.

Get Out the Process Control Vote

JIM MONTAGUE
EXECUTIVE EDITOR
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It really can be hard to see the forest for the trees—or the alarms among the pretty HMI display colors. Logically, most of the engineers, system integrators, manufacturers, scientists and physicians that I've interviewed in recent years focus on highly specialized applications and disciplines. Most technical and scientific fields seem to push for answers to always narrower questions, whether it's process engineers programming PLCs and configuring networks for ever-closer to real-time performance or hyper-specialized medical researchers examining CAT, PET or other scans for ever-teenier physiological problems and possible cures. God or the devil is in the details. I can't remember which.

Unfortunately, when many technical professionals leave their plants, hospitals or academic institutions, they also shelve much of the intellectual inquisitiveness and rigor demanded by their jobs. Sure, it's nice to mentally vegetate a bit, and mowing the lawn and washing the car don't require technical know-how. Family members, non-work friends and neighbors usually don't want to hear most workplace stories anyway.

Culture and politics and religion all demand severe levels of conformity for membership and certainly for any leadership roles. Like smart kids trying not to appear too smart in school, many technical professionals try to go with the flow and fit in. During normal times, if there ever were any, this behavior might be morally acceptable. However, there are some serious challenges facing our society that could use some of that technical know-how that too often gets left at work.

Many schools are desperate for technical mentors. TV-addled youngsters need creative outlets for their energies. School district and municipal boards—not to mention county, state and the federal government—often go begging for some level-headed leadership. Without some intelligent participation, the resulting vacuum all too often is filled by a host of lazy and destructive prejudices. Meeting no response or resistance, this resentment, fear, superstition and willful ignorance proudly goes mainstream. To quote statesman Edmund Burke, "All it takes for evil to win is for good men to do nothing."

Now, I know you're busy. I don't know a good technical professional that isn't hip deep in work. But you don't have to run for mayor. Serving on a local school board or committee usually only takes a couple of afternoons or evening per month. Just attending one or two local meetings can be very helpful. Even writing letters has way more impact than many folks realize. I've seen it firsthand.

The usual elected or appointed knuckleheads and lobbyists begin to sputter and cough when a real voice of reason asks a few questions and speaks out. Heck, just make sure you're registered to vote, check which candidates are most likely to help your community long-term, and then cast your ballot.

Even more important, it doesn't matter what side you're on. I've observed that liberal and conservative labels tend to evaporate when residents get even slightly ticked off and fired up about solving a problem in their communities. Luckily, most specific budget, infrastructure, education, health-care and employment difficulties are very similar to process control problems, and so I think any control engineer's input could help here. If you can tune a PID loop, then you can balance a budget—and avoid another Ponzi scheme, I mean, bailout.

However, if you don't participate, the goof-offs and lobbyists will think you're asleep or don't care and will continue to waste your community's precious money and time. The fox would be a fool to stop raiding the henhouse as long as the chickens are silent and the farmer doesn't object. The old "us" vs. "them" labels and the endless TV and radio bickering that follows are just part of the mechanism keeping most citizens too distracted and anesthetized to notice their hard-earned tax dollars being wasted. Process control engineers can remind them not to sleep at the switch. ■

If you don't participate, the goof-offs and lobbyists will think you don't care and will continue to waste community resources.

Process Analyzer Resources

Control's Monthly Resource Guide

Every month, *Control's* editors take a specific product area, collect all the latest, significant tools we can find, and present them here to make your job easier. If you know of any tools and resources we didn't include, send them to wboyes@putman.net, and we'll add them to the website.

ALL ABOUT PROCESS ANALYZERS

www.controlglobal.com/articles/2007/464.html

This site is the landing page for all *Control's* most recent process analyzer information. This online resource contains articles on process analyzer reliability, maintenance and service. Article titles include "PAT System Reliability," "What's Keeping Process Analyzer Engineers Up at Night?" "Process Analyzer System Safety and Ergonomics, Parts I and II," "More About Estimating Process Analyzer Projects" and "Project Roadmaps To Get You There." There is also a video entitled "Where's PAT?" a report on a survey of PAT users.

WHAT'S PAT?

www.fda.gov/Cder/OPS/PAT.htm

This site for the U.S. Food and Drug Administration tells you all about process analytical technology (PAT). PAT is a system for designing, analyzing and controlling manufacturing through timely measurements (i.e. during processing) of critical quality and performance attributes of raw and in-process materials and processes with the goal of ensuring final product quality. Links to tools, committees, presentations and other information about implementing PAT systems.

HIGH EFFICIENCY COALESCERS

PALL CORPORATION
516-484-5400
www.pall.com/pdf/GDS119STR.pdf

The technical report, "High Efficiency Coalescers Increase Online Process Analyzer Sensor Reliability," from Pall Fuels and Chemicals discusses how coalescers can be applied to process analyzers for protection against potential harmful outcomes of inaccurate measurements, such as non-optimized process control, leading to loss of revenue and costly replacement parts due to corrosion and maintenance-related problems.

PIP-ANALYZERS COLLECTION

IHS ENGINEERING
800-447-3352 http://engineers.ihs.com/collections/pip/pip13.htm

Subscribers to this web site get secure, online access to search, view, bookmark and print documents according to license agreement. Online documents are updated daily and multiple users can share a single license. The analyzers collection of PIP practices covers such topics as toxic gas detection systems; engineering guidelines, project implementation guidelines, field installation, bid and proposal information, acceptance testing and data sheets for process analyzers.

VALIDATION SERVICES

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www.spreadsheetvalidation.com

This company offers a complete service to validate your spreadsheets and provide documented evidence of their correct functionality for satisfying your regulator auditors. This pre-developed process can be used by you or adapted to your own quality systems and validation practices to provide validation of your process.

SINGLE PAT PLATFORM

THERMO SCIENTIFIC
781/622-10000 http://tinyurl.com/5zbh3b

White paper entitled "Moving Toward a Single PAT Platform" discusses the benefits of standardizing on single-platform tools for PAT, appropriate for both R&D and manufacturing, to make PAT implementation easier and more effective. PAT brings technologies into the processing environment that can achieve real time characterization and control.

STATE OF THE MARKET

THE FREEDONIA GROUP
440/684-9600 http://tinyurl.com/6lxeow

This report discusses U.S. process control instruments for the years 2001 and 2006, with forecasts to 2011. Topics covered include market size, product segmentation, market applications, trade, environmental and regulatory considerations, technology and product forecasts, industry composition and leading participants.

GET A JOB

SIMPLY HIRED INC.
www.simplyhired.com/a/jobs/list/q-Process+Analyzer+Engineer

Looking for work in process analyzing? This Web site gives you information on the job trends for the process analyzer engineer in the U.S. It lists average salaries for network engineers, senior product development engineer, technician and senior software engineers as of Aug, 2008. Also includes hundreds of listings of jobs and tools for easing your job search.

by John Rezabek

THE ONE NETWORK

Our intrepid "On the Bus" columnist joins the search for the single network standard for digitally integrated transmitters.

Our sister publication, *Chemical Processing*, sent me an alert the other day about a new feature for Micro Motion Coriolis transmitters from Emerson Process Management (www.emersonprocess.com). Its latest offering now natively supports DeviceNet and Profibus DP, and already had supported HART 4-20 mA, Modbus and wireless.

If the mythical Tower of Babel had implemented an industrial network, I think 21st-century controls professionals could have provided the design and troubleshooting. That's because it appears that our supplier community is gearing up for a diverse spectrum of interconnection options, instead of the global standard once envisioned for IEC 61158.

In the late 1980s and early 1990s, end users were eager to connect dissimilar systems—DEC Vax-based historians, tank-gauging systems, analyzer networks or minicomputers running model predictive controls—to their DCSs. Anyone remember the ISA show with the dinosaurs wearing CRT glasses? Microprocessor-based instruments, or "smart" transmitters and valve positioners, were introduced at the same time. Modbus was the de facto standard, as well as the path by which DCS vendors proclaimed their systems to be "open." We were already imagining what could be gained by connecting the microprocessors in field devices directly to the DCS, when Honeywell (www.honeywell.com) delivered DE. End users and Honeywell's competitors agreed that a proprietary solution for a digital field network was not in anyone's best interest, and work on a digital replacement for 4-20 mA began.

Twenty-five years after the first digitally integrated transmitters were introduced, there's still debate as to whether any clear standard ever emerged. The Fieldbus Foundation (FF, www.fieldbus.org) says it has "the" standard. Meanwhile, the Profibus Trade Organization (PTO, us.profibus.com) says it won the "Fieldbus Wars," citing staggering numbers of installed nodes. And some say the smart money is on Ethernet because its ubiquity may overtake all the rest.

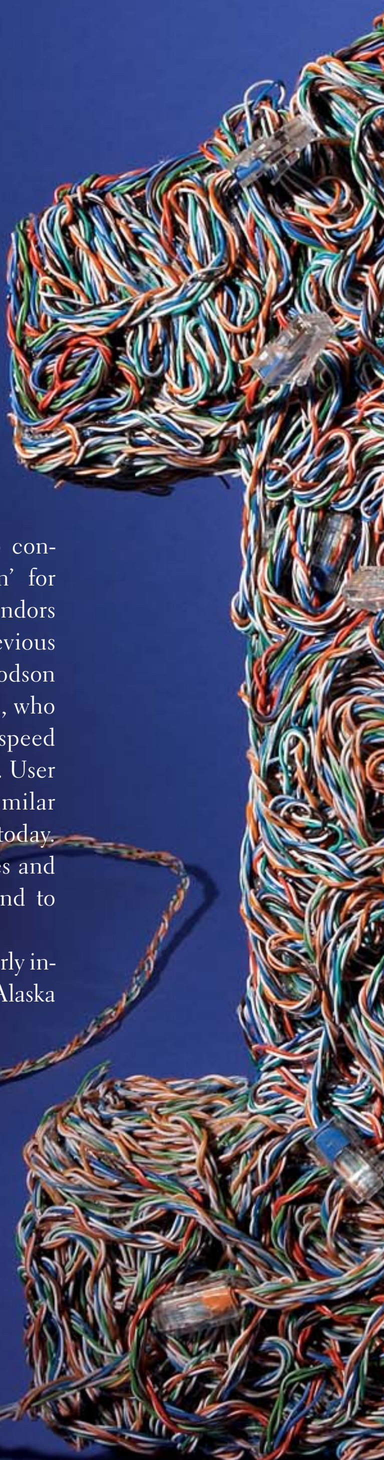
Laggards, Late Adopters and Installed-Base Inertia

"WirelessHART and ISA100.11a appear to continue their non-interoperable 'competition' for the wireless standard. It appears the vendors haven't learned this lesson from their previous wars and need to learn it again," says Bill Hodson of Hodson Consulting LLC in Philadelphia, who is working on a Foundation fieldbus high-speed ethernet (HSE) gateway for Wireless HART. User enthusiasm for fieldbus in the 1990s was similar to what we're experiencing with wireless today. And like today, deep divisions, split loyalties and competitors refusing to concede any ground to one another, delayed any standard for years.

Ten years after the first pioneers installed early incarnations of fieldbus on the North Slope of Alaska and elsewhere, the main players—Foundation fieldbus, Profibus and HART (implemented as a device digital integration strategy)—are still in the minority. How is it that a technology that was so pined for in the 1990s isn't a no-brainer today?

We Don't Need No Stinkin' Diagnostics

Fortunately, while the Fieldbus Wars were raging, users didn't hold still. A significant number continued with DCS and field instrument upgrades when the capital was available, using the technology of the day—4-20 mA and proprietary protocols like Honeywell's DE. Unfortunately,



the systems installed weren't well-equipped for integrating the upcoming fieldbus options, including HART.

In many sophisticated plants, the value of control systems had visibility well into the executive ranks. These plants staffed up and maintained organizations needed to keep the plant running optimally. Advanced control and optimization strategies rely on measurements being timely and valid, and control valves going to the requested position.

When management understands the value of its control system, resources tend to flow as needed. The other day at our International Specialty Products' (www.ispcorp.com) plant, we had a chromatograph service tech whose friend just landed a great-paying job in a Gulf Coast refinery. The plant manager there had decreed, "Analyzers will have 98% or better reliability," and they hired the people they needed to get it done with the kit they had on the ground. Once in place, an experienced staff will excel with what it has—and for many sophisticated users it isn't fieldbus.

Before any of us had a digitally integrated smart valve, we had some great diagnostics generated by the organization itself. Experienced board operators possess lot of good diagnostics embodied in the phrase, "I don't believe this transmitter." And, in less-dysfunctional organizations, they communicate as much to the instrument department. When you add to this a staff of advanced control and optimization professionals whose duties include daily scrutiny of the effectiveness of their applications, your ability to detect and even predict deficiencies in the measurement and control infrastructure becomes fairly comprehensive.

We've also had at our disposal diagnostic tools in the form of tuners and historian analysis tools. ExperTune's (www.expertune.com) Plant Triage and ControlSoft's (www.controlsoftinc.com) InTune+ can analyze standard analog 4-20 mA signals from old-school DCSs and identify many issues with measurements, positioners and controller tuning. Gensym-based (www.gensym.com) expert systems like Nexus Solutions (www.nexusengineering.com) can offer even more standardized and customized diagnostics based entirely on "olde-tyme" analog signals. Rudimentary rules such as, "If this pump is running FT-101, should show no flow," or "If the valve is 30% open, the flow should be <blank>" can be implemented without enormous effort.

"If It's a Clone, Leave it Alone"

This is a saying I learned from a friend at a major engineering procurement contractor in Kansas City. With pressure from our project managers and the finance community that bankrolls them to keep costs down and accelerate the schedule, the desire to innovate with digitally-integrated field devices is sometimes deferred. I just received an estimate from a specialty valve manufacturer to retrofit a fieldbus-capable positioner to its product for more than three times what the same product costs me. That skid suppliers discourage their clients from deviating from the cookie-cutter product they like to sell is nothing new. Shell Oil overcame this for its Malampaya deep-water gas platform and pipeline, but many of us don't have the kind of leverage Shell can bring to the table. Faced with these increased costs and delays, we often relent and take the default, usually bottom-of-the-line instruments.

There was a time when speed of execution for oil and gas production projects valued speed over innovation, but there's evidence this is no longer the case. However when backlogs at the suppliers are high, and you're told “that will add two weeks to the delivery,” you might be compelled to take the conventional alternative. No one gets fired for specifying 4-20 mA, at least not yet.

And when you're the subcontractor trying to win the lube-oil skid job on another third-party supplier's compressor, the diversity of bus technologies such as 4-20 mA and the lack of any global standard make it difficult to propose more than the rudimentary instruments you put on the last one.

We Can't Maintain What We Have

On the other end of the spectrum from the 1st-quartile refinery are those whose staffs have been cut to the bone or those where attrition continues unabated with few new hires to fill the ranks. Weary baby boomers in their 50s and 60s aren't anxious to add complexity to the alligator-filled swamp they pull into at 7 a.m. each business day. And, since adding fieldbus or native HART capability to your DCS means ripping out what you installed only 10 or 15 years ago, the cost and disruption to plant operations can be prohibitive.

As one end user reports, “One of the institutional roadblocks is having to install a new DCS, and if your DCS has lots of life left, then it's very difficult to justify Foundation fieldbus.”

The pilots of our process plants—our operators—often aren't anxious to learn any new tricks either. Finally, our host suppliers have at times been slow to adapt their products to support fieldbus and native HART. Even today, you can't easily paste a new DCS that supports fieldbus or native HART to what you have on the ground. Anyone doing an expansion is faced with either installing the soon-to-be obsolete technology of the 1990s or essentially switching to a completely new DCS.

Another end user, now in the throes of appending his DCS vendor's new system to the old, says that, “If you're planning to upgrade your DCS, don't assume your current vendor is the best choice just because you have a good track record with them. Open systems are destructive technology, and it's not surprising that some vendors have a hard time adapting.” Staying loyal to the supplier of your legacy installed base may be as painful as a new DCS.

Profibus Serves “Breakfast, Lunch and Dinner”

Before the fieldbus wars, German automation leaders asked for a standard digital bus for discrete settings such as automobile manufacturing. Profibus was created as an upgrade from Modbus and a proprietary protocol for integrating discrete devices. Lots of “purple hose” was installed, and North American users of Texas Instruments' legacy 505 and 545 PLCs found many uses for the gaily colored cable as well.

When real fieldbus solutions for the process industries, like WorldFIP and ISP, began to gel, Siemens (www2.siemens.com) and other European PLC makers that supported what we now call “Profibus DP” already had a large installed base. When it became apparent that Foundation fieldbus would likely mean drastic changes for their DP users, suppliers like Siemens went their own way and introduced Profibus PA.

PA integrates with Profibus DP, and PTO spokesman Carl Henning adds it isn't that different from DP. In fact, the protocols are identical, and only the physical layers are different. It shares the same physical layer and baud rate as Foundation Fieldbus H1, but doesn't provide control in the field.

As my friend at Siemens likes to say, Profibus offers “breakfast, lunch and dinner,” or solutions for discrete devices (DP), process I/O (PA) and Ethernet (Profinet). This is unlike Foundation fieldbus, which offers two (H1 and HSE). Also, HSE's implementation by

the supplier community has been limited to Smar (www.smar.com) and ABB (www.abb.com). Curiously, these are the same two suppliers that offer native support for Profibus DP and PA.

In terms of applications, the Profibus end-user community is largely defined by the host systems that support it. Besides suppliers to discrete parts makers such as Siemens and Schneider Electric (www.schneider.com), only ABB, Invensys (www.invensys.com) and Smar and its clones offer native support for PA. The user base is shaped along the lines of "hybrid" process plant PLC applications, including breweries, pipelines, batch chemical, pharmaceutical and ethanol plants.

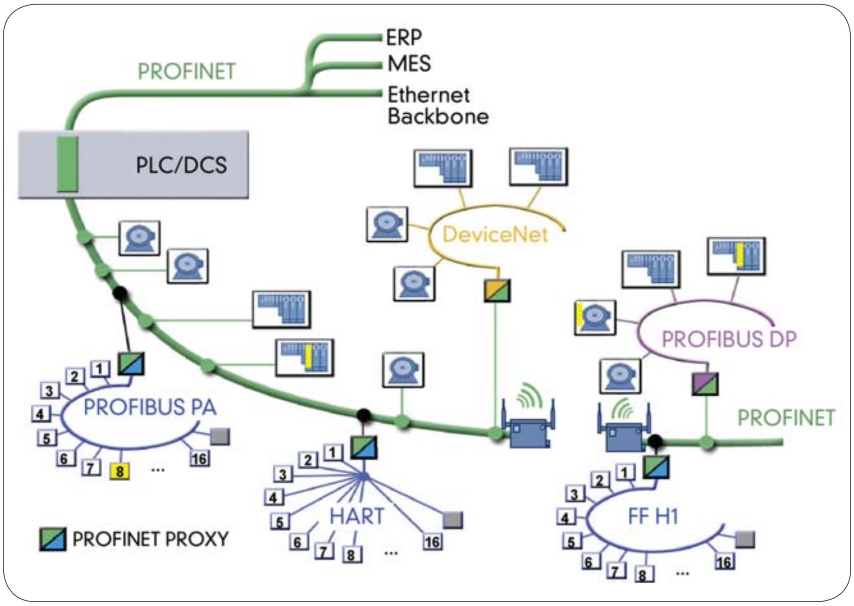
So, if you ask someone in Fluor's or Bechtel's offices in Houston how much Profibus PA is going into their clients' projects, the proportion is smaller than Foundation fieldbus. In fact, speakers representing Bechtel at a recent conference in Antwerp estimated that roughly 50% of new projects are installing Foundation fieldbus, while the remainder is mostly conventional and/or HART. Until DCS suppliers such as Honeywell, Emerson and Yokogawa (www.yokogawa.com/us) have proven applications using PA, interest in Profibus by the large process industries may be limited to DP, mainly for motor control center integration. "But, globally, the protocols are on par," adds Henning. While Profinet was positioned to integrate other protocols, including Foundation fieldbus, many large suppliers are content to provide their own, proprietary system-level networks (Figure 1).

A Strong Foundation

Meanwhile, Foundation fieldbus is a popular choice, even in Europe. At its meeting in Antwerp this year, FF touted its process industry products. However, most Foundation fieldbus applications are limited to H1, its two-wire network with the same physical layer as Profibus PA. While high-speed Ethernet has been part of FF's specifications for years, commercial implementations of HSE are still relatively few.

COORDINATION BY PROFINET

Figure 1. As the Ethernet-based version of Profibus, Profinet is one of several industrial networking methods that can help coordinate communications between several fieldbus protocols.



What was originally H2 (hunk two) back in the days of SP50 hasn't caught on, mainly because most DCS suppliers that dominate the large process industries—Honeywell, Invensys, Yokogawa, Emerson—chose to implement a proprietary network, with all current offerings based on Ethernet. And end users "voted" with their dollars, reinforcing impressions that delivering H1 is sufficient. HSE capability hasn't been the differentiator that H1 has been. Asked if support for HSE would ever be a differentiator for system choice, one user says, "For internal DCS communications, neither pro nor con. HSE seems to be a dead letter. If they pushed everything to OPC (www.opcfoundation.org), then I might get excited, assuming they had tools to keep servers and clients synchronized."

> "As long as there are different application layers and application object models for Foundation fieldbus, Profibus, DeviceNet/ControlNet, HART and the like, there will not be meaningful interconnections."

This choice of system architecture harkens back to the heritage of these systems. Unlike PLCs, a DCS was traditionally sold as a "system." Unlike the users who primarily used PLC's for control, the industries that wanted a DCS were shopping for a solution, even when this slogan wasn't part of the marketing vernacular.

Walt Driedger of Colt Engineering (www.colteng.com) in Calgary, Alberta, Canada, says that, "When you buy a PLC, you're buying the 'engine,' and so you may be on your own to provide operator interface, historian, etc. When you buy a DCS, you're buying the whole vehicle." While many PLC vendors raked together some standard operator interface, historian, alarming and reporting packages that allow them to be called a DCS, they are rarely found on the bid list for a large process plant project. Yokogawa likes to say, "We have reliability in our DNA." Users in the large process industries have a sense—or a prejudice—about who has "reliability in their DNA," and are very reluctant to "step out" unless a system has been vetted by their peers.

These heritage DCS suppliers have always controlled the system-level network and still see it as a critical to their offerings. Charlie Piper, Invensys' senior development program manager, says, "The system network for the process automation system is a vital part of our supply scope. It needs to be extremely robust. Protection against single points of failure isn't enough. I/A Series mesh network can tolerate multiple faults in different locations, while still communicating among all network equipment, and it contains patented technology unavailable commercially to do so. The system network must tie together, not only DCS controllers, but also safety and supervisory controllers. Its performance and peer-to-peer capabilities must be flawless. The system network also needs scalability. We have facilities that connect 50,000 or more instruments and field devices."

And as Microsoft Windows security patches, bug fixes and hardware changes are released, classic DCS vendors are expected to do exhaustive tests to ensure their installed base doesn't have a hiccup.

Some people grouse that proprietary networks are maintained to "lock in" customers, and with respect to safety systems, they may have a point. The effort and expense to connect a "foreign" SIL-capable logic solver may compel many to default to the DCS supplier's standard, and nearly all of the aforementioned vendors have bonafide SIL-3 logic solvers. However, large system users may think twice before connecting a SIL-capable system to any open-protocol control network, especially with growing cybersecurity worries.

Dawn of the One Network?

As you read this issue of *Control*, you'll no doubt notice many ads offering Ethernet TCP/IP connectivity for many flavors of I/O. Whether you use Modbus TCP/IP, industrial Ethernet, Profinet or EtherNet/IP, you can buy inexpensive I/O to ride on it, along with converters for RS-232, RS-485, Modbus, AS-i or wireless.

However, this doesn't mean you can hook a Cat-6 cable to a spare RG45 jack on your host system's network switch and start reading and writing to the I/O. Maybe you're brave enough if your system is small and lightly loaded, but how many of us would risk unknown network traffic from a device that wasn't explicitly approved by our host vendor? Early wireless pioneers sent measurements to the World Wide Web and read them down into their historians because no DCS engineer at these beta sites trusted their proposed system interconnection. Hodson adds, "Interconnecting via TCP/IP over Ethernet assures arrivals of messages, but this doesn't mean they're understood by the communicating parties. As long as there are different application layers and application object models for Foundation fieldbus, Profibus, DeviceNet/ControlNet, HART and the others, there won't be meaningful interconnections."

Now, Profibus, Foundation fieldbus and HART have been playing well together for a few years and cooperating via electronic device description languge (EDDL) and on the new Wireless HART interface—the backbone that brings data into the host. PTO and FF also are offering to work on the same service for the ISA-100 wireless standard, if it emerges.

However, systems using HSE as the PCN backbone are few (ABB and Smar), and systems using Profinet as the PCN backbone aren't a dominant fraction of bonafide, large-process applications. This means many users will bring in Wireless HART through gateways, which have limits. Hodson adds, "Gateways may offer connectability, but they almost always have functional sacrifices and need some application configuration."

Large-process users all support open standards. One senior process control consultant from a major oil and gas firm, who is on the team that qualifies suppliers for its bid list, says that, "With all things equal, the preference would be for an open PCN standard." However, the equals on the bid list don't show a strong leaning toward an open standard for their PCN, and this doesn't seem to affect any supplier's ability to win jobs. Whether large-system users will ever "vote with their dollars" remains to be seen. Until then, it's reasonable to expect proprietary implementations of Ethernet, gateways and OPC interconnection to remain the status quo."

For those of us in smaller I/O count facilities, where traditional PLC or hybrid architectures are the norm, the current environment may indeed look like it's being taken over by Ethernet. Choices abound, and even intrinsically safe and out-of-the-box redundant Ethernet solutions are available. That numerous protocols and application layers exist doesn't seem to be slowing anyone down. As long as your business allows more diluted accountability for system troubles, end users or their system integrators may feel free to choose. But when an enterprise agonizes about lost production and call-outs at 3 a.m. on a holiday weekend, even network-savvy system integrators may be compelled to choose single-source accountability.

Perhaps today's increased network speeds and processing power will allow open protocols like OPC UA to make dissimilar connections appear seamless, but uptake by conservative users still may be slow. "Proven-in-use would help, but it would probably end with the system having to be re-qualified [for its bid list]" adds a long-time user at an oil and gas firm. Another fieldbus end user adds, "To me, open standards are only useful when you want to have different vendors' products talk. It's becoming more important, and we are dragging the vendors kicking and screaming along with us."

"Open standards are only useful when you want different vendors' products to talk. It's becoming more important, and we are dragging the vendors kicking and screaming along with us."

With many engineers working increasingly far from nitty-gritty process control networks, reliance on system integrators and vendors will remain the norm or increase. Our present mishmash of networks and protocols will likely persist too. So it seems our suppliers are wise to claim to be all things to all people, like Micro Motion supporting every protocol it can afford.

The One Network may be a real possibility, but constraints on end users, their business and operations clients, and suppliers' interests means "everybus," "anybus," OPC and Modbus will be in our plants for years to come. ■

John Rezabek is a Control contributing editor.

CONTROL 1988–2008 20TH ANNIVERSARY

20 YEARS OF CONTROL

This month marks 20 years since October 1988, when the very first issue of *Control* reached the in-boxes of instrumentation and control professionals throughout the process industries. To mark this special anniversary year, the editors of *Control* set off in January on a ten-month journey not into the past, but into the future of process automation. We gazed into our collective crystal ball to produce a special series of Future-Casts—video prognostications on the outlook of various aspects of process automation technology. The following special section of the magazine presents the highlights of the nine completed videos on topics ranging from control valves to software connectivity. All of them can be accessed from links at ControlGlobal.com/20years.

Wireless Arrays on New Sensor Frontier

The big four primary process variables are flow, pressure, level and temperature. These are the variables we have been monitoring for over 150 years as we have sought to control plants more automatically and processes more precisely. ● We picked these variables because we could measure them. We also picked them because we could control them.

Walt Boyes discusses the technology forecast for flow, level, temperature and pressure sensors.

See the full video at www.controlglobal.com/multimedia/ 2008/051.html.

Over the past two centuries, we have developed over 11 different ways to measure flow. Each of the techniques has a set of applications for which it is best. There are several technologies that we've designed to measure pressure as well. Sometimes we use the differential of a pressure signal as a way to compute a flow value. Sometimes we use pressure to compute level. Level can be measured mechanically, invasively, non-invasively and by entirely non-contact means. And temperature is one of the first process measurements we tried to measure, because so many chemical reactions, from cooking to plastics manufacture, require control at a given temperature.

Indeed, we've covered a long list of advances in primary process measurements in *Control*'s first twenty years, and we expect to continue to do so for the next double decade, too.

So what will some of those advances be? In flow we'll see the cost of sensors coming down drastically, and the accuracy going up, which will make more applications measurable. We may even see new flow technologies to complement the Coriolis, vortex, magnetic, ultrasonic and mechanical devices we currently use. The same factors will come into play with level, pressure and temperature.

But what will be truly different is the way we will use many of these sensors. You'll see us using sensor arrays—groups of identical sensors, ganged together using smart software to process the multiple signals into a single coherent reading. Some companies, like CiDRA, have already moved in this direction.

Why is this important? And why is it different? Back in the day, it was necessary to have a single transducer in a single analog control loop. So the transducer had to be as accurate and as repeatable as possible.

But the technology exists, and the software exists, to use multiple groupings of simple, less accurate (and also less costly) sensors, and make highly accurate measurements using the aggregated signals.

Technology exists to use groupings of less accurate (and less costly) sensors to make highly accurate aggregate measurements.

For example, process pipelines often have to be heat-traced and insulated to keep the process at the optimum temperature when transferring product from one vessel to another. A very simple application of these sensor arrays would be to put several dozen simple temperature sensors on the skin of the pipe all the way down its length and use the processing software to produce a visual image of the temperature gradients inside the pipe.

CiDRA's flowmeter uses an array of acoustic pressure sensors to detect flow vortices, bubbles and entrained gas in the line non-invasively. This detection produces values for both flow and void fraction, so that the product flow can be compensated for density automatically.

How about monitoring the temperature all the way through a reactor vessel in real time? Or watching pressure surges in a pipeline in real time so that you can identify fluid hammer before the pipeline breaks?

One of the other technologies that will create synergy with lower cost sensors is the use of wireless. Hanging 30 wired pressure sensors all around a vessel is impractical, expensive and uses substantial I/O in the control system. But taking those 30 sensors wirelessly to a smart level analyzer with a single output to the control system is most certainly practical, and we'll see it done.

And we may actually see new primary process variables joining the venerable Big Four. It could be that the simple wet chemistry variables of pH, conductivity, ORP and resistivity may yet become as ubiquitous as the Big Four. New research may make corrosion a process variable as often monitored as flow or level. ■

HMIs to Deepen Operators' Process Insight

The eyes are said to be the windows to the soul. If that's true, then the human-machine interface (HMI) is the window into soul of the manufacturing process. While HMIs used to be mostly computer screens, keyboards and pushbuttons, recent technology advances are morphing that definition into new forms and functions—all in an ongoing effort to push engineers and operators' vision ever further into their processes.

An extended version of Jim Montague's exploration of the future of HMIs is available in video form.

See the full video at www.controlglobal.com/multimedia/2008/056.html.

They used to be known as man-machine interfaces or MMIs, however, this definition was replaced by the more politically correct HMI in recent years, and that name has been overtaken by human-computer interface or HCI in Europe.

HMI expert Ian Nimmo reports that from the 1950s to the 1970s, operators viewed trends on HMIs mounted in steel panels in control rooms. However, with the advent of digital electronics in the 1980s, HMIs moved onto 12-inch and lately 17-inch computer screens that began to proliferate in industrial settings, and gave users a better keyhole view into applications.

In fact, Nimmo adds that users came to rely on these HMIs and associated alarms for what they couldn't see, and sometimes became too dependent on them. Consequently, one of the main recent HMI trends is an effort by developers to get back to the big picture and help users to be more proactive, As a result, HMIs have expanded to include larger and larger overview screens and even huge video walls.

However, at the same time HMI graphics are being updated to bring back the look and feel of many of the old panel indicators and readouts they replaced. Basically, the old hardware-based constraints have gone away, and users can now interact with giant virtual panels that are more flexible and task-oriented for the simple reason that they are virtual.

A growing trend is to treat alarms, trends and graphics under a single situation-awareness umbrella.

Another HMI trend with roots in the past is data-sharing. In the past, there often were different consoles for different operator roles and responsibilities, so users had their own keyhole, but they didn't share data with one another. Nimmo says this situation has just started to change in the past couple of years, and that some of the digital walls are adopting the capability of much older panels to show data from several process areas at the same time. This push to bring the big picture back to HMIs also is changing their subject awareness, so alarms, trends and graphics that used to be treated separately are now being treated together under one situation-awareness umbrella.

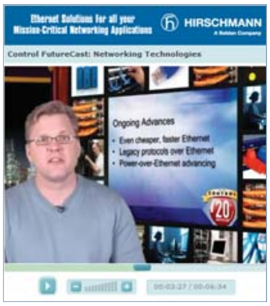
Similarly, developers are going beyond flat HMIs that basically copy P&ID drawings and are creating more hierarchical displays that go from overviews to unit views to detailed views and, finally, to detailed diagnostic views. They're also seeking to make graphics more task-related by bringing together pieces that relate to one operator's job, instead of having HMIs that just reflect the application's or plant's physical layout.

In the future, many HMIs also will add depth perception and perspective when they recognize predefined situations. For example, when a high-level or high-pressure event occurs, the on-screen representation of the equipment will be shown in perspective—perhaps moving from a square to a cube—which will allow it to show added depth, data and insight.

Because hardware is no longer a limiting factor, and because HMIs can be placed almost anywhere, users will likely move beyond simple message boards to the increased use of video conferencing, image capture and recognition, and field operators who can send back video-based data from the field.

It's possible that process-control HMIs and handheld displays may one day show up on eyeglasses for field operators and maybe even neural interfaces. However, for the near future, operators will continue to need a standardized, better-prioritized, big-picture display of what's actually happening in their applications, and HMI developers will remain focused on the best way to deliver it to them. ■

Wireless, Ethernet Dominate Networking Trends



Keith Larson puts process control networks in perspective.

See the full video at www.controlglobal.com/multimedia/2008/021.html.

When the first issues of Control were published in the late 1980s, Ethernet had already begun its conquest of the enterprise networking space. But in the industrial world, concerns over determinism held it at bay. The higher expense of MAP/TOP and other token ring-based networks, together with relentless performance improvements to Ethernet technology resulted in its top-down conquest of the enterprise information space that ultimately included process control.

Meanwhile, at the instrumentation level, the process automation industry continued to haggle over its own network standard that would be compatible with the extensive installed base of 4-20mA twisted-pair copper wire used for analog process signals.

Indeed, the decade of the 1990s saw us industry reporters spill a great deal of ink over the “fieldbus wars,” in which rival camps of instrumentation vendors did all they could to control—or stymie—progress of the standards work. All that effort ended with the IEC approving not one, but eight different options—acknowledging those many various protocols that had been commercialized, but doing little to narrow end users’ dilemma.

Fast forward to 2008. Ethernet and its various derivatives have conquered all but that industrial last mile—that final stretch of connectivity to a given temperature transmitter or proximity switch. At this level, as an industry, we still deploy a variety of industry-proprietary protocols.

> It’s straightforward to extrapolate a networking future that’s faster, more wireless and increasingly easy to set up and manage.

But the technical reasons for not having a single, unified network architecture from top to bottom are falling one by one. Security considerations notwithstanding, the day is coming when that desktop computer in the CEO’s corner office, as well as the distant pressure transmitter atop the distillation tower, exist as TCP/IP addresses on the same Ethernet architecture. Ethernet chipsets are now cheap enough to be embedded in the lowliest devices, even as present day device and fieldbus protocols are modified to run on Ethernet-compatible physical media, even simultaneously with other protocol stacks.

The process industries, of course, have come to expect loop-powered instrumentation, but continuing advances in power-over-Ethernet standards promise to overcome even this last limitation to delivering device power over the same wire as the digital Ethernet signal. Meanwhile, lower-powered devices themselves, developed in part to support wireless instrument networks, will further accelerate this continuing trend. We’re in the early stages of wireless adoption, and at times they seem a lot like the early days of fieldbus: Committees work toward a consensus standard continues even as vendors and early adopters demonstrate the technology’s game-changing potential. For process control applications, among the biggest issues are network integrity and reliability, for which self-organizing and self-healing mesh topologies appear the most viable approach for process manufacturing environments.

So, twenty years from now, what will be the networking state of the art in process manufacturing plants? Faster networks? Certainly. Increased reliance on commercial networking technologies? Undoubtedly. More wireless applications? Inevitably.

The best bet is that 2028 will look a lot more like 2008 than one might think. For example, a just-completed survey of *Control* readers indicated that a full 54% of survey respondents still use mostly 4-20mA analog hardwiring for instrument communications. Only 12% reported using primarily digital buses. So despite all the advances in digital field communication technologies over the years, more than half still rely on technology that matured some 40 years ago. By their very nature, disruptive advances are impossible to forecast, but from it’s straightforward to extrapolate a networking future that’s faster, more wireless and, with some help from the supplier community, increasingly easy to set up and manage. ■

Jim Montague comments on the ongoing evolution of calibration practices.

See the full video at www.controlglobal.com/multimedia/2008/063.html.

Calibration Shifting from Periodic to Predictive

In process control, the first rule is this: To control something, first you have to measure it. The more accurate your measurement, the more accurate your control. So, if you want to control accurately, get your instrumentation calibrated. ● Process industry veterans remember instrument shops. This is where engineers and technicians calibrated and repaired instrumentation, back in a corner of the plant. The techs used black body devices to calibrate infrared temperature sensors; deadweight testers to calibrate load cells and strain gauges; and handheld instruments to calibrate instruments and transmitters out in the field.

Today, with the loss of skills to retirements and downsizing in process plants, many of these instrument shops are gone or diminished, and so users tend to ship their instruments off to calibration services. A quick Internet search turns up about 900 calibration and repair services and 500 calibration services, with more opening every day.

To help users track instruments and detemine when calibration is needed, many suppliers offer useful programs. And, not only are many of these tools available online for free, but also many instruments have online diagnostics functions that can notify users when calibration is needed.

So where are we going? What's the future for calibration? Many industry observers predict that there will be less need to calibrate in the future because field devices are being improved all the time to be more reliable and more stable. Users will find that their instruments are generally "in spec" during periodic calibrations, and so they'll extend the intervals between calibrations. They add that users eventually will develop so much confidence in the integrity of their instrumentation that periodic calibrations will be discontinued. Instead, they'll rely on predictive maintenance based on diagnostics generated by the devices.

More stable instruments and onboard diagnostics may spell the end of periodic calibrations.

Other calibration experts say calibration will continue to be vital in commissioning new plants and in periodic maintenance of existing plants. However, calibration practices will shift from preventive maintenance to predictive maintenance, which requires high accuracy standards and sophisticated data management systems. They also anticipate a change from bench calibrations in the instrument shop to in-situ calibrations. This trend will drive increased accuracy requirements for field calibration tools and increased portability requirements for precision calibration tools.

However, the question remains—who is going to perform these field calibrations? With many experienced instrument techs at or approaching retirement age, many younger techs with less real-world experience will be maintaining increasingly complex and sophisticated systems. This likely will force system builders and calibration vendors to design greater levels of intelligence into process control systems and maintenance tools.

Also, there's expected to be a reduction in the number of pure instrument technicians and a shift towards combined electrician/instrument techs. This can be seen in the number of traditional electrical training programs now expanding their curricula to include process system maintenance.

Diagnostic tools also will undergo fundamental changes. Some observers see increasing use of HART, fieldbus, industrial Ethernet and wireless, all of which will be incorporated into future test equipment and calibration tools. They also see an increasing need for intrinsically safe test equipment. Already, many installations are mandating this limited-energy test gear throughout the plant, not merely in those units presenting a flammability or explosion hazard.

So maybe the future holds somewhat of a return to the old days, when plants maintained their own instruments. Smarter instruments, better calibration tools, highly trained technicians, and lots of hardware and software support from the vendors will help. ■

Advanced Control Strategies Move into the Field

Why do we still do single-loop control? Walt Boyes discusses the next generatin of advanced control strategies.

See the full video at www.controlglobal.com/multimedia/2008/030.html.

Why do we do single loop control? I keep asking this question when I speak at user groups, at ISA section meetings and just in general conversation. I'm going to keep asking the question because it has a bearing on where we go in the future for loop and process control. ● It is very simple, really. Back in the 1920s, when Edgar Bristol, Sr., was inventing the very first loop controller, he was working with pneumatic instrumentation, and it was very difficult to get more than one pneumatic signal to be used in the controller.

Both vendor and end-user companies have long tried to produce advanced control systems and strategies that would carry us beyond the simple PID single loop that we're so familiar with. There have been many versions of designs for automatic loop tuning, process optimization, neural networks, artificial intelligence and so-called soft sensors.

Until fairly recently, all of them have been add-ons to the basic control system, and all of them have been subject to the standard performance degradation curve. At first, everything works fine, and the expected benefits accrue.

But then processes change. Variables change. Systems and equipment change, and the advanced control software is not updated to keep pace with the process changes. Performance starts to fall off, and the plant operators and engineers begin to lose faith in the system.

Finally, the system performance degrades to the point that the operators basically shut it off. That's what has happened in the past, but in the crystal ball we're gazing into, that's not likely to happen for much longer.

Three trends are converging that will make our dependence on single-loop control part of history. The first is the movement of advanced control algorithms and strategies to the field controller. The second is the increasing availability of inexpensive sensors The third is the increasing use of fieldbus and wireless in the plant control networks.

All of the companies that make field controllers, whether part of traditional DCS companies, or programmable-controller-based control systems, are merging advanced control algorithms directly into the field controller, so that they work invisibly and are completely transparent to the operator. They will self-update, and since they will be connected to the plant control and asset management systems, they'll be able to continue to optimize plant performance regardless of changes in the plant process or automation system.

These advanced-control field controllers will also be supplemented by new types of inexpensive sensors. We are at the dawn of the age of "lick 'n' stick" sensors. These sensors will be inexpensive enough that we will be able to use many of them in a single installation, and take advantage of the fact that the precision and control accuracy of a many-sensor matrix is better and provides more information than a single high-accuracy sensor can.

There are even companies coming out with add-on wireless sensors that can take a mechanical pressure gauge and turn it into a wireless transmitter.

These sensor arrays will be paired with the advanced control algorithms that will depend on multiple variable inputs, and we'll have true multivariable control for the first time.

The final piece of the puzzle that will shape the future of advanced control is the increasing ubiquity of fieldbus and wireless in plant sensor networks.

Whether connected wired or wirelessly, sensors will be able to report multiple variables and advanced diagnostics and receive updated control information and be remotely calibrated, all automatically from the advanced process control software.

The future of advanced control is to make the plant instrumentation even more transparent to the operator than ever before—so that the operator can concentrate on controlling and optimizing the process itself, not the process automation system. ■

Three trends are converging that will make our dependence on single-loop control part of history.

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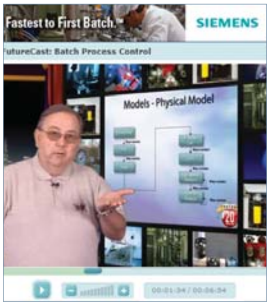

Walt Boyes explores the ongoing development of batch process automation standards.

See the full video at www.controlglobal.com/multimedia/2008/039.html.

Twenty or so years ago, a group of manufacturing and control system engineers from the food, consumer products and pharmaceuticals industries and some of the vendors who predominantly served those industries, got together to talk about a kind of control strategy that was neither fish nor fowl. Continuous processes were well known and the DCS control system was being implemented widely. On the factory floor, PLCs were revolutionizing how discrete processes and motion control were implemented. But nobody seemed to know what do about batch.

These batch pioneers first set out to write a standard for batch control. This standard, now known as S88, is arguably the most successful ISA standard, and the first that successfully crossed over the divide between control systems and automation and the business processes that drive the enterprise.

What the SP88 committee did was to define how a batch process works, and show how to describe it in a clear and repeatable fashion. It differentiated between the equipment and the recipe. It defined how recipes were to be created and how a batch process fit into a set of batch processes.

As soon as the industry realized what a great thing S88 was, the scope of the work shifted and a new committee was formed, to try to define a complete language for describing manufacturing—not just batch, all of manufacturing. This became S95, which has also jumped the chasm successfully and become a highly respected enterprise standard touted by people like SAP and Microsoft, as well as the end users and vendors in the automation marketplace.

S88 and S95 are converging into a language and methodology for all manufacturing operations.

Meanwhile, the original group of standards revolutionaries had realized that a language was needed to connect S88-enabled processes to the rest of the plant enterprise, and they developed B2MML, an XML (extensible markup language) variant that allows the batch to speak to the enterprise.

A complete convergence is underway to merge the two standards, S88 and S95 into a complete language and methodology for defining manufacturing operations.

So, in the future, it will be possible to easily and repeatably define and discuss any and all manufacturing operations, thanks to ISA88, ISA95, the B2MML committee and WBF.

But how do we make sure the "languages" don't split into vendor-sponsored "dialects?" How do we make sure that everybody's ISA88 implementations talk to everybody else's? Otherwise, the future of batch will be just as chaotic and fragmented as it was in the early 1980s.

One of the ways is through the new compliance institute that WBF and the Automation Federation have set up under the Automation Standards Compliance Institute. Called the Industrial Interoperability Compliance Institute, its mission is to make sure that manufacturing standards like ISA88 and ISA95 and B2MML are and continue to be interoperable.

What will batch processing be like in twenty years? The work of WBF and ISA88, ISA95, the B2MML committee and others is being supplemented by people who are working to make batch process control smarter, not just interoperable. In the bad old days, which still exist today in many plants, you started out by throwing the ingredients into the pot, applying heat or cold, stirring and hoping that everything would come out the way the "Golden Batch" did in the lab. If the current advanced research pans out, it will be possible to expertly steer a batch to completion and produce easily repeatable batches that meet quality requirements, every time.

In fact, it has been noted that continuous processing shares a great deal with batch, and the principles and practices of S88 can be used there, by envisioning continuous processing as a very long batch, with start-up and shutdown as the start/stop of the batch process.

The future of batch processing is bright—and the revolution in batch process control has only just begun. ■

Final Control Elements: Smarter, More Efficient

The three pillars of loop control for process automation are the field transmitter that measures and reports the significant variable, the field controller that takes that signal and turns it into a control signal, and the final control element, most often a control valve. The control valve takes the control signal and performs an operation based on the signal it gets. Field transmitters and field controllers have been getting smarter, faster, smaller and cheaper for decades. So what's been happening to control valves?

Jim Montague discusses current trends in control valves and other final control elements.

See the full video at http://www.controlglobal.com/multimedia/2008/026.html

First, let's take a little detour and look at the control loop itself. For years, we've been doing what has been known as "single-loop control."

Most people, when I ask this at meetings, simply no longer remember why it is that we do single-loop control.

Why?

The reason is that when Edgar Bristol, Sr., designed the first pneumatic loop controller nearly a hundred years ago, it was way too expensive and physically nearly impossible to use more than one variable to control the final element—the valve. So we got into the habit of picking the one variable that had the most impact on the process, and that was the variable we measured for the loop.

Even today, nearly all loop-controller algorithms have those peculiar delay times we called "huff and puff damping"—because pneumatics do not react at the speed of light, and there was delay between the sender and the receiver.

But in the future, we can expect that the single-loop controller and even the single-loop control function in the plant automation system (that's newspeak for what we used to call a DCS) will be replaced with multivariable and advanced process control schemes. These control schemes will make controllers smarter, valves smarter, and put lots of the control decisions into the loop devices themselves.

Now what about valves?

Valves have been getting smarter and more efficient for years. Smart valves from multiple vendors, which can actually serve as the entire control loop all by themselves, have been on the market for a while now.

They can measure flow, do single-loop control functions on that measured variable and manipulate the actuator they're attached to, as well as send a signal, either an analog 4-20 mA, with or without HART data, or a Profibus or Foundation fieldbus signal back to the control room.

This is what we used to call "control on the wire," and it is what these smart valves do.

There's a fly in the ointment, though. While control valves do a fantastic job of restricting, channeling and metering the flow of fluids in the process environment, they do so by dissipating and wasting enormous amounts of energy.

One of the trends we see for the next few years, as being "green" becomes more and more important and the cost of energy rises, is the use of more and more pumps and variable-speed drives instead of control valves in many batch and continuous process applications.

Indeed, motors connected to pumps, compressors and fans consume an estimated 60% of all industrial energy. In a typical control loop, an oversized motor and pump are run at full speed; the control valve in conjunction with a flowmeter effectively controls the flow rate, but also wastes energy.

A more practical–and today, possible–approach to meeting the varied load requirements of motor-driven flows is to vary the speed of the equipment by precisely controlling the speed of the motor.

And by controlling the speed of the motor to meet the needs of the process, variable-speed or variable-frequency drives (VFDs) can eliminate the need for a control valve, as well as boost energy savings and operating efficiency.

Smarter control loops, smarter and more efficient control valves, and the increased use of greener variable-speed drives…that's what we see in the future of final control elements. ■

Smarter valves are poised to take on more tasks, even as the energy savings of variable-speed drives edge them out in some applications.

OPC UA Eases Software Integration Tasks

In the bad old days, we had no way to connect different pieces of hardware, software and operating systems. We called that "islands of automation" and moaned a lot about the expense of interconnecting devices and systems. The good news was that Windows became the dominant operating system for both the commercial world and for industrial automation, and as it did so, things became easier and easier to interconnect.

Walt Boyes reviews the progress we've made in making software applications play nice together.

See the full video at http://www.controlglobal.com/multimedia/2008/029.html

Back then, Windows relied on a series of dynamic linking libraries (DLLs) that make development of reusable content like printer and other device drivers much easier to do. In the 1980s, Microsoft developed ways to use object-oriented code and produced a specification it called OLE—object linking and embedding. This made it possible to link a spreadsheet cell to a word processing table cell to an interactive graph to a presentation slide…well, you get the idea.

A group of vendors and some end users in the process automation market space thought OLE was just the ticket to fix the huge problems with connecting multiple kinds of software from multiple vendors. They produced a sort of ad hoc version of the OLE specification they called OLE for Process Control, which became OPC.

Even as the original OPC standard was developed, two standards groups from ISA and several groups around the manufacturing industries began talking about developing a higher level language to be able to describe manufacturing processes.

The first of these was the ISA's S88 Batch Manufacturing Standard, which was followed by the S95 Manufacturing Standard. Other groups, such as Mimosa, OAGIS and others, have contributed to and made parallel contributions to this process.

In recent years, the OPC standard has grown into the standard interchange format in process automation, while the use of XML (extensible markup language) has grown as a parallel methodology.

Indeed, OPC is no longer an acronym and the technology is simply known as "OPC," and applies to more than just process control. The WBF and the ISA88 and ISA95 standards organizations have been instrumental in developing the special-purpose variant of XML called B2MML, or "Batch to Manufacturing Markup Language" to use in conjunction with OPC and the other data interchange languages.

> The OPC-UA standard holds the potential to finally allow automation software applications to readily plug-and-play together.

OPC has very little connection any longer with the original OLE standard Microsoft created. Recently the OPC Foundation released OPC-UA, designed to be a "universal architecture" for process data interchange.

OPC-UA can be implemented with Java, Microsoft .NET or C, eliminating the need to use a Microsoft Windows-based platform of earlier OPC versions. UA combines the functionality of the existing OPC interfaces with new technologies such as XML and Web services to deliver higher level MES and ERP support.

So what does all this three letter alphabet soup mean? The Holy Grail of process data interchange is to be able to use software that can be made up of existing building blocks, like a Lego set, so that nobody ever has to write dedicated custom code to do any project or do any interconnection between software packages or applications.

According to many experts, the various projects like OPC UA, B2MML, MIMOSA, OAGIS and the various versions of XML are getting closer to that point. Add to this movement the drive at the international level under the aegis of the IEC to do the same for programming software platforms for programmable controllers, and we're getting close to having modular object building blocks for building the applications that we need. And we can get on with the jobs we need to be doing: improving the efficiency, productivity and capability of our process manufacturing plants.

Software applications like building blocks… that's what we see in the future of control. ■

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Upstairs, Downstairs

Data going up, data going down? Engineers and IT shake hands in the middle as OPC gives way to XML, Web Services

by Bob Sperber

About a decade ago, Kris Zywicki began studying ways to make Dow Corning's information technology (IT) infrastructure as high-performance as the silicones it produces. Starting at the company's hometown plant in Midland, Mich., he zeroed in on calculating the costs and risks of manual data entry on both sides of the production process, from enterprise resource planning (ERP) to the plant's distributed control system (DCS).

By 2002, integrated data between the two platforms was saving the plant $650,000 a year. "Today," Zywicki says, "just by doing automated data transfer, we're looking at $4 million in cost avoidance." And Zywicki, Dow Corning's enterprise integration architect, continues standardizing and streamlining systems across more than 15 plants in the Americas, Europe and Asia.

So far, the company has implemented a single, global instance of SAP business software serving 9,000 users. Operational systems in various stages of implementation include laboratory, maintenance and historian/data-manager systems. Control platforms have been whittled from "just about every system you can name" to four.

Manufacturing and software standards are converging to produce a fundamental flattening of the DCS architecture. Today, instead of proprietary interfaces and custom programming, engineers and IT management can find common connections in standards that grew from Windows and the Web.

Today, penetrating a firewall is getting as easy as Web browsing. But before going Pavlovian at the prospect, and leaving the security issues inherent in this arrangement aside for the moment, engineers have to ask questions of such Zen-like simplicity, the answers aren't always obvious.

- What data do I need from the business system to run my process better?
- What data does the business need from me to run the plant better?

Data Down, Data Up

Most plants aren't very integrated; reports circulating in the process industries indicate that fewer than 10% of plants have actually achieved a data path from the DCS up through the plant and into the ERP system.

Most orders and reports are still shared using email,

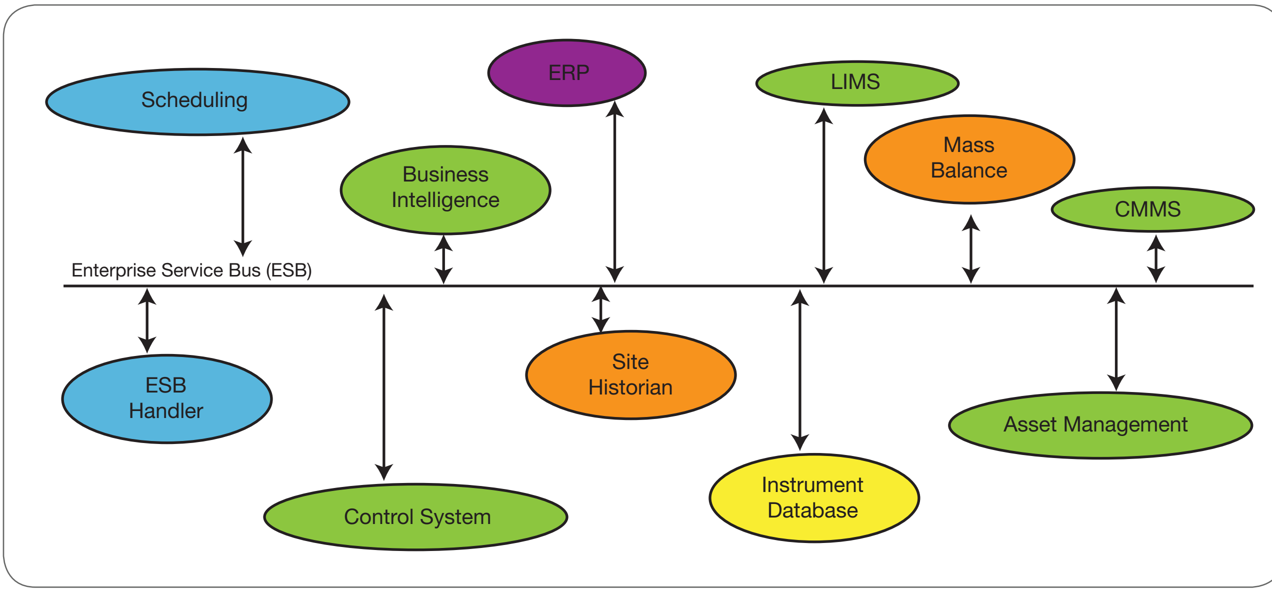

Figure 1. Service-oriented architecture simplifies the links between "upstairs" and "downstairs."

phone calls, whiteboards and spreadsheets, "but we are seeing more and more requests from our DCS users to automatically receive schedules, says Dave Emerson, director of Yokogawa's U.S. development center (www.yokogawa.com/us). Likewise, he says, production, compliance and quality reports coming up from the DCS should be automated at any reasonable cost. At the top of the ERP-to-plant data pipe, a single human error can foul up inventories and schedules for days or weeks, and be discovered only when when trailers and tankers pull up or away.

The data an ERP system sends down to the plant depends on the bill of material. At Dow Corning, data import/export varies with batch, semi-batch and continuous processes. In addition to tracing and tracing material inputs betweeen the DCS and SAP, production reporting up from the DCS is typically every four hours for, say, a week-long production run; batch reports are sent at the close of each batch.

"The whole business workflow is affected by these reports, so we can't allow plants to under-produce or over produce or run out of raw material," Zywicki says. Before his SAP-to-DCS integration project, he says "process schedulers would create process orders in SAP, then go back to the batch execution system and retype the whole production schedule—date, time, materials to be made, resources to be used... it was a lot of work, and mistakes happened."

Typically the first data DCS users start integrating are final production outputs—number or barrels of oil filled, gallons of gas, liters of material. But getting to and making use of even this low-hanging fruit has its challenges. Integrator Dennis Brandl, president of BR&L Consulting (www.brlconsulting.com), says, "the hardest thing is to figure out what that data actually means, to understand the production context."

Single-value data transmissions are obsolete; today's plants and businesses require much bigger data containers and manufacturing-specific software interfaces that can handle "full, complex pieces of information; we're talking about whole histograms of data," Brandl says. "That kind of integration requires you to build processes on your shop floor or into your DCS system to keep collecting data and making calculations on it. That's when integration gets harder."

Use the 'App' Map

Brandl's into building processes; he's chair of the ISA committee behind the ISA88 batch standard and editor of the ANSI/ISA95 family of control-to-enterprise integration standards. With roots in Ted Williams' early-1980s' Purdue Reference Model, "95" provides a model that end users, integrators and vendors can share in integrating applications at key layers in the enterprise. (For details on this model go to www.controlglobal.com/0810_Integration.html.)

Only a fraction of production data need ever reach the business office in any direct fashion. "Only about 10% of management data is exchanged with operations management applications; and only about 10% of operations management data is exchanged with the business side," says Dave Woll, consulting vice president with ARC Advisory Group. "Every step up represents less information by an order of magnitude."

ERP may "own" cost accounting, and control systems may "own" loop parameters, but there's lots of functional overlap, in particular, at ISA5 Level 3. So while DCS and ERP vendors offer interfaces between their systems, usually the con-

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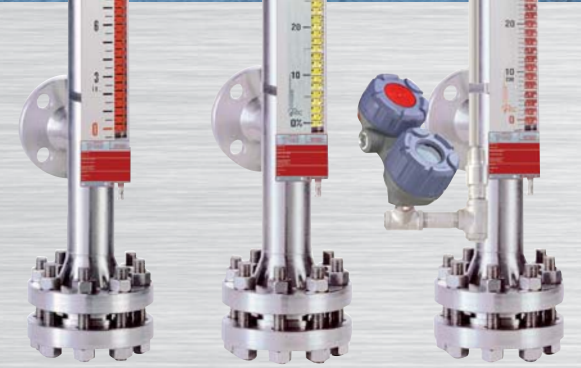

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6646 Complex Drive • Baton Rouge, LA 70809 • 1-866-556-7466 • info@orioninstruments.com nection is through the DCS vendor's historian, which reaches up to Level 3, which serves as a demilitarized zone to negotiate the architectural conflicts between real-time control processors and transactional business systems. It provides that middle zone where key enabling technologies meet.

For Zywicki's ERP-to-DCS integration project at Dow Corning, RLINK, part of OSI's Pi System (www.osisoft.com), provides the data map from above and below.

Ask a Historian

Historians and application databases have been relatively easy to access from above or below using SQL Server-type databases. Since the early 1990s, Open Database Connectivity or ODBC has provide a standard way to map data paths between business and plant systems' relational databases.

In the mid-1990s, OLE for Process Control (OPC) advanced this mapping. The most familiar OPC protocol, DA (Data Access) provided a format to map data in real time and made custom drivers, such as the drivers that were once the basis for many a HMI/SCADA software vendor, obsolete. Another OPC protocol, AE (Alarm and Events), offers transactional, on-demand transfers; a host of others protocols specifically address historical data, batch data, server networks and a platform-neutral XML documents. The latter illustrates the convergence of IT and Web standards in the plant, which is no longer the exclusive domain of engineers.

The most ambitious OPC standard further reflects this. The first draft of OPC UA (Unified Architecture) was released in February 2008, with a final approved specification planned by year's end. "UA" combines all OPC protocols into one, while shedding its Microsoft underpinnings for one based on a service-oriented architecture (SOA) that follows the World Wide Web Consortium's Internet standards. But UA will be years in coming.

"The link between the DCS and the plant data system has become easier with the maturing of OPC," says Pat Kennedy, CEO of OSIsoft. "The real issue is configuration and maintenance, not installation. Also the systems are getting so big that some sort of meta data is useful to understand the information, and this has to be configured too."

Integrator Timothy Alosi, vice president of engineering services with New England Controls, Mansfield, Mass., knows it. To connect two computers with OPC servers via an OPC mirror in an Emerson Delta V DCS, he first "sat down at one computer and pinged the other one by IP address. Then I pinged it by name; then I created a shared directory on each side, and logged-in with the user I thought we'd use for this computer. Then I checked to see if I could browse for the user and if I could copy files back and forth. Also in my Delta V, I had to set user priveliges for the right process areas... and I hadn't even gotten to OPC yet!"

The two computers were sitting next to each other with nothing but a cable between them. Alosi says connections become exponentially more complicated by network swtiches, and "once you want to connect to another site, it's essentially impossible. I've seen engineers pull their hair out and do a lot of yelling and cursing for two weeks to make an OPC connection work."

Markup of Maturity

In the control arena, all DCS vendors either offer a historian or tie to others, and they are typically installed with a firewall above. This presents problems for OPC, but not for SOA-generation tools such as Web services and XML that, by design, can traverse firewalls with the ease of Web browsing. And both have their purpose for plants trying to bring data above and below the firewall.

"OPC is well known and understood by control engineers, and Web services are well known and understood by the IT guys," says Yokogawa's Emerson,


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Web It

For more information of integration standards and techniques, log on to the following Web sites.

- OPC—www.opcfoundation.org
- B2MML, BatchML—www.wbf.org
- WBF, The Forum for Automation and Manufacturing Professionals—www.wbf.org
- ANSI/ISA95—www.isa.org/standards
- SOA/World Wide Web Consortium—www.w3c.org
- Purdue Reference Model—www.pera.net/Pera/Wha_Ref_Model.html

whose latest DCS architecture offers Web services. A few, or possibly a single engineer at a site will want to learn enough XML to convert ERP-level data into operational or control systems, so "the guys doing the control applications and function-block work won't have to worry about it," Emerson says.

This will make life easier in the real world for empathetic IT leaders who seek to keep engineers "as far from becoming IT specialists as possible, so they can focus on engineering their products and processes," says Zywicki, who is co-leader of Dow Corning's global SOA initiative.

The WBF organization's XML committee, which Dave Emerson chairs, is in its fourth release of Business To Manufacturing Markup Language (B2MML), a set of XML schemas based on ISA95 data models. Co-authored by Brandl, B2MML provides a royalty-free, common data roadmap. At present, the data mapping is still a manual affair, but broad adoption could lead to automation analagous to OPC's elimination of custom software drivers more than a decade ago.

At minimum today, SOA, Web services and XML serve as the state of the integration art and a utilitarian software linga franca. ■

For more go to www.controlglobal.com/0810_Integration.html.

Bob Sperber is a contributing editor to Control.


Distance Measurement

The **Gaming** of **Modeling** and **Simulation**

Tomorrow's control engineers are playing today's computer games, with their realistic simulations. Will tomorrow's process simulators and modeling software adopt game technology?

by Rich Merritt, contributing editor

Back in the day (circa 1979), the engineers at Electronic Associates (EA) in Monmouth Beach, N.J., let me cause my own "Three-Mile Island" incident using one of the simulators they built to train nuclear plant operators.

Those 1979-era simulators consisted of a complete replica of a nuclear reactor's control room, with all the single-loop electronic controllers and panel readouts connected to a minicomputer simulating the reactor. The instructors at EA showed me how to "scram" a reactor. They led me through the entire process, saying, "Shut off the feed-water pump. Close this valve. Ignore that alarm." I uncovered the core, and scrammed the simulated reactor. Great fun!

At about the same time, the movie "The China Syndrome" was released, and scared audiences with the near-meltdown at a fictitious nuclear plant. The hero, a control engineer named Jack Godell, keeps telling everyone there's a problem with a pump, but no one listens. If the Godell character had had modern computer modeling and simulation software, he could have fed all the vibration data into a simulator, the computer would have predicted the outcome, and he wouldn't have been machine-gunned for his troubles.

Fast-forward 30 years, and the folks at video surveillance vendor Longwatch (www.longwatch.com) have built the simulator Godell needed. Longwatch president, Steve Rubin, explains, "We took some clips from "The China Syndrome," and put them on an HMI screen to illustrate what such a simulation might look like to an operator."

In the simulation, the HMI screen first shows normal operation, then an alarm goes off, and the video switches to a "live" camera in the pump room. We watch as the pump shakes itself to death and falls to the floor. [Go to www.controlglobal.com/0810_Simulation.html to see this video and others. The direct link to the video is www.controlglobal.com/0810_SimChina.html.]

The pump animation in "The China Syndrome" was the result of 1970s movie magic, using mainframe computers with about the same computing power as today's PlayStation 3. But we've come a long way since then, with video gamers leading the way. For example, in the new iRacing racing simulator (www.iRacing.com), the builders laser-scanned in each race track to "replicate the personality, eccentricities and challenges of the track with mathematical precision." [ⓘ To see this realistic simulation in action, go to www.controlglobal.com/0810_SimRacing.html.]

So the question is, can we use the same technology for future process modeling and simulation software? Why would we want to?

Getting Down With Graphics

HMI screens have improved in recent years, mostly in the area of graphics. Today, process control equipment and icons are downright realistic. Marcia Gadbois, vice president of business development for InduSoft (www.indusoft.com), says these HMI graphics lend themselves to modeling and simulation. "When running a simulation, we can make the valves open and close, the pumps start and stop, tanks fill and empty, and show variables changing on the screen."

Figure 1. This realistic racing simulator uses laser-scanned images of tracks.

But going much beyond this level of graphics in the process control industry is probably unlikely. Companies are not going to laser scan their process areas, so they can be animated on an HMI screen. Though CAD packages can certainly show a 3-D representation of a process unit, what would be the point? There really isn't anything to see. In a process plant, most action takes place inside things like batch reactors, tanks and distillation columns.

N-D Better Than 3-D

Robin Brooks, managing director of process improvement software vendor Curvaceous Software (www.curvaceous.com), advises thinking beyond 3-D

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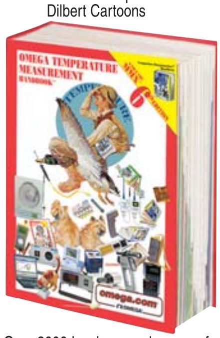

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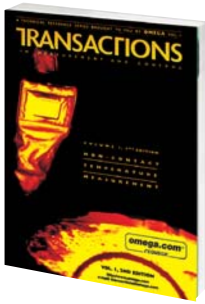

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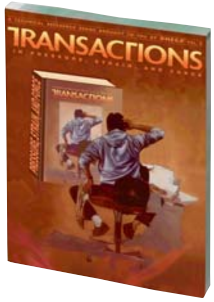

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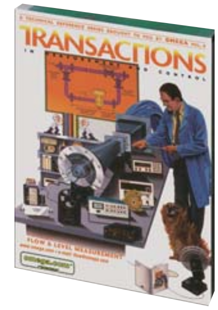

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graphics to multiple dimensions (N-D). "We see the future as N-D with process operation and alarms and alerts tamed and seen in context," he predicts. "N-D lets operators see many more variables with alarms and all the interactions between them, and is capable of eliminating alarm floods. How much interaction? Probably less than today, because controls will get better and better, and operators will be forced out of the loop. Start-up and shutdown will be computer-controlled for increased safety. Their role will be limited to deciding what to do in cases of genuine equipment failure only."

In Curvaceous' N-D simulation of a multi-phase batch process, which runs at about 100x real time (batch processes are slow in real life), black dots are variable process variables, red indicates an alarm, and blue is corrective advice for open or closed-loop use. Green lines are multi-variable control limits. An operator just has to keep the black dots inside the green lines for a perfect batch. [ℹ (Go to www.controlglobal.com/0810_SimCurv.html to see this simulation.]

Longwatch's Rubin agrees with Brooks about operator functions. "Watching an HMI screen has been described as long periods of boredom interrupted by moments of panic," says Rubin. "If an alarm occurs, operators leap into action. If the plant has video connected to the HMI screens, a camera shot can be instantly put on the HMI screen, so the operator can see what's happening out in the process unit. It might be a leak, a tank overflowing, or some other visual event." Rubin thinks video is a better solution than animated graphics for simulations. "All these video snapshots can be archived for future use in a computer model or simulation," he says. "Then, when the simulation says a tank will overflow, a video snapshot of the tank actually overflowing could be put on the screen."

Tim Gellner, director of operational consulting at systems integrator Maverick Technologies (www.mavtechglobal.com), Columbia, Ill., says better graphics with higher resolution aren't needed. "The sole function of graphic displays is to provide the operator with timely, easily digestible information about the process being controlled and to facilitate the operator's ability to make the correct decisions when a process upset occurs," says Gellner. "Unless better graphics can enhance this functionality, they may just be glitz. On the other hand, when using simulation tools for analyzing work streams and product flows through a facility for optimization purposes, the more realistic the graphics, the better the simulation, and the higher the impact."

Greg McMillan, principal consultant, Emerson Process Management (www.emersonprocess.com), adds that, "Graphics aren't as important for process and control system design studies, but they sure help sell the idea and impress users—particularly the ones holding the purse strings."

Jonathan Phillips, Arena Simulation (www.arenasimultion.com) product manager at Rockwell Automation (www.rockwellautomation.com) agrees. "Simulations with detailed animation aid in selling whatever is presented," he says. "Also, they can help when the audience may not have a great understanding of the system or isn't focused on its minute details, such as an engineer presenting a proposal to accountants about a capital expenditure."

Animating Automation

Discrete automation simulations generally have better graphics than process modeling. "Discrete automation simulations benefit from detailed visualization," says Hosni Adra, product manager/partner at CreateASoft (www.createasoft.com). "Graphics help identify where a robot can be positioned in relation to parts and other equipment to improve efficiency and performance."

For example, CreateASoft built a Simcad simulation of a 300,000 sq ft warehouse. "The company needed to improve efficiency of its put-away process with available material handling equipment," explains Adra. [ⓘ Go to www.controlglobal.com/0810_SimWarehouse.html for this video.)

Proposed changes included moving racks further apart and losing one rack of capacity, but the Simcad simulation showed it would work. So, the company reduced head count and improved velocity, and reduced put-away time from 7 hours to 3.5 hours. In the video, you can see simulated robots, AGVs and people scurrying around the warehouse.

Likewise, Molded Fiber Glass (MFG, www.moldedfiberglass.com) in Ashtabula, Ohio, produces parts from polyester resins and fiberglass reinforcements (FRP). Robert Morrison, MFG's founder, says they used Simcad to model a composites manufacturing plant. "The model required tracking multiple variables including cycle times, labor costs, and manpower utilization," he says. "The goal was to detect and identify bottlenecks, and reduce overall production costs. Using Simcad's graphical interface, MFG built the model representation of the manufacturing line, and then added manpower allocation and cost detail."

Worth More Than a Thousand Words

It's hard to just talk about simulation. You need to see it to truly grasp the exciting possibilities it offers for process operations. Below is a list of the links on ControlGlobal.com to the simulation videos referred to in this story.

The China Syndrome
www.controlglobal.com/0810_SimChina.html.
This video from Longwatch that would have saved Jack Godell's life. In the simulation, the HMI screen first shows normal operation. Then an alarm goes off, and the video switches to a "live" camera in the pump room. We watch as the pump shakes itself apart and falls to the floor.

Speed Racer
www.controlglobal.com/0810_SimRacing.html.
In the new iRacing racing simulator (www.iRacing.com), the builders laser-scanned each racetrack to replicate the personality, eccentricities and challenges of the track with mathematical precision. This video from Grassroots Motorsports magazine (http://grassrootsmotorsports.com/), shows a driver running an iRacing simulation,and explains how the simulation was done.

Better than 3-D for Batch
www.controlglobal.com/0810_SimCurv.html
N-D lets operators see many more variables with alarms and all the interactions between them and is capable of eliminating alarm floods. In the video black dots are variable process variables; red indicates an alarm; blue is corrective advice for open- or closed-loop use. Green lines are the multi-variable control limits. All an operator has to do is keep the black dots inside the green lines for a perfect batch.

Warehouse Robotics
www.controlglobal.com/0810_SimWarehouse.html
Discrete automation simulations have much better graphics than process modeling, probably because it's important to see what the equipment is actually doing. This video is a Simcad simulation of proposed changes to a 300,000-sq ft warehouse. In the video, you can see simulated robots, AGVs and people scurrying around the floor of the warehouse.

Helicopter Controls
www.controlglobal.com/0810_SimHeli.html.
See the online continuation of this story for the solution to control problems in a helicopter control system involving three interacting PID controllers. Engineers used LabView to put the data into the simulator, create a model and run tests. The simulated control had 10 times better response than the helicopter's standard control system, and the final control algorithms in the simulator could be loaded directly into the helicopter controller.

Using results from Simcad's animation and line analysis, MFG found its bottlenecks, adopted a proces flow that saved one man hour per part, maintained current production rates, and reduced labor required at the plant.

Driving a Simulator

Tomorrow's engineers, accustomed to the fast response of computer games, will be bored with traditional process simulators.

"Traditional simulation requires an operator to generate and pass code to a computing engine, which then has to be compiled," explains Adra. Once the simulation starts, changes can't be made in a traditional simulator.

The first step in a dynamic simulation, then, seems to be automating the way a simulation is set up.

"ExperTune's PlantTriage software uses active-model capture technology to develop process models from normal operating data," says George Buckbee of ExperTune (www.expertune.com). "The software monitors the process 24x7, finding, qualifying and storing models in a database, so they're ready for use. This software helps engineers develop a detailed understanding of the dynamic process response. With these models, they can choose control strategies and tuning for optimum process results."

For instance, Eli Lilly pulled historical data, and fed it into ExperTune's PID Loop Optimizer to develop dynamic process models of a bioreactor. These model pairings were then used to develop an MPC controller. It was tested offline in a simulator before implementation in the real reactor.

As for "driving" a simulator, many "traditional" simulators can do it. Gellner says, "Even in simple loop-back simulations you can modify parameters on the fly by testing controllers' responses under well-defined and documented scenarios."

However, vendors don't promote dynamic simulation very well. Perhaps because it's new ground, and many vendors are busy preparing next-generation simulators. Vikas Dhole, vice president of engineering product management at AspenTech (www.aspentech.com), agrees this is possible, but yet scarce. "On-demand decision support provided via real-time simulations is available," Dhole says. "The challenge is combining a simulation tool's technical capabilities with a graphical interface that can interpret data quickly and easily. Though these two elements are converging, less than a handful of commercial players are able to support such product development, and even fewer have something available currently." ■

Rich Merritt is a Control contributing editor

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What We Think We Know about UPSTREAM Straight Run

Current research suggests that "popular wisdom" may be wrong.

by Richard A. Furness and David W. Spitzer

Sometimes data flies in the face of what we've been taught for generations. People thought the earth was "flat" for most of recorded history. Its flatness was accepted as fact (at least by all but a few of the most forward-thinking people) until it was mathematically proven otherwise. Only in 1492, did Columbus sail the "ocean blue" in a westerly direction to find a path to India, and even then he didn't succeed. Pictures of the round Earth became available only 40 years ago as a byproduct of space exploration and courtesy of NASA's Apollo missions.

Now we're confronted with the another "flat Earth" meme, this time in the case of flow measurement. What we "know" regarding upstream straight run distances and what we've recently found appear to be in conflict.

What We "Know"

Flowmeter operation is based on geometry in conjunction with a measuring principle. For example, differential pressure flowmeters present a restriction to the flow across which a differential pressure related to the flow rate is produced. Generating the proper differential pressure depends on the presence of a fully developed, uniform, symmetrical and non-swirling velocity profile upstream of the flowmeter.

Distorted velocity profiles, such as those occurring downstream of a pipe fitting or throttling valve, can change the relationship between the flow rate and the differential pressure produced, because the swirl causes unpredictable and

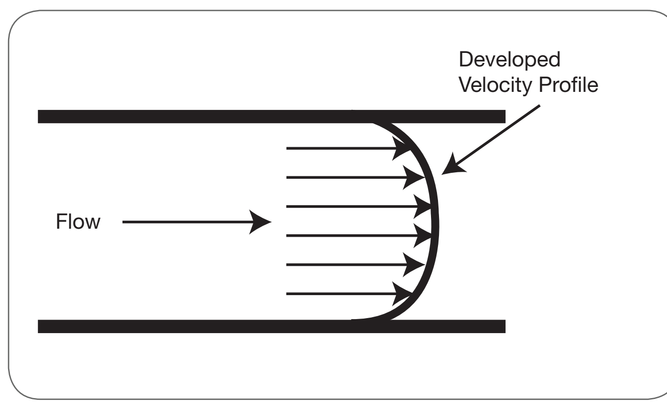

Figure 1. Developed velocity profile free of distortion. This is an ideal difficult to reproduce outside of textbooks.

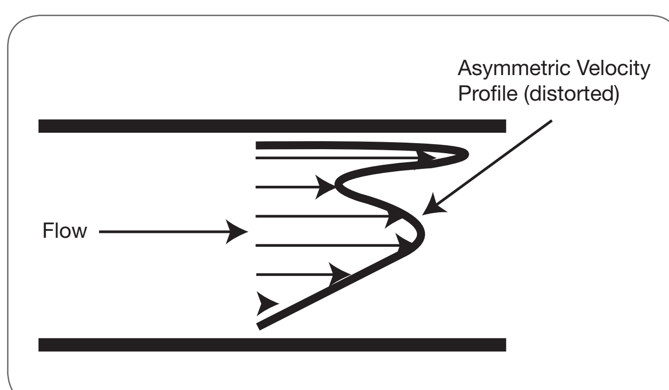

Figure 2. Distorted velocity profile caused by unstable and unpredictable velocities at the pipe wall.

unstable velocities at the pipe wall that manifest as pressure changes that affect flow measurement. Similarly, multiphase flow conditions can alter this relationship, but in a different way (Figures 1 and 2).

One method of generating a fully developed, uniform, symmetrical and non-swirling velocity profile is to allow the fluid to flow in an infinitely long straight pipe. This geometry allows distortion produced after fittings, valves and pumps to attenuate and produce a velocity profile similar to that presented in textbooks, standards and installation guides. However, this installation is impractical due to its excessive length.

> What we "know" and what we've recently discovered appear to be in conflict.

From a practical standpoint, flow profile effects can be reduced if sufficient pipe diameters of straight run are installed upstream of the flowmeter so any remaining distortion present doesn't affect the flowmeter significantly. The upstream straight run required varies with flowmeter technology and the complexity of the upstream piping configuration—and more than the nearest fitting to the flowmeter needs be considered. The minimum upstream straight run requirement for a given flowmeter, piping configuration and size can be determined by testing the flowmeter with different lengths of upstream straight run. Testing generally shows that the upstream straight run (expressed in pipe diameters) required is essentially independent of pipe size. Therefore, the minimum number of straight runs required to achieve accurate flow measurement typically is expressed in pipe diameters and published in tables or graphs. As such, standards do not give adequate guidance on the effect of pipe diameter on flow measurement—especially in sizes above 24 in.

In the previous century, the rule of thumb was to install flowmeters with 10 diameters of upstream straight run and five diameters of downstream straight run. A more detailed investigation of the requirements for different flowmeter technologies reveals that some flowmeters require longer straight runs, while others operate properly with less. Excessive straight

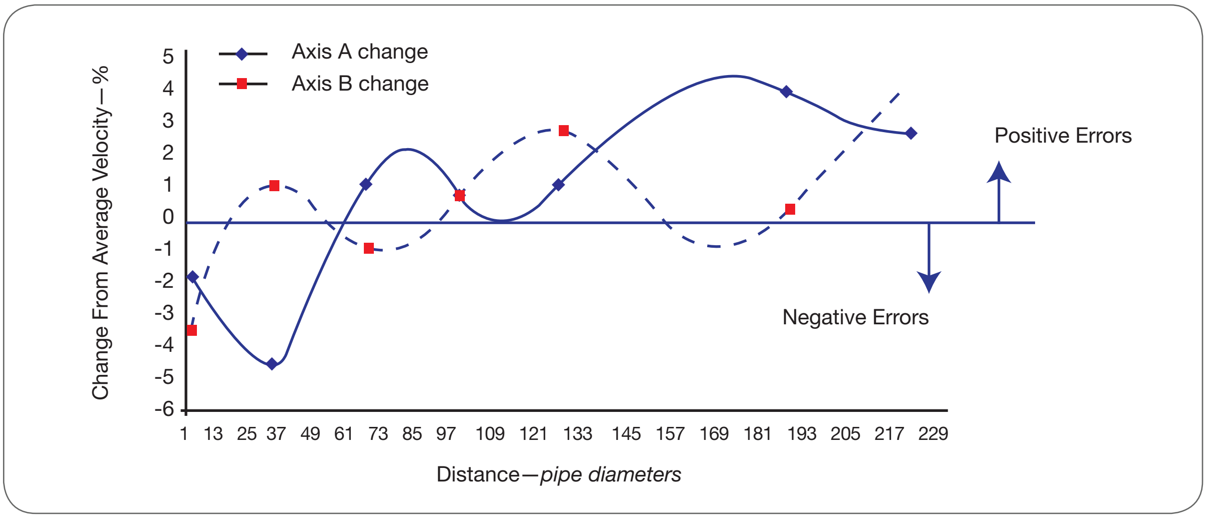

Figure 3. Flow velocity errors in a 48-in. straight pipe.

runs can have economic penalties in installations where acceptable flowmeter accuracy can be achieved using a shorter upstream straight run. However, insufficient straight run can adversely affect the performance of a flowmeter installed with only 10 diameters of upstream straight run This is especially true where 40 diameters (or more) are required for accurate flowmeter operation, such as when a large-diameter orifice plate is downstream of multiple bends.

Though it's incomplete because initial testing was only done on small pipes, this body of knowledge was developed over decades, and it's presented in textbooks, standards and installation guides. It shows that a flowmeter installed in a piping configuration requires a minimum number of diameters of upstream straight run to ensure accurate flow measurement. This distance was shown to be adequate for the decay of disturbances in pipes smaller than approximately 12 in. Further, it's generally accepted (but not stated) that the straight run requirement (expressed in pipe diameters) is independent of pipe size. Stated differently, the number of upstream pipe diameters required for accurate measurement is independent of pipe size.

What We Found

Recently, experimental work in sev-

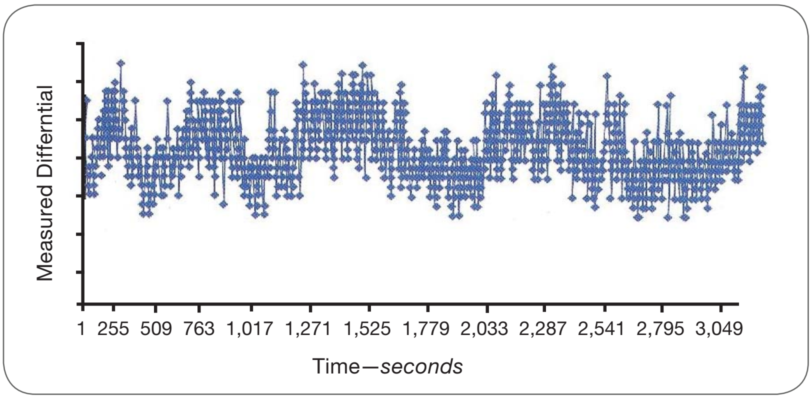

Figure 4. Measured pressure difference between opposite sides of pipe.

eral parts of the world has yielded a different picture. Flow velocities at right angles to each other were measured along a 200-diameter section of straight 48-in. pipe in South America. Given what we "know," we'd expect to measure indications of velocity profile distortion (velocity error) within the first few diameters of pipe (say 5Ds to 15Ds), and a uniform velocity profile downstream of this section after the distortion attenuates.

The results of velocity testing (Figure 3) show that indications of velocity profile distortion extend throughout the entire 200-diameter section without any reduction. The magnitude of the velocity errors was between -4% and +4%, depending on position along the pipe section. Also, the velocity error actually increased beyond 100 diameters!

These results are explained by the presence of rotational distortion (swirl) that doesn't readily attenuate in large pipes. Flow testing indicates that swirl is attenuated in relatively small pipes because that swirl is in relatively close contact with the pipe wall, so the effect of wall friction influences all parts of the flow area. However, in large pipes, the swirl has far less contact with the pipe wall. In one of our studies of a large pipe (over 4 meters in diameter), the pipe wall had a negligible influence in the main body of the flow. By way of explanation, the momentum inherent in the swirl increases with the mass flow (in three dimensions), whereas the pipe wall

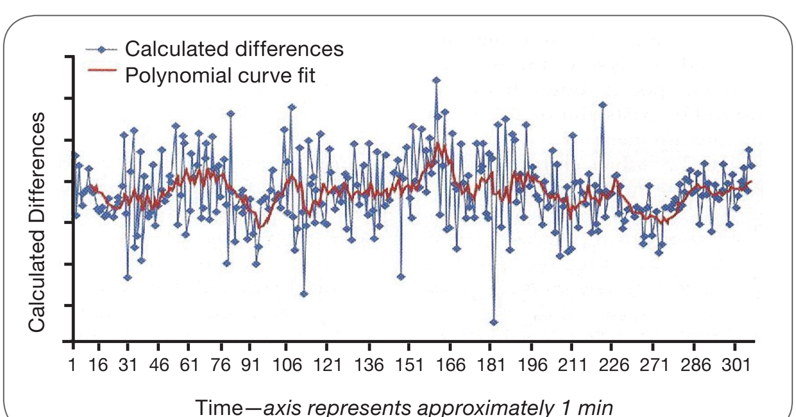

Figure 5. Calculated flow differences – high flow.

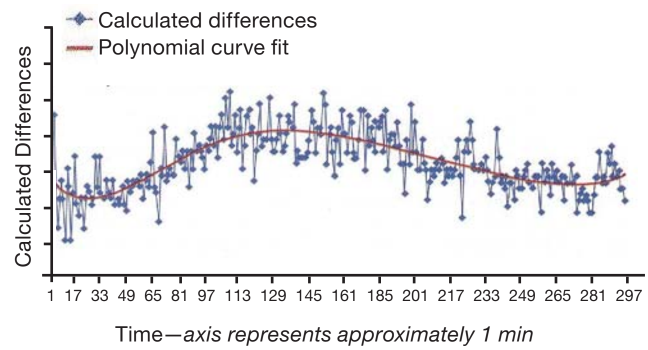

Figure 6. Calculated flow differences – low flow.

surface increases with its area (in two dimensions). Therefore, the ability of the pipe wall to attenuate swirl should decrease as pipe diameter increases.

A large differential pressure flowmeter in North America was installed with its recommended 5 diameters of upstream straight run. Operators reported differences between flow measurements made on opposite sides of the flowmeter, which we subsequently confirmed by more detailed experimentation. One would expect pressures on both sides of the flowmeter to be identical. However, the pressure difference between taps on opposite sides of the pipe were quite different and oscillated (Figure 4). The operators also found that introducing a flow upstream of the bends affected the flow measurement by as much as 10%. Please note that this observation is anecdotal and hasn't been tested rigorously.

Introducing a flow upstream of the bends affected the flow measurement by as much as 10%.

In this installation, the flowmeter was installed downstream of two large bends located within 2 diameters of one other. A general rule of thumb is that fittings within 5 diameters of one other generally create swirl. Bends in different planes, complex valves and pumps are similarly troublesome, and generate different profiles in different planes at the same position along a pipe. The differences in the static wall pressure at the flowmeter inlet, plus the oscillating pressure difference between upstream and throat taps on opposite sides of the pipe, is an indication of the presence of bulk swirl in the line.

The differences between flow measurements taken on opposite sides of the flowmeter also oscillated with different periods under high and low flow conditions (Figures 5 and 6). In particular, doubling the flow reduced the period of oscillation by about half, while the flow measurement bias

Figure 7. Swirl encrustation "fossilized" onto straight pipe wall.

errors varied from –1.5% to +1%. This shows that swirl depends on flow rate.

Furthermore, physical data also is available to support the premise that swirl propagates down large pipes more than just a few pipe diameters. Consider the photo of the interior of a 100-year-old water pipe installed as part of a water supply system in North America (Figure 7).

The pattern of encrustation on the pipe wall follows the average motion of the fluid over the century and reflects the presence of swirl in the flowing stream. The flowmeter in this particular installation exhibited flow measurement errors that equate to millions of dollars of revenue. Theory developed in the 1950s in the U.K. hinted this may be the case, and now we've observed it.

What Next?

The extent to which swirl can be present in large pipes calls into question what we "know" about the upstream requirements for flowmeters in large pipes. The magnitude of the potential flow measurement errors caused by these results can be significant—regardless of flowmeter technology. Further, the upstream straight run requirements in flowmeter standards and manufacturers' recommendations may be woefully inadequate to reduce the influence of swirl in large pipes effectively. Further investigation is necessary (and is on-going) to quantify these effects and/or develop standardized techniques to detect and mitigate the effects of swirl in large pipes. We plan to report the findings as the data is gathered and analyzed. ■

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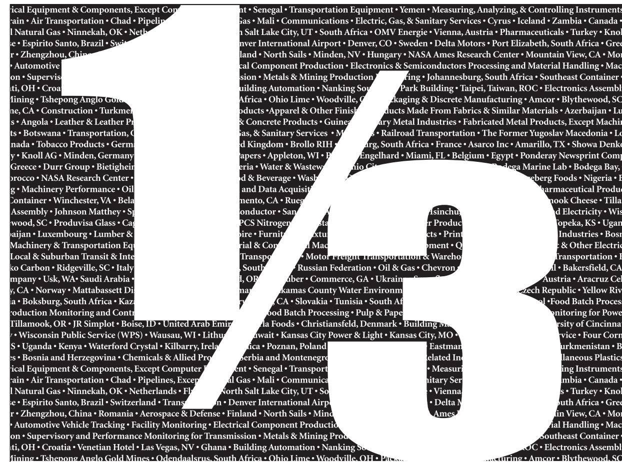


PE Registration Versus ISA CAP Certification

Professional Engineer or Certified Automation Professional: Which certification is best?

by Paul Darnbrough PE, CAP

Stop me if you've heard this one. A doctor, a lawyer and a controls engineer are led to the guillotine for various professional crimes. The doctor is first in line, but the falling blade jams halfway. The executioner spares the man, declaring divine intervention. The lawyer is second in line, but again the falling blade sticks and the man is spared. Finally, the controls engineer is marched up, but before he enters the device he looks up, points and says, "I see your problem, it's right there in the actuator."

Engineers tend to help themselves less than other professionals do. Everyone is familiar with the rigorous schooling and exams that doctors, lawyers and accountants must pass before practicing, and few would argue for any easier benchmark. Certification and licensing for control systems practitioners is not as widely known, but they're no less important for these professionals, the companies they work for and the public at large.

Why Do You Need Professional Credentials?

Every profession wants to improve its practitioners' technical competence, and the process of obtaining credentials helps achieve that goal. In addition to familiarizing professionals with applicable codes and standards, this process contributes to better practices, results in safer designs, increases breadth of understanding and improves standardization and efficiency.

The process also benefits employees and employers. Potential employees gain a documented means to demonstrate their qualifications to potential employers. Employers have some assurance of the competence for new hires, and they can represent qualifications of credentialed employees to customers.

Certification and licensing work in conjunction with a formal education and work experience to provide a level of personal prestige in industry. Furthermore, they encourage an employment structure where senior personnel provide training for newer employees along with a means to hand down practical experience. The Professional Engineering (PE) process, in particular, requires senior PEs to provide references for engineers planning to take the test.

To PE or Not to PE

PE licensure was first developed around a century ago at the state level to ensure that public works were designed safely. Today the major PE disciplines parallel university engineering degrees: civil, electrical, and mechanical.

Though PE licenses are state-specific, the National Coun-

TABLE 1: PE VS CAP		
How Hard Are They to Get?		
	PE	CAP
4-Year Engineering Degree	Required	Accepted, but not required
Other 4-year Technical Degree	Not accepted	Accepted, but not required
2-Year Technical Degree	Not accepted	Minimum requirement
Work Experience Required	6 years	5 years, or 10 years in conjunction with a 2-year degree
Application Process	Hard	Moderate
Cost (filing, exam, study)	<$1,000 initial	<$1,000 initial
Exams Required	FE and PE	Just CAP
Difficulty of Exams	Quite difficult. Two exams, each of long duration	Challenging because of wide range of topics

cil of Examiners for Engineering and Surveying (www.NCEES.org) represents and administers the examination process across the U.S. To obtain a PE, a person generally needs to get a four-year degree in the selected field, pass a Fundamentals of Engineering exam, obtain six years of professional experience under the direction of another PE, and pass a Principles and Practice of Engineering exam.

When you obtain your PE license in one state, you will often find that a path called comity will enable expedited licensing in other states. Once obtained, the PE can be renewed for life, although some states require continuing education units.

The PE license is a legal right to practice in a certain area of expertise. The title "engineer" is legally protected in many states, and usually a company offering engineering services must have a PE in a position of responsibility.

The major PE disciplines are called practice acts, meaning that persons holding these licenses also have the authority to sign and seal engineering drawings. Government engineering employees may be required to have a PE, and engineering work performed for government agencies usually requires a PE stamp.

Controls Systems Engineering (CSE) is not one of the primary PE fields, but instead is a fairly recent development available in many, but not all states. It is focused on process control topics and is supported by the ISA.

However, the CSE PE is called a title act, meaning that persons receiving this PE can use the title but have no authority for signing documents and drawings.

Captivating Alternative

This brings us to another professional certification, the ISA Certified Automation Professional (CAP). The CAP is a relative newcomer, but it has the goal of defining the control systems professional. As with the PE, the CAP is also intended for persons working at the highest levels in their field.

While the CSE PE focuses on process control, the CAP targets a wider range of automation topics to demonstrate competence in the entire field. As detailed on the ISA web site (www. isa.org), the control systems domains include feasibility study, definition, system design, development, deployment, and operation and maintenance.

The technical fields covered include continuous control, discrete control, reliability, safety, integration, software, maintenance, start-up, and engineering work structures. Economics and estimates are also covered.

Where the PE requires a four-year engineering degree, the CAP is open to those with a four-year technical degree so that physics, math and other similar majors may apply. There is also a path for two-year degree holders with extensive documented industry experience to obtain the CAP.

One final difference is that the ISA CAP bills itself as a worldwide program, which may be important to certain companies or industries. The PE, on the other hand, is specific to the United States, although many countries around the world offer similar engineering licensure.

Is the PE Worth It?

The PE is the most widely recognized credential, with the CSE PE most directly applicable to the control systems field and the Electrical PE a close second. In reality, almost no control systems work truly requires a PE stamp, yet obtaining a PE is a valuable demonstration of an engineer's training and experience.

My electrical PE has been valuable in my career. Those in the industry appreciate the effort involved in

TABLE 2: PE VS CAP, BENEFITS		
	PE	CAP
Accepted across U.S.	No, state-specific	Yes
Recognized worldwide	No	Yes
Legal recognition	Yes, in most cases	No
Industry Acceptance	High	Low, but growing
Peer Recognition	High	Low, but increasing
History/Tradition	Over 100 years	4 years

becoming licensed and many projects require a PE on staff.

My position as control systems engineering manager at KDC Systems (www.kdc-systems.com) has rarely called for me to stamp electrical drawings, but I constantly apply engineering principles in our work. Core members of our controls group include Mechanical PEs and Canadian PEs, and they bring exceptional value to our work.

I don't hold a PE in control systems, but a former colleague of mine does. *Control* senior technical editor Dan Hebert, PE, says, "I passed the California Control Systems PE exam in the mid-1990s. I found the exam to be difficult, but quite fair, as it tested for real-world practical experience rather than theoretical knowledge."

"I obtained a Louisiana Electrical Engineering PE a few years later. Because of comity, I only had to take a simple exam concerning principles and practices, with no technical test required," adds Hebert.

"I wanted to get a PE because of its industry-wide recognition. I also needed it so that I could get licensed in other states," says Hebert. "For me, the benefits of the PE have exceeded the time and trouble required to obtain the certification."

Should You Get a CAP?

With ISA's backing, and a system that allows qualified people from many technical backgrounds to take the test, there is every reason to believe the CAP will continue to gain momentum. It offers an option that works specifically for the process control industries.

In my case, the CAP was another avenue for professional development. Studying for the test was a valuable way to revisit topics I don't use on a daily basis and to identify areas where I needed improvement. The CAP tested me on topics outside of those covered by the electrical PE, but still key to a successful automation career.

Gerald Wilbanks, PE, vice-president at Documentation & Engineering Services in Birmingham, Ala., and member of the ISA CAP Steering Team, has produced a CSE PE study series for the ISA. He says, "CAP certification is a personal and professional attainment that provides documentation and clear proof that an individual has the tools and knowledge to work in the varied areas of automation. It has filled a true

DEFINING THE CONTROL SYSTEMS FIELD

Technical disciplines always cover a range of subjects, but the control systems field is particularly wide-ranging. Even a straightforward control system design requires proficiency with physical processes, mechanical equipment, electrical power distribution, control panel design, instrument and valve selection, and much more.

The work must be performed in compliance with a variety of codes, standards, and regulations, and the design must be drawn and documented, test plans created and executed, and field commissioning performed.

Doctors, lawyers and accountants enter their professions by way of specific higher-level education and degrees. Control systems professionals, on the other hand, follow a variety of paths. Some are degreed electrical, mechanical or chemical engineers who gravitate to controls. Others are mechanics, maintenance personnel or technicians who become proficient with one type of equipment and then expand into other types or gain expertise with associated computer software.

Universities typically do not offer control systems degrees, and when they do, they are often math-based specialties or minors of other degrees. There is value in having a theoretical understanding of control algorithms, but much of the actual work in industry revolves around applying commercial off-the-shelf components to offer a complete solution.

How do you certify such a profession? The goal of the CSE PE and the CAP is to answer this question.

need by providing recognition for individual achievement for those who may or not be engineers."

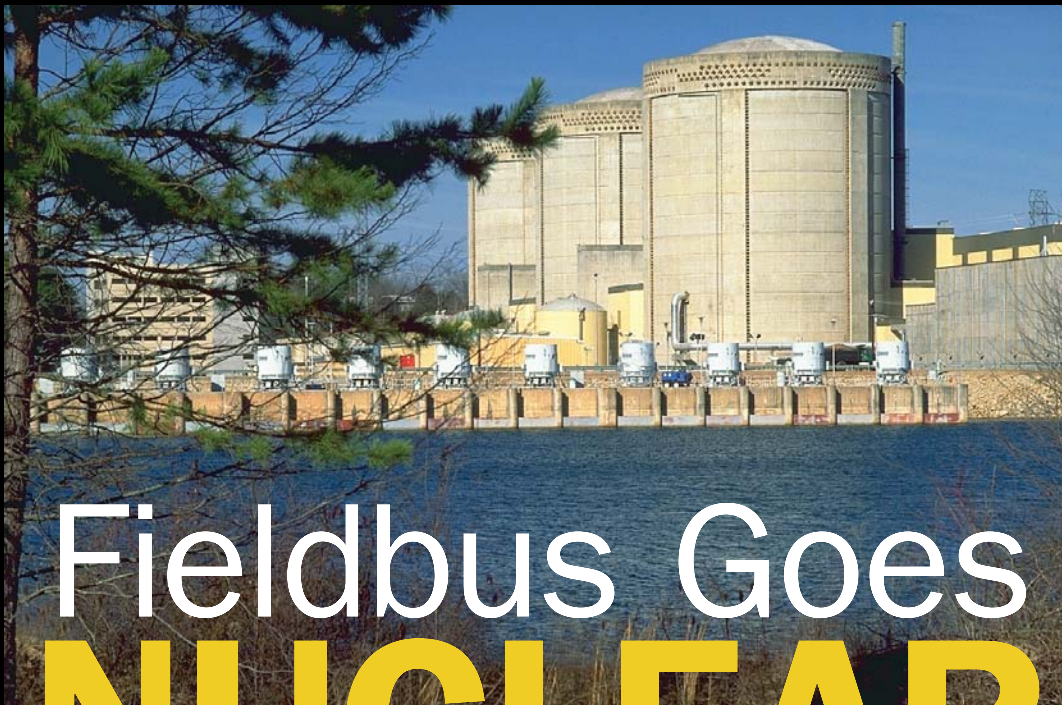
What's Best for You?

Each person must decide which certification, if any, is more applicable to his or her work intent and career development. It is desirable to become both a PE and a CAP.

I would always encourage degreed engineers to pursue the PE in their discipline as soon as possible in their career. If you know you are focusing on the process control industries, then the CSE PE is a good option to obtain an official engineer title. However, keep in mind the possible limitations of the CSE PE not being a full practice act.

Likewise, obtaining the CAP should be a goal of all automation professionals. If you are already targeting the PE, then the CAP can be obtained concurrently or later. There is no downside to achieving widely accepted and high quality credentials in the control systems field. ■

Paul Darnbrough PE, CAP, Engineering Manager, KDC Systems, www.kdc-systems.com



Fieldbus Goes NUCLEAR

Fieldbus technology simplifies building new plants and getting older units up to speed.

by David W. Spitzer

Nuclear power was the rage back in the 1960s and 1970s—until the incidents at Three Mile Island (1979) and Chernobyl (1986) brought nuclear power plant development to a grinding halt. Despite these setbacks, nuclear energy represents approximately 20% and 80% of the electricity generated in the United States and France, respectively. Recent fossil fuel price increases and concerns regarding global warming refocused attention on the development of more nuclear power plants because nuclear fuel is less expensive and because nuclear plants inherently do not generate greenhouse gases.

Nuclear power plants were typically licensed to operate for 40 years, and their design, construction and operation are strictly regulated. Rigid documentation requirements form significant impediments to upgrading instrumentation in nuclear power plants, especially when the operating license nears expiration.

However, the nuclear industry is constructing new nuclear power plants. In addition, many nuclear power plants are now renewing or in the process of renewing their licenses, so they can operate for another 20 years. Newer technology, plus additional years of operation, combine to increase the viability of upgrading the obsolete and cumbersome existing instrumentation systems that are difficult to maintain.

Larry Witt, director of applications of the Nuclear Division at Weed Instrument (http://weedinstrument.com) classifies nuclear power plant instrumentation, "based upon its operating environment. The most demanding environments (Class 1E harsh) are inside the containment structure with exposure to high levels of radiation. These instruments are typically applied to important monitoring, safety and shutdown applications. They are qualified to environmental standards such as IEEE 323 and IEEE 344 that describe testing for seismic effects, thermal aging, radiation aging, vibration and loss-of-cooling accident."

Not Everywhere, But Lots of Places

Some instruments cannot be adequately age-tested for the full 40-year plant life. Witt adds that, "temperature elements and other simple devices can usually be age-tested for 40 years. However, pressure and temperature transmitters can often be age-tested for 10 to 20 years, so they are replaced when their age corresponds to the age-test period in the environment to which they are subjected." Microprocessors in particular do not fare well in high-radiation environments, so analog instrumentation is commonly applied in these harsh locations.

"Less demanding environments (Class 1E mild) are generally located outside of containment and used for safety functions. Less rigorous thermal and radiation testing is required to qualify instruments in these locations. In locations with low levels of radiation, microprocessor-based instruments can be applied. However, the required software verification and validation of these devices is both extensive and expensive, so many plants opt to install analog instrumentation in these locations, even though microprocessor-based transmitters are superior and might allow the plant to generate more electricity."

Nonetheless, fieldbus instruments could be used in these applications with appropriate qualification and testing. Willard Killough Jr., PE, instrumentation engineer at Duke Energy Carolina Oconee Nuclear Station in Seneca, S.C., is using, "fieldbus instrumentation in some mild non-safety environmental areas including the borated water storage tank, bleed holdup tank and concentrated boric acid storage tank."

However, there is a significant amount of instrumentation in nuclear power plants that is located outside of these areas, where the equipment will not be exposed to radiation including the boiler, generator, cooling water, cooling tower and utility systems. These locations are often termed "balance of plant" (BOP) applications, where microprocessor and fieldbus equipment are acceptable. Witt estimates that the amount of instrumentation in Class 1E (harsh), Class 1E (mild) and BOP is approximately 10%, 20% and 70%, respectively.

Nuclear power plants in North America are typically operated continuously at or near their operating limit because this strategy tends to reduce the purchase of imported fuel while reducing cumbersome load changes. Shutdowns are generally limited the 20-to-30 day window required to refuel approximately every 18 months. Killough says, "It is costly and difficult to make changes due to documentation issues that include drawings, calculations and the review process that entails operational and safety reviews. As such, the cost of hardware, software, configuration and installation is often minor compared to the paperwork involved."

Easier, Quicker, More Consistent

Killough's experience indicates that upgrading to fieldbus was not that complicated.

"Replacing 48 old recorders with multi-channel monitors was more difficult than upgrading to fieldbus because the logistics of working on the monitors in a concentrated area were more challenging," he says. "In contrast, the fieldbus bricks (junction boxes) were installed prior to the outage. The outage time was used to replace the pneumatic system with a fieldbus system. The fieldbus system underwent both a factory acceptance test and a site acceptance test where approximately 90 transmitters were calibrated and configured in 4 days."

Killough found that the work performed during the site acceptance test was easier, quicker and more consistent than previous tests that he performed. He attributes this to a combination of people and technology. In particular, the technicians were interested in the technology and were able to easily understand and use it.

Figure 1. These new cabinets are located in the cable-spreading room in a mild environment that is air conditioned and heated to 66 °F.

He adds that, "during the outage, the new instrument cabinets were installed, and the racks were replaced in approximately 45 days." The net result is that the plant now has the infrastructure to add points online—even though the plant typically prefers to wait to make changes during an outage.

David Larson, consulting engineer at Duke Energy Carolina Oconee Nuclear Station adds that, "fieldbus saves approximately 40% of the wiring costs, since one cable can be used to communicate with multiple transmitters or devices. Some existing analog cables were tested and reused for fieldbus communications, the longest of which was approximately 180 meters (600 feet). Cable installations were typically twisted shielded pairs in interlocked or braided armor cable." These changes provided a fieldbus infrastructure by replacing existing instruments and utilizing the existing cables for the infrastructure. Most of the instruments replaced had previously provided process data to an operator aid computer or provided indication in the control room. With the infrastructure in place, the one twisted shielded pair cable would support eight to nine transmitters or devices that could be added to the segment at any time.

"Six control loops were installed after their control valves were retrofitted with fieldbus positioners," he explains. "The fieldbus installation was easy, and control of the turbine oil cooler control valve and "F" feed-water heaters is now significantly better."

The fieldbus equipment has a human-machine interface (HMI) with monitoring and trending that was not available with the pneumatic system. Larson adds that, "In a few instances, logic is now performed with fieldbus relays (solid-state relays) because the existing (hardware) logic could not change in order to provide a wire-for-wire replacement of existing wiring. Even with this constraint (without constraints, the logic could have been performed in software), this implementation is more accurate, simpler, and easier to maintain as compared to the old system that had pneumatic pressure switches that provided dry contacts to the various interlocks and annunciators."

Art Martin, principal instrumentation and control engineer at Burns & Roe, Oradell, N.J., concurs that it should not be a problem to use fieldbus technology in BOP applications. Regarding non-BOP applications, Art says that, "various aspects of the use of digital electronics of instrumentation and safety applications are currently being studied by the Nuclear Regulatory Commission (NRC). Key issues include diversity and defense-in-depth, digital communications, and cybersecurity. Newer nuclear plants in Europe and Japan use digital controls, but not digital measurement devices. There are ongoing NRC research projects focused on the above issues that are applicable to both new and existing nuclear plants."

Cutting Cable Cost

Martin sees fieldbus technology reducing the cost of cabling. Kevin Cole, assistant chief instrumentation and control engineer at Burns & Roe, adds, "Fieldbus technology reduces drawing complexity as compared to using conventional measurement devices. However, the overall cost of the drawings is similar because more time is necessary to layout the segments. Nonetheless, fieldbus system installation costs are lower." Retrofitting existing installations can be costly because changes related to safety require the implementation of a 5059 process that analyzes the entire system to ensure that the change does not impact plant safety.

Martin adds, "even non-safety changes require a significant amount of paperwork, including updating calculations, specifications, drawings (including "as-built"), and instruction, operating and maintenance manuals."

The two-way communications offer maintenance savings, while reducing the exposure of personnel to the process. "Ideally, fieldbus technology would be great in mild and severe environments from a maintenance perspective. Unfortunately, this has not yet been full embraced," says Martin.

Fieldbus technology is typically 20 to 40 years newer than most of the existing technology installed in the BOP portion of nuclear power plants in North America. Many articles have been written about the virtues of fieldbus, including its lower installed cost, easier troubleshooting, extensive diagnostics and the like.

However, Mike Miller, engineering supervisor at Duke Energy Carolina, whose team is currently installing fieldbus instrumentation in the Oconee Nuclear Station says, "Cost savings and faster startup may be nice. However, the major benefit that fieldbus technology brings to nuclear power plants is usually omitted from everyday discussions. In one word, our major benefit is the scalability of fieldbus technology. Our existing instrumentation is 30 to 40 years old and difficult to maintain. Documentation and installation issues make upgrading cumbersome and expensive, so, in the past, we have replaced broken equipment with equipment of the same 40-year-old design just to keep the plant operating. Even if an instrumentation upgrade were economical, it might take as long as a decade from inception to final implementation. The ability to add instrumentation to a fieldbus segment without affecting the remaining instruments on the segment (scalability) will allow us to change virtually all of the instrumentation without waiting for a major outage. This gets us over a large operational obstacle while providing significant cost savings attributable to reduced documentation, implementation and scheduling requirements."

Interoperability

"The principle reasons that Duke Energy selected a fieldbus solution were integrity, interoperability and diagnostics," says Fernando Liboni, project manager at Smar, Sertaozinho, Sao Paulo, Brazil, who supplied Duke Energy's fieldbus instrumentation. "Integrity is a critical factor in power plant operation that was formerly addressed using pneumatic instrumentation. Duke selected Foundation fieldbus technology instrumentation to achieve similar system integrity and reduced the number of potential single points of failure by implementing control strategies in the Smar System 302 host and field transmitters.

"In addition to reliability, fieldbus technology also provides the interoperability between equipment provided by different suppliers. Redundant fieldbus segments working in conjunction with diagnostic information available to the operations and maintenance personnel provide online information that can be used to better diagnose and fix problems —often before the process is affected."

Duke Energy was also able to use existing cables previously used for electronic instrumentation for over 30 years. This reduced the cost of the project, length of the shutdown, and start-up time because only the bricks and field equipment needed to be installed. Liboni adds, "instrument availability has been 100% since the first start up in 2005." With this infrastructure in place, Duke Energy continues to add fieldbus loops to replace pneumatic instrumentation.

In short, fieldbus technology appears to be viable for both new and existing nuclear power plants. Not only can it replace legacy systems economically, but also provide advanced diagnostics and scalability to provide operational benefits and flexibility in the future. ■

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845.623.1830 or www.spitzerandboyes.com

Integrators Morph into Engineering Firms

DAN HEBERT
SENIOR TECHNICAL EDITOR
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Most system integrators focus on the automation, electrical and instrumentation needs of their clients. In the process industry, these three areas make up about 20% of a project. The other 80% is mechanical, process and facilities work. Most system integration companies decline this work, leaving the lion's share of project revenue to others.

But some enterprising firms have decided to take on this work themselves. "Our firm, Mangan Inc., decided 14 years ago to expand from our system integration roots and become a full-service engineering company," says Steve Simmons, operations manager of the Long Beach, Calif., office.

"In our company's early years, any required mechanical work was executed by a partner," he says. "After four years as an automation-only company, we decided to add internal staff to perform other tasks by hiring our first mechanical engineer in 1994. We wanted to provide one-stop shopping for our clients, and we were missing out on a significant slice of revenue by not offering process/mechanical and civil/structural work associated with our automation projects."

Mangan started slowly and expanded its services as its expertise grew. "Our mechanical work initially consisted of the valves, piping and actuators associated with our system integration work," recalls Julie Caldera, PE, program manager for Mangan.

"After hiring a mechanical engineer and a piper, we began bidding on small-to-medium, multidiscipline engineering projects with existing clients, usually complementing some facet of an automation project," explains Caldera.

Later on, its services expanded significantly. "Fourteen years later, we have a full complement of multidiscipline engineers and designers, and we offer all the engineering services that normally go along with automation projects. In addition, we perform many multidiscipline engineering projects that have very little automation," concludes Caldera.

In addition to automation engineers, Mangan now employs chemical, industrial and maritime engineers and a civil/structural engineering consultant. It also has several piping/mechanical designers and a civil/structural designer on staff.

At Mangan, multidisciplinary projects now constitute about 30% of its project total and an even higher percentage of total revenue.

Mangan employees' understanding of the total project is now much improved, as the automation employees work side-by-side with professionals from other disciplines. This helps increase understanding of the entire project scope, a clear benefit to automation efforts.

As with any new venture, there were challenges. "We had to learn to market new services to existing clients, and we had to adapt our job safety analysis and risk management techniques to address process/mechanical work adequately—and convince our own automation engineers that we could offer added services with a high level of quality," observes Caldera.

While Mangan hired internal staff to expand its services, other firms prefer to go a different route. "There are benefits to including mechanical work in projects, the primary one being that you are able to offer your customer a complete solution," says Michael Gurney, executive director at system integrator Concept Systems. "We have established partnering relationships with top-notch mechanical design/fabrication houses that have an appreciation for controls," adds Gurney.

"Good controls with a poor mechanical design is problematic, as is poor controls on a good mechanical design. Each is integral to the other, and the design needs to be approached as such. If a customer wants to synchronize two belts, he or she can do it with a chain or with two servo motors, one a mechanical solution and the other a controls solution. Establishing the guidelines for such conflicts upfront is critical to a sound working relationship," advises Gurney. ■

"We missed a significant slice of revenue by not offering process/mechanical and civil/structural work with our automation projects."

Orifice Rangeabilty; Bubblers for Difficult Service

"Ask the Experts" is moderated by Béla Lipták, process control consultant and editor of the Instrument Engineer's Handbook (IEH). Preparation of the 5th edition of the handbook requires three co-editors. If you are interested, send in your resume. To ask a control question or to join our team of experts answering the questions in this column, write to liptakbela@aol.com.

Q I am trying to choose a suitable flowmeter to measure the flow rate of argon gas. I received a data sheet for one that appears very strange to me. The data sheet says that the flow element was an orifice, and the limits of flow were from 5 Nm3/h to 280 Nm3/h!!! The operating pressure was 21 barg. We are not using the orifice plate flowmeter for this application because its rangeability is only 3:1. I have looked for a flowmeter to cover this large range (56:1), and so far no success! Would you please help me in this regard?

info@nirooresan.com

A The flow measurement range of a conventional orifice-dp cell combination is limited to 3:1. Intelligent dp cells can switch their range to achieve a rangeability of 10:1, but in most designs, the error in percent of actual flow will increase as the flow drops. A more accurate reading is obtained if, instead of range switching, you place two d/p cells on the same orifice, a high- and a low-range one.

If you need a range that exceeds 10:1, you can use several parallel pipe runs of different sizes and open or close as many runs as needed to keep the actual flow always between say 50% and 90% of the maximum flow in the active runs.

My choice for this high-pressure gas flow application would not be to use orifices at all. For a > 50:1 range, I would use one or preferably two Coriolis meters in parallel. If at low flows, you can live with an error of about 5%, one Coriolis meter is enough. Other high- rangeability flowmeter options include thermal (20:1), turbine (10:1), utrasonic (10:1), and vortex (10:1).

BÉLA LIPTÁK

Q We have a bubbler application that has a plugging problem. We have tried various configurations of the tip to reduce the plugging—angled, notched, etc., with little relief.

I remember that many years ago in another difficult application another engineer used a dip-tube diaphragm. I believe there were separate diaphragms on the high and low sides, and that the diaphragms had very small holes. There was a very light purge, on the order of 1 SCFH or less, through a dp regulator for each side. This was very successful.

Unfortunately, that engineer is no longer with us. Now I'm working for another company, and nobody at that plant can remember where the diaphragm was purchased.

Both applications are not pressure vessels. The new application runs at 20-25 psig.

Can you recommend some vendors for this application?

JIM BECKER
Bayer MaterialScience
james.becker@bayerbms.com

A Is the questioner referring to the PMC 1:1 pneumatic repeater design (www.pmc1.com), which I have previously modified to build a submersible variation to replace bubbler tubes? PMC now makes an electronic dipstick version. The same folk also make submersible electronic transmitters. PMC does have a pneumatic dip tube replacement as a standard product.

These units were originally built for the pulp and paper industry (PMC was once the Paper Machinery Company), but I have found them handy in mineral processing units over the years.

IAN H. GIBSON
Engineering Consultant
Process, Control and Safety Systems

A A prominent cause of plugging of bubble tubes is dehydration of the solution or slurry in the vessel by the purge gas. One solution is to hydrate the purge gas in another bubbler of clear solvent before it enters the main bubbler. Another possibility is the use of a liquid purge.

GREG SHINSKEY
Process Control Consultant
Wolfeboro, NH 03894

A I do not know where you can get diaphragms such as the ones you mention.

In my experience, however, the smaller the bubble orifice and/or purge rate, the easier it is to get plugging. Large-diameter orifices (I have seen 6-in. diameter bubble pipe tips) are often used in wastewater wet wells with good results. It may take a while for the expanded section to fill and equalize if the purge gas is stopped or the bubbler end uncovered, but the large orifice did work pretty well.

I do remember once seeing a bladder-type pressure sensor setup, but I do not remember the manufacturer.

I will also mention that notches in a bubble pipe tip are often used to make the bubbles release in the best spot with regard to error from liquid moving past the orifice.

AL PAWLOWSKI, PE
ALMONT Engineering
Baton Rouge, La., U.S.

A It is well-known that plugging problems decrease as the square of the diameter of the dip tube. The problem writer gave no information as to the cause or definition of plugging in his application.

If the problem is salts build-up, then a small purge of the appropriate solvent will help keep the relative humidity high enough to reduce the drying effect of the dry gas. Higher liquid flow rates might wash the salts out.

If the problem is freezing polymers, a few users heat the purge gas and/or use a steam- jacketed dip tube.

At one time, it was thought that a notch in the end of the dip tube caused the gas bubbles to be smaller and thus cause less pressure noise. Note that anything more than a very small notch would result in some difference in dip-tube pressure as the supply flow rate changed. It is very important to be sure that the purge gas supply is ALWAYS at a pressure higher than the vessel. Otherwise, the vessel fluids back up into the dip tube and often stay there. The purge gas flow is controlled by a needle valve, not the pressure regulator, and observed with a small rotameter. If a supply pressure regulator is used, it must be a "non bleed" type so that if the vessel pressure becomes higher than it should be, process fluids will not enter the dip tube system. Some engineers argue that the constant flow regulator sometimes recommended will open on loss of supply pressure and allow back flow.

Always remember that despite flow sheets and declarations by process people, at some time every vessel and every pipe will be exposed to pressures up to the relief valve pressure or failure pressure, and correlatively, every closed system will eventually be exposed to a high vacuum.

The purge-flow supply rate must be more than enough to overcome the maximum rate of pressure rise in the purge system. Note that this involves knowing the gas volume of the purge system, since the pressure of the entire purge system must be raised.

In extreme cases where no level measurement device except a purged dip tube was reliable and the dip tube always eventually would plug, a number of schemes were used to either permit quick dip-tube replacement or to facilitate drilling out the plug. These schemes usually involved systems of ball valves, packed slip joints and other clever mechanical devices.

Moore Products made several purged remote chemical diaphragm seals. These were used where plugging problems were insurmountable or where purge gas flow into the process was not allowed. They used a simple pressure balance scheme where the purge gas pressure on the dry side of the diaphragm rose to match the pressure on the wet side. Excess supply gas was vented outside the vessel through a vent connection as the purge gas rose above the process pressure.

These have limited pressure and temperature ratings. Installation requires a nozzle large enough to pass the assembly. Some small pressure differences will exist across the diaphragm, and errors may result from these.

CULLEN LANGFORD, PE

A If the installation is in an existing plant, the bubbler pipe itself is usually made and installed by the user. If it is a new plant, the engineering firm designing the plant provides it as a piping item. A few suppliers also exist, such as Campbell Scientific, CR10, Omega Engineering, Kele Assoc., Texmate Inc., Introtek International.

The various aspects of bubbler-based level measurement are discussed in Chapter 3.2 of the 4th edition of Volume 1 of the *Instrument Engineers' Handbook*.

BÉLA LIPTÁK

Q I have a device called the Loop Slooth for rapid troubleshooting of ground loops. Information about it is at www.loopslooth.com. It gives a brief pictorial overview of how the Loop Slooth works and has links to the instruction manual and to a paper in the *Review of Scientific Instruments*. I'm interested in finding companies that might be interested in this product.

PAUL BELLAN
Circuit Insights LLC

A The best possibility would be with the companies who have related products. Usually their R&D or product development groups are the ones that review concepts from third-party sources and determine their market viability. But certain companies have a policy of developing only those ideas which are created internally.

The Loop Slooth might be of interest to companies like Fluke, AEMC, Elcontrol, BMI/Dranetz, . . .

JERRY SPINDLER
Jerry.Spindler@us.endress.com

What Users Need

Data acquisition that is fast, safe and less costly

Many users of data acquisition and SCADA systems and recorders are looking for higher speed and throughput capacity for the devices they use. Many are also investigating wireless data acquisition technologies because of the ease of setup and the savings in hard wiring costs.

In a recent study from Venture Development Corp., "Data Acquisition Products Global Market Demand Analysis," researchers focused on external chassis and modules and plug-in analog boards. The most important product selection criteria for data loggers, distributed/remote I/O, paperless chart recorders, USB PC front-end modules, other PC front ends and standalone systems were accuracy, ease of use, durability, number of channels and communication network capabilities.

For the plug-in analog I/O board types, users ranked accuracy, ease of use, number of channels, compatibility with operating systems and reliability.

VDC forecasts that in five years, 28% of the external chassis and module products and 9% of the plug-in analog I/O boards will be using A/D converters with higher than 18-bit resolution.

The surge also is on for wireless data acquisition devices. Expect to see many more of these in the coming months. According to National Instruments, they have "undergone consolidation and standardization. IEEE 802.11 (Wi-Fi) has become rugged enough to meet the requirements of harsh industrial environments."

On the SCADA front, security is a real concern for process industry buyers. Security vendors are making great strides in solving this problem, but this is a tough nut to crack, and we do have a way to go.

PATTI POOL
ppool@putman.net

CIRCULAR CHART RECORDERS

OMEGA ENGINEERING
☎ 203/359-1660 www.omega.com

Microprocessor-based CT6100 circular chart recorders have a menu-driven interface for configuration and

calibration and are user-configurable via a front-panel keypad. The backlit LCD is large-character, alphanumeric and has simultaneous digital display of process variables for each channel. All channels are compatible with industry-standard sensors and signals.

PID/DATA ACQUISITION SOLUTION

RED LION CONTROLS
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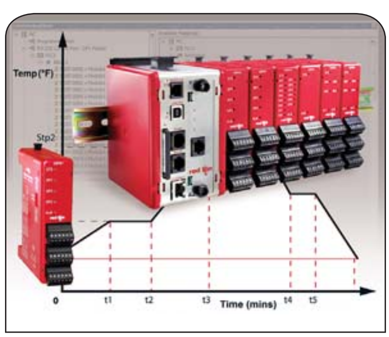
Modular controller, with ramp/soak control, provides multi-zone PID control, data acquisition and I/O for PC, DCS or PLC systems, while integrating data logging and advanced alarm management. The latest updates in-



clude Crimson 2.0 programming software that allows users to integrate multi-segment temperature profiling for processes in the autoclave, heat-treating, food and chemical industries. The ramp/soak functionality consists of a profile or succession of setpoint ramp and soak periods.

BATCH RECORDERS

HONEYWELL PROCESS SOLUTIONS
☎ 602/313-4054 hpsweb.honeywell.com

X-Series recorders and TrendManager Pro Batch offers a batch capability that provides users with the ability to view and analyze data in terms of batch. Users can create up to six batch recording groups in the recorder that can be started/stopped/paused/resumed/aborted independently of the other groups. Each batch recording group supports an independent batch counter that can be used to increment the batch number automatically. Enter batch information at the recorder us-

ing internal pre-configured drop-down lists for batch information, the recorder's keypad or the standard USB port to enter batch text information with a USB type keyboard or barcode reader.

DAQ DEVICE

ADVANTECH, INDUSTRIAL AUTOMATION GROUP
☎ 800/205-7940 www.advantech.com

USB-4718 is a dedicated USB-based thermocouple module that supports seven different types of thermocouples (J, K, T, E, R, S, B), six voltage input ranges, 0-20 ma or 4-20 mA current input (to support a variety of sensors), and 16 isolated digital I/O channels. The device supports either

USB 2.0 or USB 1.1 buses. With its bus-powered design, no additional battery power or power supply is required. Simply connect the module to any computer or notebook, install the supplied software, and the signal will connect directly to the USB-4718 DAQ device.

LOOK! NO SOFTWARE

YOKOGAWA
☎ 800/888-6400 YOKOGAWA.COM

This EtherNet/IP-compatible communication interface for recorders and data acquisition equipment passes the ODVA conformance test. The interface eliminates the need for dedicated special software to connect data acquisition equipment with

other devices, thereby simplifying system development.

WI-FI DATA ACQUISITION

NATIONAL INSTRUMENTS
☎ 800/258-7022 www.ni.com

Ten Wi-Fi and Ethernet DAQ devices for remote measurements include signal conditioning and direct sensor connectivity for electrical, physical, mechanical and acoustic signals. Engineers can combine Wi-FI DAQ with LabVIEW software to meet their wire-

less structural diagnostic, environmental and machine condition monitoring application needs by reducing cabling costs. Using the IEEE 802.11 standard for wireless networks, the Wi-Fi devices stream data on each channel at more than 50 kS/s with 24-bit resolution.

VIDEOGRAPHIC RECORDER

ABB INSTRUMENTATION
☎ 215/672-2684 www.us.abb.com

SM500F field-mountable videographic data recorder can be installed into a panel, wall or pipe without an enclosure. Its fully sealed NEMA 4X and IP 66 enclosure provides protection from water, dirt and dust, making it suited for hose-down and dirty applications. The recorder comes with a choice of either

color or monochrome display to show the data in a variety of formats including chart, bargraph and digital indicators. On-screen historical logs provide operators access to alarm, totalizer and audit-trail data. Data can be removed from the recorder with a 2-GB SD camera card.

EVENT RECORDER

RTK INSTRUMENTS LIMITED
☎ +44 (0)1423 580500
www.rtkinstruments.com

System 9000TS offers 1-msec resolution of events and can be supplied as a stand-alone sequence-of-events recorder or by using the optional alarm annuncia-

tor features, it is possible to build a full alarm and event management system that captures, records, prints and displays the events for later analysis while providing displays and alarms for immediate action at the plant.

Ametek Links Analyzer Hardware to Networks

"Remote instrument monitoring offers numerous operational and economical benefits, whether on or offsite," says Tom Marecic, vice president and general manager of Ametek Process Instruments. Connecting analyzers to a common network liberates data from individual analyzer "islands" and helps users implement process analyzer technology (PAT) strategies. ● Ametek's new LinkBus Remote Instrument Monitoring System (RIMS) provides users of Ametek analyzers with a standard analyzer/computer/database connection and a variety of service packages that can be used to customize the users' experience with the analyzers. A single LinkBus RIMS can be used for up to 16 analyzers, including Thermox Series 2000 and IQ analyzers, Western Research 880/Series 4000 photometric analyzers and 5000 Series moisture analyzers. And you can add additional LinkBus RIMS networks.

"More than one LinkBus RIMS may be preferred with each assigned a unique IP address," Marecic says. "For example, all the important analyzers in one processing unit or operation can be linked to a gateway with a RS485 cable. Each process unit may have multiple analyzers with the resulting 4-20 mA signals routed to the DCS for control. The LinkBus RIMS can be connected to the plant LAN using a standard Ethernet connection and viewed from any PC on the system simply by using the generic web browser."

The gateway unit is installed and connected by means of a two-conductor twisted pair in a daisy chain. The gateway communicates with each controller-based analyzer via RS485 and each gateway provides a single Web-enabled user interface for up to 16 analyzers.

The LinkBus RIMS platform provides Internet and Ethernet communications capability as well as bi-directional DCS communications using either fieldbus or Modbus protocols. It acts as an HTTP server and supports TCP/IP, FTP and POP3 email. Users also can incorporate either OPC or XML client-server capability. The LinkBus RIMS collects and reports process trends and analyzer response time information in addition to all sensor data and functions. Fault alarms can be issued automatically by email.

Ametek offers use of a secure VPN through an ISP for bidirectional communications to the analyzers from external sites. This system enables access to browse the LinkBus RIMS without compromising the security of the customer's enterprise network. To verify secure entry and use, the system has already been field tested to operate through a typical corporate firewall. Each remote user is assigned a four-digit password and an electronic key that changes its six-digit number every minute for a very high level of security protection.

LinkBus is offered stand-alone, or with one of three different service packages from Ametek. The first package, onsite monitoring, provides email messages to be sent to the plant analyzer service group to schedule maintenance. The second package improves Ametek service by adding third-party notification to the onsite monitoring package providing notification by email to remote locations, and limited direct analyzer communication access permission on a case-by-case basis from a factory field service engineer. Finally, the third package from Ametek's service group is a Web-enabled service that grants bi-directional access to the analyzers through the LinkBus RIMS for the analyzer manufacturer or its regional support center, or a third party service facility for an annual fee that is based on the number of analyzers at the end-user's facility. ■

For more information, call 412-828-9040 or log on to www.ametekpi.com.

Safety System Can Be Used For Process Control

Everyone talks about doing more with less, but few people or companies actually do it. And, even those that appear to succeed often come up with little more than half-measure improvements or savings. Still, relentless economic forces continue to demand more performance at less cost, and in process control and automation this means combining capabilities and related software and hardware where possible and practical. One example of this is the gradual link being forged between some distributed control systems (DCSs) and formerly separate safety-instrumented systems (SISs).

For instance, RTP Corp. says its new RTP 3000 critical control and safety system is an update of its RTP 2500 system. Buddy Creef, RTP's sales VP, says RTP 3000 can be used both as an SIS and for basic process control because it has a complete software suite like a DCS plus an advanced instruction set that gives it sophisticated analog capabilities. However, because RTP still mainly targets safety users, the firm stresses that RTP 3000 has the flexibility and reliability to achieve SIL 1 to SIL 3 safety using the same Simplex, dual-redundant and triple modular redundant (TMR) components.

"We decided several years ago that RTP needed to get involved in the safety business," says Creef. "So, we built an IEC 61508-compliant DCS, launched it in 2003, and secured TÜV approval in 2006. Since then, we've used customer input to refine RTP 2500 and create RTP 3000. All improvements in RTP 3000 are the result of customer input."

RTP 3000 maintains the main benefits of the RTP 2500, such as 99.9999% availability; more than 2,800 years mean time to fail safe (MTTFS), competitive pricing, site license of software, high diagnostic coverage, and 1 millisecond (msec) sequence of events (SOE) on digital and 2 msec SOE on analog. User-generated improvements in RTP 3000 include increased availability in a smaller footprint, and ease of use features, such as automatic diagnostic creation, expanded instruction set, increased performance, 1 msec SOE on all digital and analog points, and a 25% cost reduction.

"Our customers were most interested in increased ease of use and improved availability" says Creef. "It's important that plants run uninterrupted unless a shutdown is necessary. When a shutdown is necessary, it's important that the SIS provide as much information as possible about the cause of the shutdown and that the information it provides be easily understood. Most of the features we've added address one of both of these customer requirements."

Creef adds that RTP 3000 is easier to use thanks to several automatic capabilities. For example, RTP 3000 automatically creates diagnostic information and tags for its users. It also automatically relays this data to HMI screens, which means better information for users and less downtime.

Availability was increased by adding redundant "chassis processors" in one chassis. This pushed RTP 3000's MTTFS to more than 3,000 years, assuring that processes won't be interrupted by SIS faults. And, when a shutdown occurs, automatic diagnostics that made commissioning easier will also make diagnosing problems easier.

RTP's architecture gives the RTP 3000 "node processors" for logic solving and chassis processors for I/O scanning. Creef says this increased processing power enables increased diagnostics to insure RTP 3000's integrity. It also allows RTP 3000 to maintain a 5-msec scan regardless of I/O point numbers or the user's program size. Besides maintaining its constant 5-msec scan time, RTP 3000 achieves a 12-msec reaction time from seeing an input to actuating a change. Creef says competing systems run at 300 msec to 500 msec.

"We also have a unique software policy. Our NetSuite software suite, which includes configuration, HMI, alarming and data archiving, as well an OPC server and simulation functions, is sold as a site license," adds Creef. "Users purchase one site license, and they're able to use it on as many applications as they want. Support and upgrades are even included in the site license price." ■

For more information, contact RTP by phone at 954.974.5500, by e-mail at buddy.creef@rtpcorp.com, or on the web at www.rtpcorp.com.

Shed the Wires for Configuration

Configuration and diagnostics of field devices is almost by definition tedious, time-consuming and expensive. Now Endress+Hauser has addressed those issues with its new Field Xpert SFX100, the process industry's first wireless configuration tool. The Field Xpert is an industrial PDA that enables technicians to configure HART-based instruments in the field, simplifying and speeding up installation and diagnosis of problems.

Robert Bensberg, E+H's product manager for Field Xpert, calls it "the complete HART communicator for industrial applications." Field Xpert's package consists of Field Xpert handheld, whose form factor and GUI are based on industrial PDAs; Device Xpert configuration software for start-up diagnostics and servicing for all registered HART devices; and a HART/Bluetooth modem for device connection.

Device Xpert software supports use of multiple connections. Users can configure a specific serial port and address the scan range appropriate to one scenario, and then configure another connection to address a different requirement. The software shows each device in a group view, so finding the correct parameter is easy. If the location of a specific function is unknown, the integrated Function Finder locates it in all HART devices, an especially useful feature when working with complex devices with many parameters.

Device Xpert also offers the range of diagnoses supported by the Device Description (DD). It interprets DD extensions, allowing access to custom functionality normally not available in handheld terminals. These include envelope curves from Endress+Hauser time-of-flight level transmitters, valve signatures for positioner actuators and custom calibration routines. It also supports automatic distribution of DDs via the Internet or a WLAN to enable quick start-up and diagnostics.

"Device Xpert software is designed for project commissioning and maintenance. It also supports regular daily requirements of field technicians. Customers especially like the intuitive graphical user interface," says Bensberg. "This makes the device easier to use and the customer is immediately comfortable with it."

Field Xpert SFX 100 uses the Windows Mobile operating system, making it possible to install additional software applications for plant asset-management activities, such as maintenance, calibration service and documentation.

Users can access devices through a either WiFi or a Bluetooth connection. "Because of the Bluetooth adapter, Field Xpert doesn't have to be hooked up with wires," says Bensberg. "All you have to do is go to a location within range of Bluetooth."

SFX100 also supports Fieldgate FXA520, allowing Ethernet communication to remote HART field devices. Bensberg says support for other communications protocols is in development.

SFX 100 is a rugged instrument suitable for use in Class 1, Division 2, hazardous areas and is ready to use out of the box. Its dimensions are 7 x 3.3 x 1.5 in. The non-explosion-proof version weighs 1.2 lbs, and the explosion-proof version weighs 1.5 lbs.

The display screen is 3.5-in transreflective TFT color; 64 k, OVGA, 240 x 320 pixels. It has both portrait and landscape modes, and is protected by a Makrolon panel. The housing has IP 65 (immersion for brief periods) protection, is antistatic and non-corroding.

The non-explosion-proof version operates in ranges of 14 °F to 140 °F (-10 to 60 °C). The explosion-proof version works in ranges from 14 °F to 122 °F (-10 to 50 °C).

Available accessories include a leather carrying case, a USB data transmission set, Viator Bluetooth interface for HART, a charger and spare stylus.

SFX costs $3,000-$4,000, and is available in October. ■

For more information call 888-ENDRESS or go to www.us.endress.com.

Piezoresistive Sensor Stabilizes Pressure Transmitter

Users of smart pressure transmitters always need more assured stability. The key to providing that stability is making sure those users don't have to calibrate or check their calibrations as much as they did in the past. As a result, there has been a steady stream of innovations in smart transmitters since they were introduced 25 years ago. The latest comes from Yamatake America, which spent the past 10 years researching sensing technologies, and chose the best for its new smart transmitter. "Yamatake saw the need to develop a brand-new sensor, and then built a new transmitter around it," says Bob Harvey, Yamatake's sales and marketing director. "The main challenge was increasing long-term stability that could help reduce end user costs."

Consequently, Yamatake's Azbil AT9000 advanced pressure transmitter is based on piezoresistive technology that's extremely repeatable, and so can provide the stability required in many applications. The piezoresistive sensor consists of a silicon substrate and a micromachined diaphragm that deforms with pressure, which allows the sensor to measure resistance variances. AT9000's sensor is bonded to the unit's mechanical structure, which helps Yamatake's eliminate dissimilar materials that can contribute to erroneous readings.

"We changed the structure of the sensor, so it now has the best stability specification in its market and industry," says Harvey. "In fact, AT9000 maintains a stability of ±0.1% of upper range limit (URL) for 10 years. It replaces a product that had ±0.1% of URL for one year. Besides reduced maintenance and labor, this stability also means tighter control, increased throughput, and better quality, too."

Once it developed AT9000's piezoresistive sensor, Yamatake integrated features to make its new smart transmitter useful to users in various process industries. For example, AT9000 offers:

- Virtually zero downtime due to calibration;
- First-day accuracy throughout the transmitter's life;
- User-customizable interface that can measure and display in units chosen for specific applications;
- Optional alarm output functions to alert users to small problems before they become big ones; and
- Certification to SIL2 of the IEC61058 standard by TÜV for use as a component in a Safety Instrumented System (SIS).

"Besides displaying its data in any configuration or units users want, AT9000 has discrete alarm outputs that can be wired to a PLC, annunciator or DCS. I think it's unique among pressure transmitters. This means users can wire a relay to the device, set high and/or low levels, and then check whether limits are exceeded or if process changes have occurred. Many of AT9000's features are useful in chemical and petrochemical applications, and its SIL 2 level and alarm functions will be especially helpful where safety is crucial."

In addition, a summary of AT9000's specification as a DP transmitter includes its outputs for 4-20mA DC, HART and Yamatake's proprietary Smart Field Network (SFN) protocol, as well as digital output in DE protocol. Its specified accuracy is ±0.04% of calibrated span (GTX30D/31D/32D). Its measuring span is 0.4 in. of H_2O to 2,000 psid in four models. AT9000's maximum working pressure is up to 6,000 psi; its turndown ratio is 200:1; and it has global FM/NEPSI/ATEX certifications for explosion-proof performance in intrinsically safe settings.

"AT9000's reference accuracy on key models for flow is ±0.04% of span, which compares to 0.1% to 0.075% for typical transmitters," adds Harvey "This reference accuracy combined with AT9000's long-term stability and its other added capabilities packs this transmitter with performance, but not at a premium price." ■

For more information, contact Yamatake America at 888.262.4639, email at bharvey@yamatakeamerica.com or visit www.yamatakeamerica.com.

Portable Fieldbus Segment Commissioning

Any time a way is found to simplify the establishment, testing or repair of a fieldbus network, it's a cause for celebration. Pepperl+Fuchs' Advanced Diagnostic Module (ADM) Commissioning Kit is the latest reason for a party. "There's nothing like it on the market today," says Kristen Barbour, P+F's FieldConnex product manager. ADM is a complete diagnostics package in a rugged, portable case that enables users to commission, troubleshoot and validate a fieldbus segment, even without a control system. All kit components come prewired, and there's no need to wire anything internally in the fieldbox.

DIN-rail secured and packed inside a rugged Pelican case, ADM can be used in Zone 2 areas. "All the connections are on the outside of the case, so you don't even have to open it to use it. You just hook it up and it's good to go," says Barbour.

However, the beauty of the system is that it allows commissioning of fieldbus segments without connection to the control system.

"Many times, control equipment isn't installed at the same time as the fieldbus segments," explains Barbour. "There's no way to know if the physical layer and fieldbus devices have been installed correctly. With the ADM kit, you don't need the control room. You can power the segment, and look at all the aspects of the installation through the diagnostic module. You can actually commission the segments without connecting to the control room. You can validate that the system is working prior to the control system being powered up."

ADM also is useful in older plants, explains Barbour. "You can use it either in the control room or out in the field," she says. "Without the kit, the technician would have to take a bunch of handheld tools with him—a voltage meter, an ohm meter, etc. Now all the diagnostics and troubleshooting are automated."

Intelligent software, which contains knowledge of the physical layer from the control system down to the device, identifies problems with the segment. "This takes away the need to have a fieldbus specialist on site during installation," adds Barbour.

The standard kit includes a Pepperl+Fuchs Mobile ADM, a 120-V mA power supply, a 25-V fieldbus power supply, a 120-V ac power cable, a USB cable and a fieldbus device cable with clip-on leads.

The kit is available with a National Instruments PCMCIA H1 interface card so users can verify segments prior to the host/control system installation. For users who already have a Mobile ADM, a basic kit is also available with just power supplies and cables.

Mobile ADM eliminates repetitive tasks and automatically generates network documentation for each segment and device, and enables maintenance personnel to pinpoint fault locations from the control room. Comprehensive measurements are transmitted in real time to the maintenance station and can be easily viewed by an OPC software client.

The P+F Mobile ADM is a comprehensive physical layer measurement tool for Foundation Fieldbus H1 and Profibus PA installations. It provides the exact segment and individual device data needed for analysis of the fieldbus physical layer, and intermittent segment malfunctions can be traced without the need for a permanent connection.

Ryan Kelly, instrument and controls engineer at Chevron in Houston, says of the ADM, "Both kits worked perfectly, and the cases were well-suited for taking out onto the platform amongst all the dirt, dust and dripping water. An extremely useful feature is the ability to power the kit from either 120-240 Vac or 24 Vdc." ■

For more information, call 330-486-0002 or go to www.pepperl-fuchs.com.

Livin' is Easy with Level-Headed Liquid-Level Transmitters

Checking the level once in one tank is easy. Repeatedly monitoring a dozen or 100 tanks is just a little more difficult, especially when lightening strikes—and so any help is appreciated. To give users the assistance they need, MTS Sensors developed its Level Plus liquid level transmitters, and the rest has been history. ● Randy Wiese is instrument and electrical technician at Texas Eastern Products Pipeline Co.'s (TEPPCO) tank farm in Creal Springs, Ill., and he's had 16 Level Plus transmitters in place since the terminal began operating in 2001. These units check refined product levels at Creal Springs and two other nearby facilities. Wiese says three major oil and gas transmission lines intersect here, and the largest, a 26-inch from TEPPCO and Marathon Oil in Beaumont, Texas, comes straight into his terminal.

"The Level Plus units get us to within 1/100 of an inch of the exact amount of product we have in each tank, and reports back via our HMI," says Wiese. "Besides precise volume, we also get temperature data, which is important because ambient temperatures can affect that volume. These gauges have to very accurate, and they are."

Wiese adds that Level Plus' 50-foot flexible tank cable is easier to replace than the rigid pipe that goes with the GSI gauge he has on one tank. Connected to a flange at the top of the tank, this cable has built-in resistive temperature devices (RTD) spaced along it, and its gauge is in a float that moves along the cable as it sits on top of the product.

"I can change out the flexible cable myself in an hour and a half because it's rigidly mounted, but it's flexible until it reaches to the bottom of the tank where the float and sensor is. I can just pull and replace the sensing element, update the software, and be back up in 90 minutes," says Wiese.

Wiese acknowledges there have been a few RS-485 bus network and lightning-related issues that meant replacing two or three communication boards. "We're on solid rock and it's hard to ground our systems, so we added some surge protection and lightening arrestors this past spring, and our failures are down to none" adds Wiese. "Overall, we couldn't be happier with MTS' transmitters, and their support has always been available and very helpful. MTS recently told me we'll be able to do wireless, and so we're studying that now, too."

To measure other precious liquids, Lawrenceburg Distillers Indiana uses about 100 Level Plus M Series transmitters in about half of its 500 blending and finishing tanks. These tanks previously used D8 solid-rod gauges that had mostly local displays, but there were ongoing arguments about what was on the very bottom of tanks where there was no indication, according to John Netzley, Lawrenceburg's power and control engineer.

"With the M Series we get digital data, high accuracy, no drift and remote readings," says Netzley. "This is especially important for us because we're highly taxed—about $17 per 50-gallon barrel of 100-proof product—and we must calculate inventory and taxes. So we need to know temperatures, and Level Plus' embedded RTDs give us very good temperature readings and precise volumes within 1/100th of an inch, so we can better determine zero levels."

Tom Horn, terminal manager at BP's terminal in Fairfax, Va., reports that his six above-ground tanks receive finished gasoline and diesel via a 24-inch line from BP's Texas City refinery. He adds that 10 Level Plus transmitters were added to his tanks about three years ago, and that they've been accurately measuring volume and temperature since then. "Level Plus measures to less than 1/10 of an inch for us, and previously we could only get to 1/8 inch. We also get net gallons, gross gallons and temperature readings that show us how close we are to 60 °F," adds Horn.

"This 20% better accuracy helps with inventory and scheduling because we can make more accurate forecasts about the product we're going to need," explains Horn. "When product is delivered, the real-time tank data comes through our office HMI, and we can watch the tanks fill up, which is nice for our operators."

Horn adds that data from MTS' transmitters also is tied to the Fairfax terminal's Top Tech automated loading system, so staff at BP's headquarters in Chicago can check inventory and make forecasts as well. ■

Featured Product

CONTROL VALVE ACTUATORS

ROTORK PROCESS CONTROLS
☎ 585/247-2304 www.rotork.com

Electric, non-intrusive CVA control valve actuators provide HMI capabilities, fail-to-position protection and energy savings. They are available in linear and quarter-turn actions and there is no need for air supplies. Repeatability and resolution are less than 0.1% FS. Designed for process control applications, including those that use HART and Foundation Fieldbus, the actuators include wireless Bluetooth communication that can be used for actuator set-up and adjustment. A data logger provides important data such as valve torque profiles and statistical information.

SIMPLIFIED PROGRAMMING TOOLS

NATIONAL INSTRUMENTS
☎ 800/258-7022 www.ni.com

LabVIEW 8.6 allows engineers to design advanced control systems using programmable automation controllers (PAC) based on field-programmable gate arrays (FPGAs). These PACs can reduce ma-

chine wear, increase system throughput and consume less power in applications ranging from machine control to integration of complex measurements for optimized production. Function blocks are based on IEC 61131-3. To help engineers debug their systems, LabVIEW 8.6 introduces an Ethernet-based maintenance tool that allows I/O forcing and displays current CPU and memory status as well as current I/O values and status.

SERIAL DEVICE SERVER

ADVANTECH, INDUSTRIAL AUTOMATION GROUP
☎ 800/205-7940 advantech.com/ea

The EKI-1524 server allows up to four RS232/422/485 serial devices to be re-

motely monitored, managed and controlled over Ethernet and IP networks. Equipped with dual 10/100Base-TX Ethernet ports and dual media access controllers (MACs), this device ensures data transmission even in the event of a network failure.

FIBER OPTIC IR TRANSMITTERS

OMEGA ENGINEERING
☎ 203/359-1660 www.omega.com

Series OS4000 industrial, high-speed, fiber-optic infrared transmitters measure temperatures from 200 °C to 1600 °C (392 °F to 2912 °F) using three standard optical fields of view and three standard fiber-optic cable lengths. The CE-compliant

transmitter has a response time of 1 msec and adjustable emissivity from 0.05 to 0.99. Other features include built-in laser sighting for lens probe positioning, linear analog output (1 mV/deg, 0-5 Vdc, 0-10 V dc or 4-20 mA), high and low alarm outputs, fiber-optic gain adjust, maximum and minimum temperature measurement, RS232 interface and a PC interface software to allow changing response time, high and low alarm set points and data logging.

For more products go to www.controlglobal.com and click on the Product Info tab on the home page.

Puzzler Extravaganza

Greg McMillan and Stan Weiner bring their wits and more than 66 years of process control experience to bear on your questions, comments, and problems.
Write to them at controltalk@putman.net.

GREG MCMILLAN
STAN WEINER, PE
controltalk@putman.net

Greg: In case our readers have been lying awake at night wondering what the answers to this year's Puzzlers are, we here present the solutions that are every control engineer's dream or nightmare.

Stan: "How much information is in the process variable versus the output of a PID controller on disturbances, sensor drift and offset, and valve dead band and resolution?"

Greg: We answered this puzzler in the July column titled "Disturbing Remarks." Since a tuned PID controller transfers variability from the process variable to its output, and each mode of the PID adds information content on magnitude, duration and rate of change of the process variable, the story is generally in the controller output on the process, measurement and valve.

Stan: "What are the implications of an integrating or runaway process response on control valve dead band, resolution and stroking requirements?"

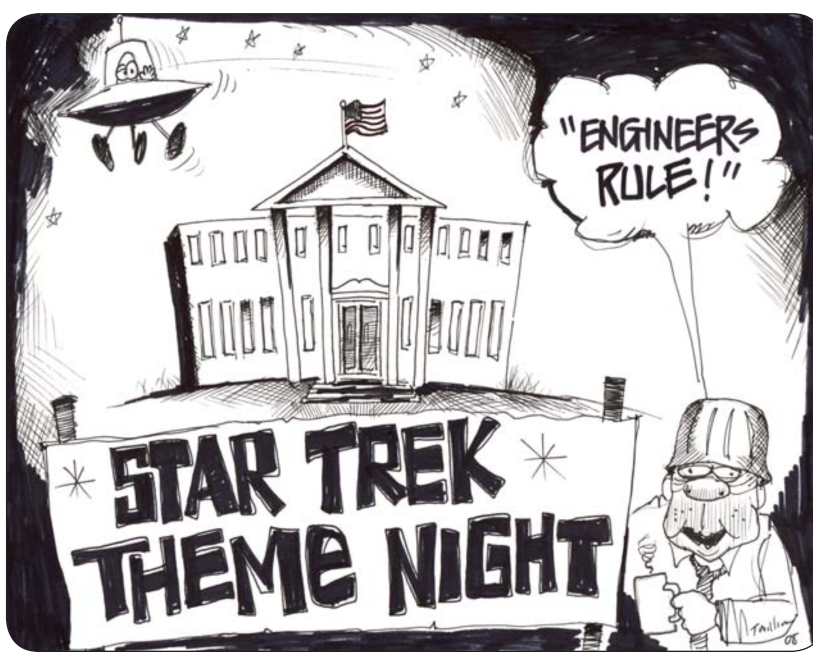
Greg: The implications are all bad and generally worse the higher the integrating and runaway process gain. Dead band will cause these valves to cycle, and if the valve response is too late or too slow, the process variable can ramp or accelerate off-scale.

Stan: "What was the rampant valve problem fostered by a lack of position feedback?"

Greg: The belief that a valve actually moved when a controller output changed was a widespread fantasy until the advent of smart positioners. Smart positioners are sometimes worse than dumb ones when the feedback is on the actuator shaft position rather than the trim position for some classic high-friction rotary valves. In these dastardly situations, where a cheap piping valve is posed as a throttling valve, the smart positioner is providing negative knowledge. (See www.chemicalprocessing.com/articles/2007/200.html.)

Stan: "What are the major sources of changes in loop dead time?"

Greg: The sources are everywhere, but one of the most insidious is from control valve dead band and resolution because step changes in the controller output from most manual tuning methods will not reveal this dead time. The controller should be in auto to identify it. This dead time is the dead band or resolution divided by the rate of change of the controller output, which is extremely variable. Dead times also come from secondary time constants, such as mixing, sensor and thermal



lags, and the one thing you can say about time constants is that they are not constant. Dead time also comes from transportation delays, where the dead time is the volume divided by the total flow.

Stan: "When does a steam rate feed-forward for a three-element boiler drum-level control cause problems?"

Greg: I think we answered this and other feed-forward questions in prior columns. If the steam and feed-water flow is too noisy or not representative of the flow, which can happen at low rates, then it is best to go on straight level control directly to the valve. If the inverse response is so severe, the boiler may trip on level. In this case, the three-element feed-forward, which is based on a material balance, may make it worse, and an impulse feed-forward with the opposite sign is used instead during the inverse response to prevent a level trip.

Stan: "What are the application considerations for nuclear magnetic resonance analyzers and near-infrared analyzers?"

Greg: In some ways, they are similar to neural networks in that you need a lot of lab samples and training data sets and if anything in the process changes, you may need to redevelop the models.

Stan: "When does a proportional-integral-derivative (PID) controller perform better than a model-predictive controller (MPC)?"

Greg: For a single loop where derivative action is essential, a PID may be best, but either one can be made to look great or lousy based on tuning. So pick the one you like best and tune it better, in the time-honored tradition of most papers touting a special algorithm. We also have an answer to this question from George Buckbee.

George: PID costs substantially less than MPC. It costs less to design, less to install and less to maintain. PID achieves very good results for single-loop control, with low cost, simplicity and relative ease of tuning. For individual control loops, where there is little process interaction, PID is the low-cost solution, and there is little benefit offered by MPC. With complex, interacting systems (such as distillation, for example), there can be substantial benefits to an MPC layer, and the added expense and complexity may be justified. However, keep in mind that MPC systems are often put in place on top of lower-level regulatory PID loops. You should be sure that the PID layer is functioning properly before investing in a layer of MPC on top. Most plants are indeed dynamic environments. Raw materials change. Products change. Production rates change. Seasons change. To be successful, a controller must be sufficiently robust to handle these changes. Both robust PID tuning and adaptive MPC models are capable of handling these scenarios. You should use control-loop monitoring tools to ensure that the controllers continue to perform well as these conditions change, regardless of the controller.

Stan: Now for the question of the hour: "Why wasn't an engineer selected for the VP spot?"

Greg: The answer is in these timely top ten lists from Randy Reiss, who is becoming my best resource for my delisted brain.

Top Ten Reasons Not to Pick a Control Engineer as a Candidate for Vice President of the United States

10. There is no model-predictive control for the vetting process
9. Attack dog label is often overlooked for the Ole' Dogs in the control room.
8. Keeps asking the press corps, "Where are the valves?"
7. Campaign stops have to be scheduled around production.
6. Foreign policy?… Hasn't been seen since his visa expired last week."
5. Nobody would understand, "It's the process gain, stupid"
4. Fuzzy logic may be misinterpreted as scandalous.
3. Keeps checking if the campaign bus is properly terminated.
2. Only knows one speech, and it's that one about the time constant being so-o-o-o-o important.
1. The dress code at the White House does not include steel-toed boots, a pocket protector and a coffee-stained shirt.

"Top Ten Reasons to Pick a Control Engineer as a Candidate for Vice President of the United States"

10. Was vetted by his last wife…That means she took the 'Vette, right?
9. Foreign policy experience" Can you say "outsourcing"?
8. Increase production, reduce costs, properly handle waste … It's the economy stupid!
7. No personal life outside of the plant means no possibility of scandals.
6. Has inside connections at the oil and energy companies; That's a requirement these days, right?
5. If he can figure out why Big Paul brought that monkey into the control room last Tuesday, he can decide any split vote in the Senate.
4. One time spent six hours out in the plant with a maintenance guy who kept singing that "How a Bill Becomes a Law" song from Saturday morning cartoons.
3. Knows how to handle dead time.
2. When that 3:00 a.m. phone call comes, he'll already be awake, worrying about loop tuning
1. A natural diplomat; has a keen understanding how logic plays a tiny role in management decisions. ■

AD INDEX

CLASSIFIEDS

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How Far We've Come

George Bush is on the threshold of the White House, even as a charismatic black community organizer from Chicago runs for the U.S. presidency, and—halfway around the world—a superpower is mired in conflict in Afghanistan. ● This may sound awfully familiar, but the year to which I'm referring is 1988: George Bush the elder is on his way *in*, even as Jesse Jackson makes the first credible bid by an African American for the Democratic Party's nomination. And the superpower hopelessly embroiled in Afghanistan? The Soviet Union, of course, which will no longer exist in just a few short years.

Such was the world stage 20 years ago, when in October, the process automation community received its very first issue of *Control*, the first (and still only!) magazine focused exclusively on the information needs of instrumentation and control professionals in the process industries. Much has changed in the past 20 years, even as much remains the same.

Back then, it seems, much more of our time was spent in the weeds of technical detail. I can remember when this magazine published tables comparing the technical specs of various distributed control systems, including such stats as network highway speed. Can you imagine anyone even asking such questions today?

And while the control function must by necessity remain, the focus today is not on process control itself, but increasingly on abstracting and insulating end-user personnel from the need to understand all those technical details.

Much effort today is spent not on understanding process control, but on insulating plant personnel from needing to.

Further, this abstaction is at work along two different planes: At the instrumentation and control system level, where suppliers are striving to facilitate easy—even automatic—configuration of increasingly sophisticated control strategies, and at the optmization level, where the decades-old quest for the Holy Grail of computer-integrated manufacturing (CIM) is finally being achieved under the banner of real-time performance management (RtPM).

Process manufacturers—and the process automation suppliers who serve them—are at work on two fundamental questions: How can we make it easier for plant personnel, who are stretched thin and often undertrained, to more easily manage their process control systems and instrumentation? Further, how can they do so even as they confront the imperative to optimize their plants in economic terms?

Two trips I took over the past several weeks illustrated for me not only the primacy of these issues, but also the potential to tame them.

The first trip was to Austin, Texas, for a sneak peek at Emerson's latest release of its DeltaV digital automation system. (See exclusive story elsewhere in this issue.) The latest generation of the system's engineering tools all are driven by the vision of making the jobs of all plant personnel—from engineer to technician to operator—easier. The development team's motto? "Configuration is a four-letter word."

I also visited Dallas for the Invensys Process Systems Client Conference. There, Hannes Mittermaier of Sasol, the global chemicals and fuels manufacturer based in South Africa, explained how his company had worked with Invensys to implement a top-to-bottom RtPM system within one of its organizations, including development and deployment of economics-based performance metrics and dashboards at each level of the organization–*all with no additional capital expenditures.*

At its foundation, the project relies on Invensys real-time accounting algorithms deployed at the controller level, feeding operator dashboards. Just knowing the economic impact of their decisions, operators were able to make the investment pay for itself in only two months.

"The benefits were easy to evaluate and the accountants agreed!" said Mittermaier. "There are no islands of automation any longer," he added, "only islands of organization."

Okay, so maybe we really can't just forget about process control. But perhaps we'll all finally be able to speak a language the accountants can understand. ■

FOXBORO 100

1908 – 2008

One Hundred Years of Innovation

Redundant fault-tolerant Nodebus allows I/A Series system to be one of the first process systems to leverage new-wave, low-cost Ethernet technology

Foxboro and SAP certify the first interface to an ERP system, linking the I/A Series system with the R/3 business system

I/A Series system Integrator 30 Gateway provides interfaces to all types of industry standards allowing open communication and free flow of information

Embedded MPC is introduced, providing multivariable predictive control capabilities in the I/A Series system

I/A Series transmitter brings Intelligent Automation into the field with remote diagnostics and serviceability features

Engineering and marketing teams dedicated to the pursuit of keeping technology "Continuously Current"

Foxboro Plug-in Migration solution is designed for one-for-one I/O replacement cards (no rewiring). I/A I/O modules provide a low-cost, low-risk solution for systems approaching end of life

I/A SERIES SYSTEM, THE NEW STANDARD

1990–2000

Foxboro. One Hundred Years of Innovation.

This year marks our centennial, and to celebrate, we'll be revisiting each decade over the coming months. It all began in 1908, brothers E.H. and B.B. Bristol opened shop in an empty factory in Foxboro, MA—which proved to be the perfect fertile ground for their innovative brand of engineering. With hard work and ingenuity, The Foxboro Company was born. Within a few years, the Company began introducing the first of many innovations that would revolutionize an industry.

And the first 100 years are only the beginning. The Foxboro product line, an integral part of the Invensys Process Systems portfolio, is poised and ready to meet the challenges and opportunities of the coming decade — with Continuously Current technology, Innovation and Know-How. To learn more visit us at www.ips.invensys.com

FOXBORO

IPS
INVENSYS PROCESS SYSTEMS

SpectraSensors
Tunable Diode Laser Based Gas Analyzers

Laser-fast, Precise Measurements from
Trace to High Concentrations in Process Gases

SpectraSensors®

Tunable Diode Laser (TDL) technology offers a pioneering solution without tradeoffs — fast, repeatable and reliable gas measurements coupled with operational simplicity and low maintenance costs.

TECHNOLOGY

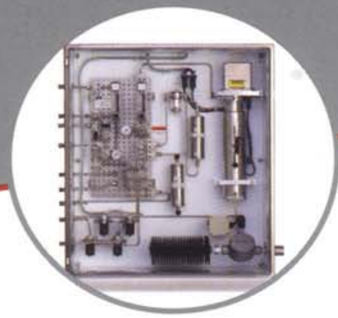
SpectraSensors gas analyzers use robust, tunable diode lasers. The emitted light passes through the gas sample and is measured by a solid-state detector. The laser is tuned over the absorption peak several times per second.

Excellent measurement repeatability makes SpectraSensors' gas analyzers ideal for even the most punishing of environments.

THE COMPANY

SpectraSensors is a NASA spin-off that commercialized tunable diode laser technology from JPL. Now the company is an industry leader with superior analytical tools for the hydrocarbon processing industries.

SpectraSensors' global installed base is supported by the corporate headquarters in Houston, Texas and a world-class manufacturing facility in Southern California. Additionally, the company has sales offices in key locations around the world.



RELIABILITY & REPEATABILITY

By its nature, the SpectraSensors TDL method is not susceptible to aging effects, making its factory calibration a timeless constant. As a result, the calibration remains stable over the life of the analyzer with no drift and no light source fading. Excellent repeatability makes SpectraSensors analyzers ideal for a variety of applications.

SPEED

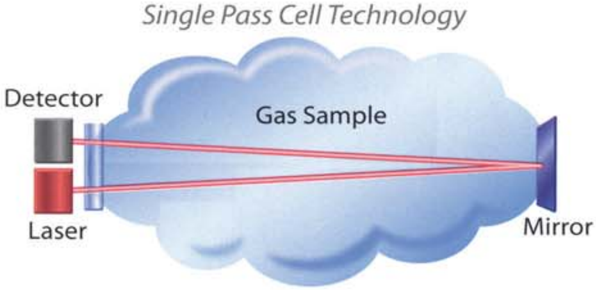
Measurements are set to update in seconds or less. Alternative analytical tools such as electrochemical sensors and gas chromatographs cannot match the real-time precision of laser beams. During process upsets, SpectraSensors analyzers maintain their full operating capability and avoid measurement delays that could extend for hours, as seen in other devices.

LOW COST OF OWNERSHIP

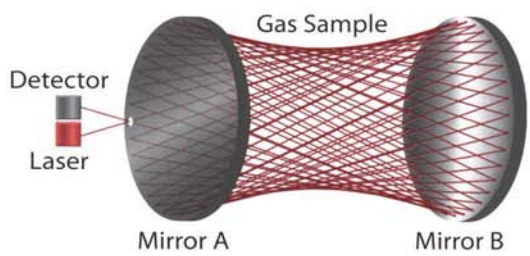
Operating costs are dramatically reduced by eliminating the cost of consumables, extra measurement probes, labor and overhead associated with excessive maintenance.

SpectraSensors is a leading manufacturer of superior gas analyzer technology for online process control.

Single Pass Cell Technology



Herriott Cell Technology



Single Pass Cell or Herriott Cell Technology

In addition to our single pass sample cells, SpectraSensors analyzers incorporate a compact Herriott Cell comprised of a laser and two curved mirrors that allow for long optical paths within a small space. The extended interaction path guarantees the ideal combination of low detection limits (sub-ppm), high stability and practical size.

Measure H_2O, CO_2 & H_2S in Natural Gas with one technology!

Drift free laser diodes ensure robustness and long term, maintenance-free use.

Proven performance for a large number of natural gas companies around the world.

>Natural Gas

PRODUCTION

- > Instant response to wet or sour gas
- > Reliable in remote locations and offshore platforms

GAS PROCESSING

- > Prevent off-spec gas and unnecessary shut-ins
- > Reduce dehydration and sweetening costs

PIPELINE

- > Reduce corrosion / Increase public safety
- > Increase response to off-spec gas
- > Reliable and trustworthy measurements

STORAGE

- > Ensure sales gas is within pipeline tariff levels
- > Improve process control with faster response

LNG

- > Measure trace levels
- > Help avoid damage to expensive assets
- > Extend mole sieve life

DISTRIBUTION

- > Ensure high quality gas
- > Reduce back-flushing and line pigging

Dependable TDL's for Extractive, Online Process Control!

Measure H_2O, HCl, H_2S, NH_3, CO_2. No carrier gas, no tape, and no light source replacement shrinks maintenance costs.

Superior performance in a wide variety of harsh applications with no ongoing calibration.

CATALYTIC REFORMERS

- > Real-time moisture during turnaround recovery
- > Lower maintenance costs and increase uptime

REFINERY FUEL GAS

- > Automated 2-point validation
- > Meets 40 CFR 60 Subpart J requirements
- > No Carrier Gas and No Lead Acetate Tape

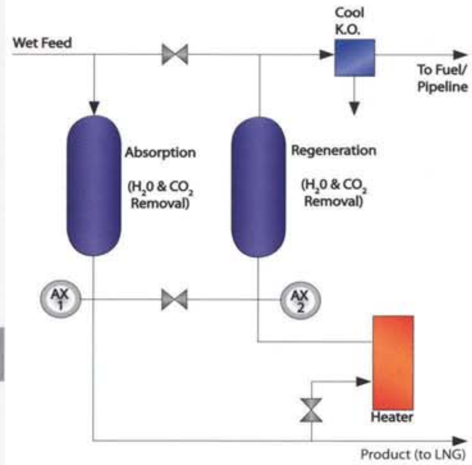
GAS PROCESSING

- > Trace H_2O, H_2S and CO_2 in Butanes, LPG, etc.
- > Lower maintenance costs and increased uptime

APPLICATION HIGHLIGHT
Liquid Natural Gas (LNG)

The presence of even trace moisture or carbon dioxide can damage equipment during compression and liquefaction.

SpectraSensors Analyzers enable extended life between regeneration and prevents contamination in the final product.



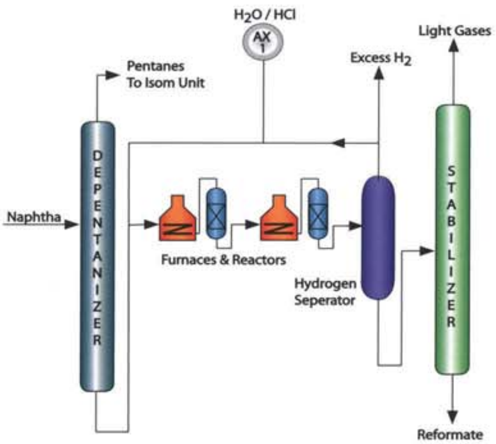
Flow diagram of Dehydration Process in LNG

TYPICAL SPECIFICATIONS

LNG

H_2O Range	0 - 1 ppmv	±25 ppbv
CO_2 Range	0 - 50 ppmv	±100 ppbv
H_2S Range	0 - 10 ppmv	±500 ppbv

Refinery<



Flow diagram of a Refinery Reformer

APPLICATION HIGHLIGHT
H_2O and HCl in Hydrogen Recycle Stream of Refinery Reformer

The presence of moisture and other contaminants can poison catalysts; thus reducing the life and efficiency of the catalyst.

SpectraSensors Analyzers enable extended regeneration frequency through improved water/chloride balance and eliminates blind recovery. Also, measurement drift and uncertainty is eliminated.

TYPICAL SPECIFICATIONS

H_2O Range	0 - 50 ppmv 0 - 500 ppmv	±2 ppmv (dual range)
HCl Range	0 - 10 ppmv	±500 ppbv

Trace Gas Measurements in Seconds!

Measure trace H_2O in Ethylene and Propylene.

Measure trace Acetylene in Ethylene. No spectral interferences, and no drift.

Extremely fast analysis time – 1 second updates are typical. No Routine Service Needed – No carrier gas.

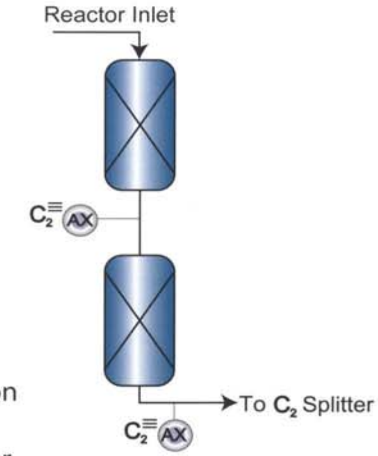
> Ethylene Production

APPLICATION HIGHLIGHT

Acetylene Measurement in an Acetylene Converter

The proper operation of the Acetylene Converter unit requires fast and precise monitoring of acetylene at the mid-bed and as it exits the final reactor.

Using Tunable Diode Lasers, the results are updated every second. High resolution eliminates interferences and the non-contact measurement means the analyzer has no routine maintenance.



Flow diagram of Acetylene Converter Unit

Other important purity measurements can be made using TDL analysis such as H_2O, CO_2, NH_3 and Methane.

TYPICAL SPECIFICATIONS		
C_2H_2 Midbed Range	0 - 3000 ppmv	±5 ppmv
C_2H_2 Final Output Range	0 - 2 ppmv	±50 ppbv

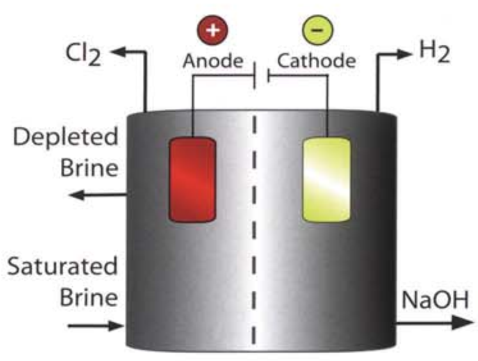
APPLICATION HIGHLIGHT

Moisture and Oxygen Measurement In Chlorine (Chlor-Alkali Plant)

The Chlor-Alkali process is used to manufacture Chlorine (Cl_2) and Caustic Soda (NaOH) through the electrolysis of brine. To ensure efficient Chlorine production and minimal corrosion, the measurement of moisture and oxygen in the Chlorine product is critical.

The TDL Analyzer is ideal for this challenging application because the sensing components never touch the sample. The analyzer operates with negligible impact on its reliability.

The analyzer is available in as a single moisture measurement or a dual (H_2O and O_2) measurement configuration.



Flow diagram of Chlor-Alkali Electrolysis Cell

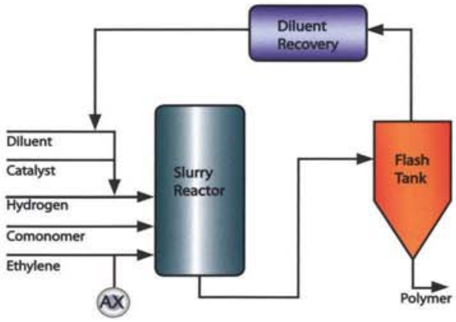
TYPICAL SPECIFICATIONS		
H_2O Range	0 - 2000 ppmv	±40 ppmv
O_2 Range	0 - 2%	±0.01%

APPLICATION HIGHLIGHT

Trace H_2O Analysis in Polyethylene Plants

The presence of even minute amounts of impurities in the feed streams can have a negative effect on the efficiency of the reaction and the overall quality of the final product.

SpectraSensors TDL based analyzers can detect changes in concentration during process upsets without wet-up and dry-down delays. Furthermore, the TDL analyzer does not desensitize in very dry samples over long periods of time.



Flow diagram of a typical Olefins Reactor

TYPICAL SPECIFICATIONS

H_2O Range	0 - 2 ppmv	±50 ppbv

Other< Applications

TDL Analyzers – A New Solution to Old Problems

TDL Process Analyzers enable new possibilities for long standing analytical measurement pain-points.

In addition to the application examples given in this pamphlet, TDL analyzers are a viable solution for the measurement of H_2O, H_2S, CO_2, NH_3, HCl, O_2 and more – in a wide range of processes such as

- Air Separation Plants (High Purity Bulk Gases)
- Steel Mills (Coke Oven Gas)
- Specialty Chemical Plants (Environmental Monitoring)

TDL analyzers are quickly becoming known for their simple design, trouble-free operation, easy installation, with no maintenance requirements or field calibrations.

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