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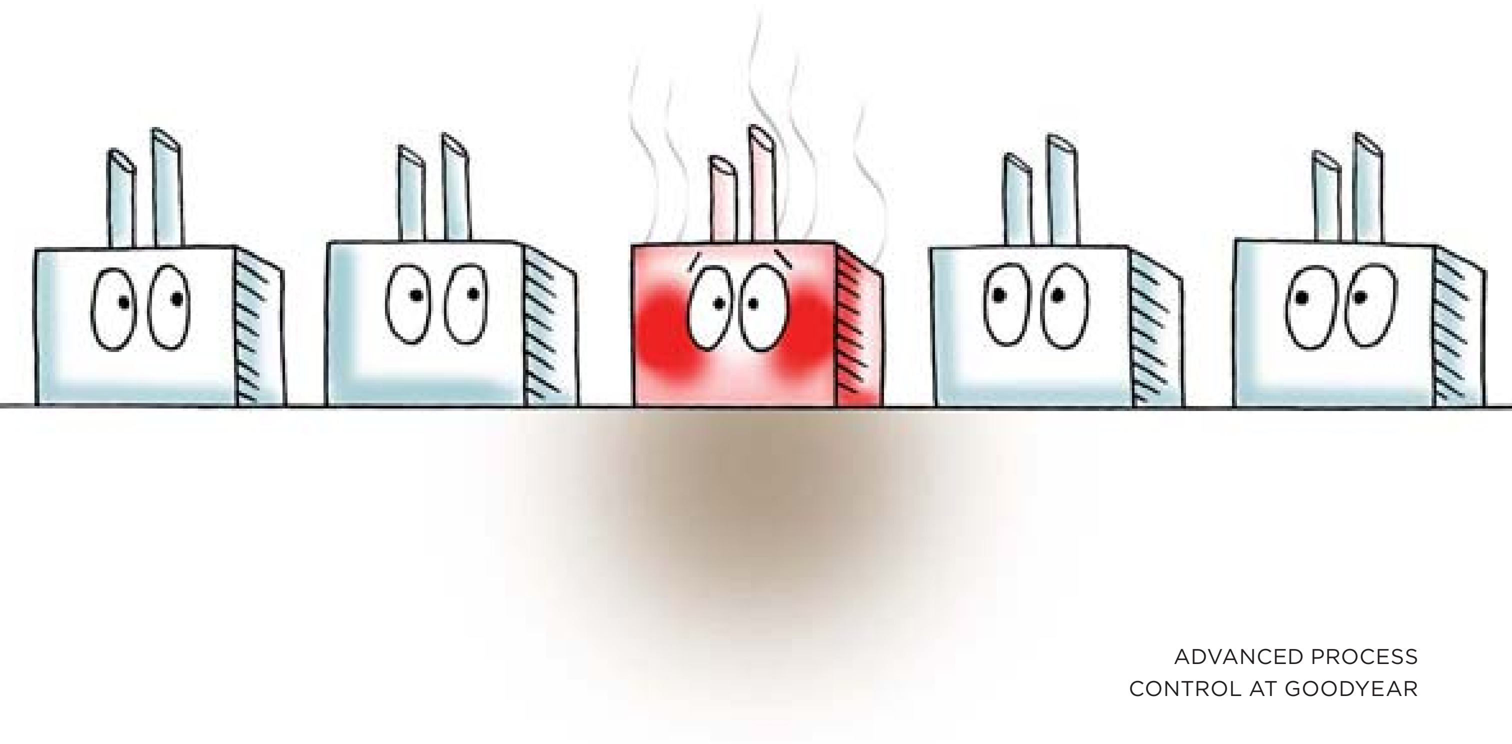

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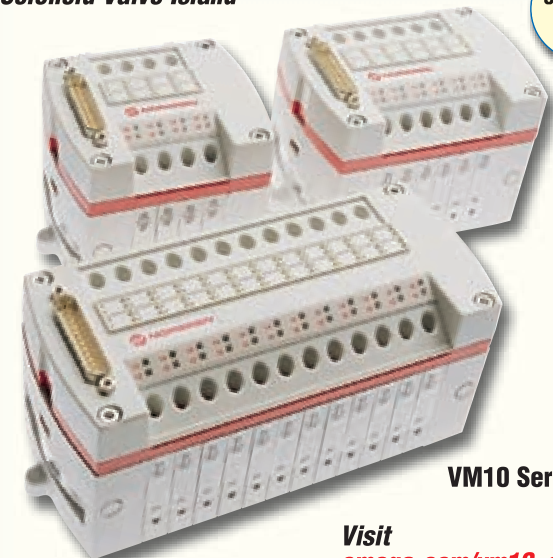

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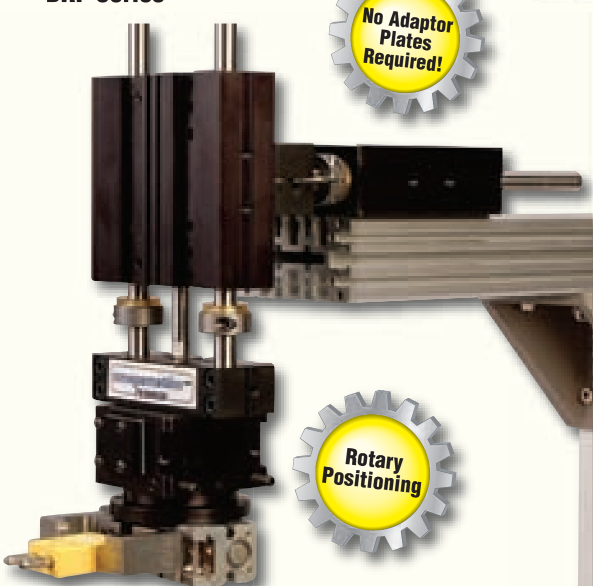

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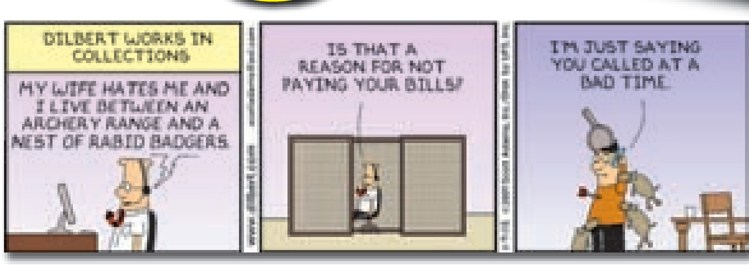

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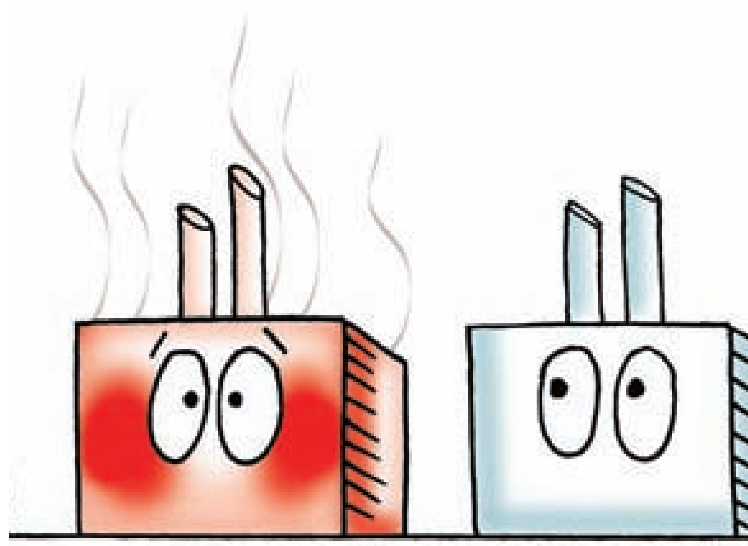

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DEPARTMENTS

CIRCULATION AUDITED JUNE 2010

Chemicals & Allied Products	12,548	Rubber and Miscellaneous Plastic Products	4,403
Food & Kindred Products	12,638	Stone, Clay, Glass & Concrete products	2,057
Paper & Allied Products	3,470	Textile Mill Products	1,361
Primary Metal Industries	5,445	Petroleum Refining & Related Industries	3,877
Electric, Gas & Sanitary Services	3,116	Tobacco Products	115
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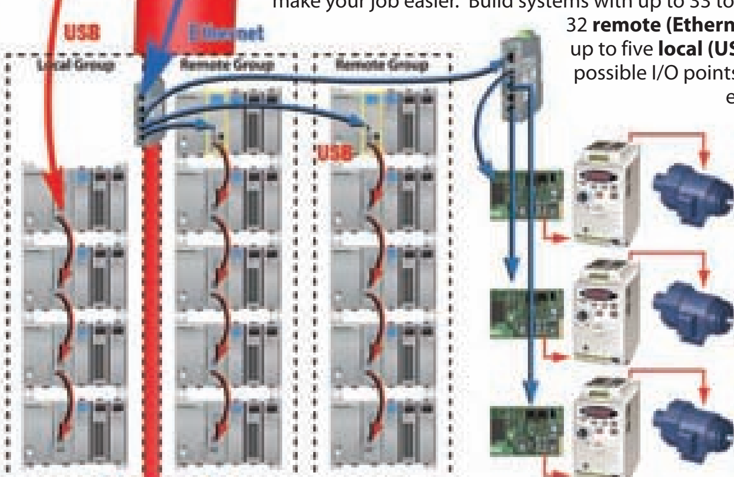

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Doing with Less or Happy Thanksgiving!

WALT BOYES
EDITOR IN CHIEF
wboyes@putman.net

The good news is that the recession is over. The bad news is that the growth curve is barely off zero, and it is going to be several years before we're back to where we were before the greedmongers brought the economy to a crashing halt. "I said 'Greed is good,' but I didn't know they were going to make it legal!" says Michael Douglas, reprising his role as Gordon Gekko in the movie *Wall Street: Money Never Sleeps*.

For all the rest of us, we need to try to get through the next four or five years with jobs and savings more or less intact and with retirement plans more or less on track. Yeah. That's going to be easy.

Let's break it down. If you're in the 55 to 65 age group, as I am, you're probably going to have to work past 65, maybe long past. If you like what you're doing, that works out fine. If you're just hanging on until retirement, you might want to try on that blue vest with the orange piping.

Even at our ages, there are things we can do to make ourselves more marketable, so we don't get let go in a "resizing" that is actually getting rid of the older, higher paid workers. Keep up. Read the journals. Attend seminars and webinars. Join Facebook and LinkedIn professional groups for automation professionals. Make an effort to pass your knowledge along to younger workers and be seen by your management doing so. It will make you more valuable in their eyes, and if they do lay you off, it may get you brought back as a $250-an-hour consultant.

If you are in the early part or the middle of your career, much the same advice applies, just more so. I've written before about the letter I received from a recently laid-off engineer who had spent 37 years with the same company doing basically the same job. His skills were 37 years old, and he had no resume. It's that blue vest again.

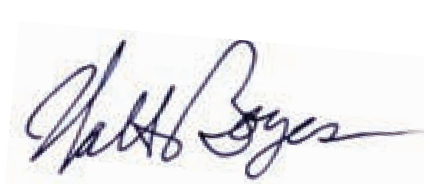
Your skills are yours. They belong to you and they go with you wherever you go. Time was, "He who dies with the most toys wins." Now it is, "He who has the most skills wins."

As automation professionals, we should have the largest skill set in all of manufacturing. You think that's bunk? Well, take a look at what we know, and what we're expected to know. ISA developed a profile of the automation worker for the U.S. Department of Labor a few years ago, and I reprinted it in my book, *The Instrumentation Reference Book*, 4th Edition. See also www.careeronestop.org/CompetencyModel/pyramid.aspx?AT=Y.

You work all week, and the last thing you want to do is to study and read technical stuff on evenings and weekends. You have a family. You have a life. Well, make time during your work day to expand your skills. Campaign with your management to make that essential. If they won't help you, consider going where management will. Remember, there is very little loyalty left, and you shouldn't have any qualms about going somewhere better.

Above all, differentiate yourself as an automation professional by knowing as much as you can about the business of the company you work for, or you are doomed to be in the same job forever. Engineers' salaries typically top out at about 40 years old, while managers' salaries keep going up. Why? Because managers are worth more to CEOs than engineers are. Yes, I know that's wrong. So?

If you want more respect as an engineer, you have to get the attention of the suits on the top floor. That means being able to talk to them about how your job directly affects their bottom line. It might not be the job you signed on for in engineering school, but it's the one you'll need to master now if you want any job at all. Meanwhile, be thankful for the job you do have. Happy Thanksgiving!



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[Editor's note: The following are posts and comments taken from our "Unfettered" and "The Great Kanduski" blogs at www.controlglobal.com.]

Thoughts on Stuxnet

On his "Unfettered" blog, Joe Weiss posted "Stuxnet and the Smart Grid," which stated:

"Stuxnet has at least two major implications for Smart Grid. The first is Smart Grid uses key management. Stuxnet is one of the first cyberattacks to use compromised digital keys. Since then, at least three other cyber vulnerabilities have used compromised digital keys. There should be a reassessment of the key management process for Smart Grid. The second is the more insidious aspect of Stuxnet that attacks control system logic. Programmable logic controllers (PLCs) and other controllers with Windows front ends are used throughout the Smart Grid for controlling renewable resources, and for modern automated substations and other grid systems. These systems can be vulnerable to Stuxnet-type attacks. Control system policies and procedures need to be developed and implemented immediately to at least minimize these types of attacks."

Blog reader ab3a commented:

"This [first] problem isn't as new as many might think. This article from the Feb. 21, 2005, edition of eweek.com (http://tinyurl.com/5xcm6s) is about the lack of security in a digitally signed key. Digital signatures are the foundation to trusted computing. However, the more keys one has to trust, the more likely it is that something will sneak in through a compromised key. Few give any thought to that aspect of trusted computing. Now that Stuxnet is well-known, perhaps this attitude will change."

Later, ab3a added:

"Stuxnet attacked the STEP 7 development environment and inserted some new library routines. Then, when the developers or integrators downloaded a new version of the software, the rogue code was inserted in the PLC program.

"Back to reality. There are many integrated development environment (IDE) packages for many platforms. Authenticating the code in the foundation libraries is something that I have heard of only among the most paranoid installations. Almost nobody does it.

People authenticate entire installation programs, but I've never heard of anyone authenticating a working IDE or an HMI. This measure is possible, but is it practical? How far should our paranoia about protecting our infrastructure go?"

Automation Week 2010

Ian Verhappen, "The Great Kanduski," gave a positive review of the new ISA Automation Week (AW) 2010, and asked for suggestions for improving it next year.

Jon DiPietro had a list:

"1. Free wireless will make it easier for people to attend—they can stay in touch—and promote AW through social media and sharing. I hope we really promote that as I think it's a big deal for attendees.

2. We should think about ways to increase the interaction between exhibitors and attendees. I'm not sure why the exhibits were closed during the sessions—there were two occasions when I wanted to see exhibits and couldn't.

3. The contingent of journalists present was pretty thin. Maybe there are accommodations we can make in order to get more of them there to cover our event.

4. I would like to see one of the tracks run as an "unconference." We could create a website/page where conference attendees submit abstracts and then publicly vote on the subjects that interest them. The top three vote getters end up getting a speaking slot.

5. We could borrow Emerson's idea and set up a social media help booth. Emerson employees signed up hundreds of people and showed them how to use Twitter. This created a small army of people promoting the Emerson event."

BÉLA LIPTÁK
liptakbela@aol.com

Software for Renewable Energy Processes — 4

Solar technology began in 212 BCE when Archimedes concentrated the sun's rays to ignite Roman ships. Now our space stations are powered by solar panels and lifted into space by hydrogen peroxide engines. It was in 1861 when Auguste Mouchout created the first steam engine powered by solar energy, and in 1883 Charles Fritz first turned the sun's rays into electricity. It took almost a century until, in 1954, Calvin Fuller and his team at Bell Laboratories constructed the first silicon solar panels, which had an efficiency of 6% and a cost of $300 per watt of electricity produced.

Today, solar cell efficiency can exceed 30%, and the installed costs have dropped below $10/Wp. Wp is the peak electricity produced under "standard conditions"—equivalent to bright sun in the tropics (25 °C and light intensity of 1 kW/m2). On average, each Wp produces about 5 kWh/day. The key limitation of PV cells is that any given semiconductor only responds to a certain wavelength of radiation and can therefore convert only a portion of it to electricity. This limitation is gradually being overcome.

The cost of conventionally generated electricity in the United States averages about 10¢/kWh. In contrast, solar electricity costs around 15¢ to 17 ¢ per kWh. Once installed, the fuel (solar energy) is practically free, and the useful life of the cells range between 25 to 35 years. The energy payback period (the number of years it takes for the cells to generate the energy that was needed to manufacture them) ranges between one and four years.

As of 2010, the total global electricity generating capacity is 4800 gW, the installed solar generating capacity in only around 25 gW or 0.5%. On the other hand, solar is the fastest growing power-generation technology in the world, increasing at an annual rate of 60%. Last year the First Solar Co. ranked Number 7 on *Fortune*'s list of the fastest growing companies, and thin-film and nano-solar technologies might even exceed that rate. Today's market share of thin-film solar cells (copper indium gallium selenide (CIGS) is approximately 15%. The commercially available thin-film solar cells have an efficiency of 11%.

Solar is the fastest growing power-generation technology in the world, increasing at an annual rate of 60%.

The total use of renewable energy in the United States (including hydraulic and biomass) is around 10%, and the total use of solar energy is about 0.2%, while that of Portugal, for example, is nearly 50% (Figure 1). On the other hand, the trend suggests that we will be catching up in the coming years. For example, the Westland Solar project in the San Joaquin Valley will be the world's largest solar power plant. It will generate 5 gW on 30,000 acres of land. Increased use of solar energy is also motivated by factors such as the high transportation expenses of gasoline. In Afghanistan, for example, the cost of delivering gasoline is hundreds of dollars per gallon.

Solar Energy Storage and Transportation

In the coming articles, I will concentrate on the software needs for control and optimization of solar energy storage and transportation systems, giving particular emphasis to my reversible fuel cell design (http://belaliptakpe.com/solar-hydrogen-power-plant/). Some of these software packages might seem overly complex,

PORTUGUESE SUNSHINE

Figure 1: A solar power installation in Serpa, Portugal. Nearly 50% of Portugal's energy is derived from solar power.

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but at a time of unmanned drones and Google's unmanned cars, they should be feasible. I will start the discussion with small units serving individual homes and smaller industrial plants.

The optimization software needed for PV systems with both storage and grid connections has to 1) provide total automation, including record-keeping, 2) provide capability to reconfigure the system to automatically maximize profitability and 3) provide self-diagnostics.

In developing the software package, the primary goal must be simplicity, so its operation does not require more understanding from the homeowner than what's needed for operating a thermostat. To provide this requires total automation, so that the system will safely operate on its own, without the need for the homeowner to take any action at all. On the other hand, the software must allow the homeowner (or preferably the electric company) to update any data or setpoint, such as changes in the price of electricity (during normal, night or peak periods, if they differ). If the home has electric car(s) charging during the night, the software package must be provided with the target amount of electricity needed to be in battery storage in the morning.

Grid Connected PV System with Net-Billing Meter

The main components of a simple installation are the solar collectors and the intelligent, bi-directional electric meter, which is furnished by the electric utility company. Such a system has no electricity storage capability. Therefore, when solar electricity is insufficient or unavailable (at night or on cloudy days), it obtains some or all of the electricity needed from the grid (red direction of electricity flow in Figure 2). Inversely, when excess solar energy is available (beyond the needs of the household) it is sent to the grid (green direction in Figure 2).

Billing is done on the basis of net electricity used (or generated) during the month. This net amount is a function of the size of the solar collectors, the insolation in the area, the weather conditions and other factors (dirt buildup or collector maintenance, etc.)

The economics of the operation is a function of the contract with the electric utility and is also affected by government support. The utility either charges (or pays) a flat rate for the electricity or a rate that changes with the time of the day. If the second is the case, it's likely that the night rate is the lowest, and the "peak rate" is the highest. Peak rate is usually applied when the power plant is operating at nearly full capacity (usually because of high air conditioning loads on hot summer days). Under these conditions, receiving the excess solar energy is advantageous to the utility because it does not need to start up its emergency generators. Sending "peak electricity" to the utility is also advantageous to the homeowners if the rate paid is higher.

It is the utility company that takes government subsidies and regulations into consideration, so that the homeowner just receives a monthly statement without requiring any additional paperwork. Besides direct subsidies, the government in some countries guarantees a fixed rate for the solar energy sent to the grid. This rate is often higher than its "market value." In such cases the utility is required to distribute that extra cost among the "non-solar" households.

As shown in Figure 2, the electric meter is an intelligent one that auto-

matically considers the electricity flows in both directions and displays the net total (cost or payment) at any time during the month. The software provided by the utility is automatically adjusted for times of day variations in cost rate or times of "peak periods," so the homeowner is not burdened with adjusting them.

The software in the intelligent electric meter should also be able to perform other control tasks, such as to automatically charge the batteries of the electric car(s) when the electricity is inexpensive ("night time"), and to maximize the amount of electricity sent to the grid (by temporarily turning off optional users) during periods when peak electricity rates apply on hot summer days.

None of this software, nor the intelligent net-billing utility meters themselves exist today, but as energy costs increase, they will. The purpose of this series of articles is not only to describe software that is available, but also to describe the control software needs of the future as renewable energy systems become more complex and sophisticated.

Our tax dollars should be invested in new technologies that guarantee an energy future that is inexhaustible, clean and free. The use of solar shingles is already cost-effective in the southern half of the United States and installing them would not only eliminate unemployment, oil imports, energy wars and the destruction of nature, but would also lower unemployment, because of the millions of carpenters, electricians and laborers that their installation would require. ■

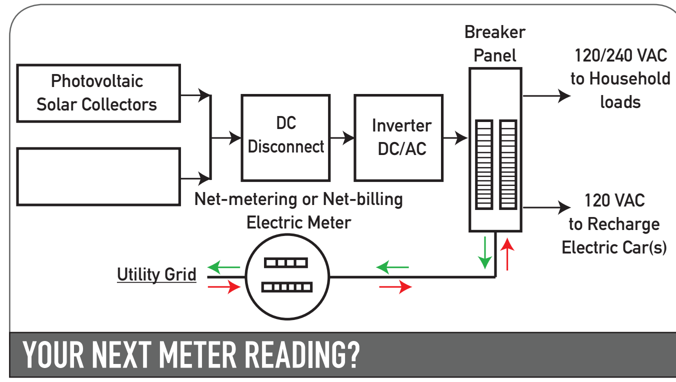
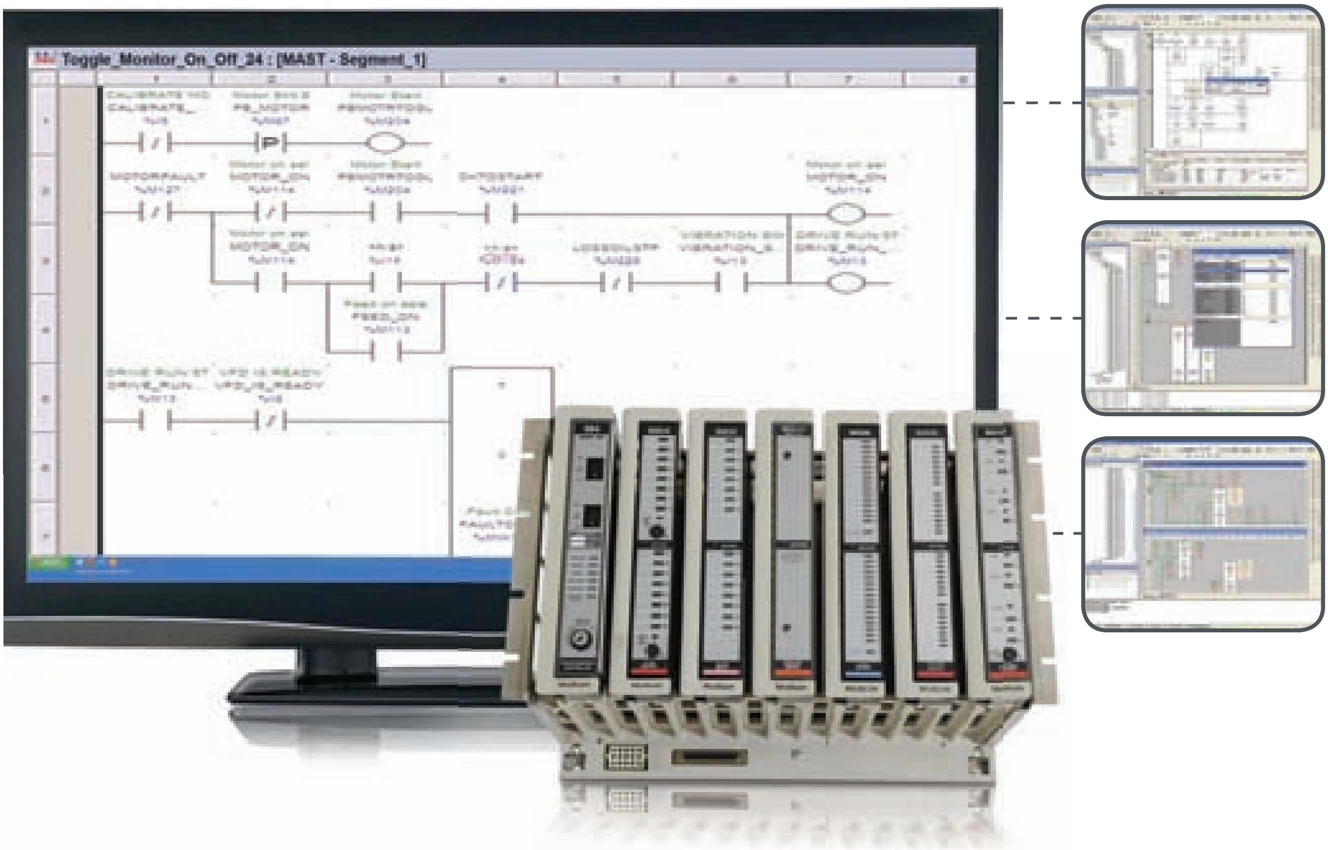


Figure 2: Grid-connected solar collector system with two-directional utility meter for net-billing.



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We Get It – Wireless Works

JOHN REZABEK
CONTRIBUTING EDITOR
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A few months back, I received a quote from my instrument salesman that was shockingly devoid of the previously ubiquitous WirelessHART attachment. Every prior quote—in my case almost exclusively for wired devices—contained an added attachment extolling the virtues of wireless. So when I opened the one with no such addendum, I wrote him back about the missing attachment. "You must have lost it," I joked. Can anyone remember an instrument technology that was marketed with such persistence and zeal?

Perhaps that's because WirelessHART emerged in products well before the completion of the ISA 100.11 wireless specification. Consensus standards are messy and difficult for suppliers. It's much easier to create the standard and then just dish it up. Isn't this how we ended up with multiple fieldbus standards?

Well now we have multiple wireless standards. The "freedom to choose" that was so fundamental to the mission of ISA SP50 and later Foundation fieldbus is not particularly strong in the wireless arena. If you have the wrong system, you may not be free to choose your favorite field device—unless you're happy with two wireless backhauls, one for ISA 100.11 devices and one for WirelessHART.

There's some talk of convergence, but what convergence can avoid stranding hundreds of existing WirelessHART users? The Fieldbus Foundation is working on a specification for a backhaul to serve both, but host suppliers would need to push forward support of Foundation High-Speed Ethernet, instead of preempting an open solution with proprietary ones.

I worked for one of the companies that installed early betas of WirelessHART before 2005. The effort at a fairly modern refinery on the West Coast included measurements of rotating equipment bearing temperatures, which turned out to be of extraordinary value, allowing the plant to predict failures before they caused an unplanned outage. But, to this day, I've never understood why such valuable measurements—claimed to have saved tens of thousands or even hundreds of thousands of dollars—couldn't justify running wires.

And, none of us sitting around at that 2004 Technology Information Exchange (TIE) had applications that were aching for a wireless solution. We already had wireless solutions that were rarely used because they were rarely needed. We had a lot of aging legacy systems that needed a path to modern digital integration, and most of the legacy systems had wires connecting the DCS to field devices. We had scores of new safety interlock applications requiring SIL-rated safety instrumented functions—no one saw wireless helping us with that. Even tank farms, where we always dreamed of using wireless, required SIL-capable systems. No one could imagine wireless measuring up in that area. The mountain of measurements stranded due to the expense and/or complexity of running wire—that could be solved with a Zigbee or Dust radio mesh—were off the radar, as it were, of many process industry users.

WirelessHART products have been available since at least 2007, and today one can obtain compatible products from ABB, Endress+Hauser, Siemens, Pepperl+Fuchs, Emerson and others. Given the numerous installations already in the field at diverse end users, and the prestige of the excellent suppliers who support it, I'm happy to say I'm sold. WirelessHART works and delivers as advertised.

Is there anyone remaining out there who thinks otherwise? I haven't installed any personally, but I have plenty of neighbors and friends who have, and none of them are ripping it out.

Wireless is not a hard sell—most managers are ready to approve it if the expense seems justifiable. They are typically already big users of wireless, from their laptops to their iPhones and Blackberries. Maybe it is our overly conservative process culture, but I think it's really "fitness for purpose" that causes most users to just keep yanking in their copper twisted pairs. ■

Wireless is not a hard sell—most managers are ready to approve it if the expense seems justifiable.

GE Energy Acquires Dresser Inc.

$3-billion deal brings Dresser's valve business into GE fold.

GE has announced that it has signed a contract to acquire Dresser Inc., a global energy infrastructure technology and service provider. The $3 billion deal is the latest in a series of acquisitions over the last 10 years that has helped grow GE's energy business and deliver record profitability.

Dresser's portfolio, which includes technologies for gas engines, control and relief valves, measurement, regulation and control solutions for gas and fuel distribution, will expand GE's core energy offerings, and extend its reach into adjacent offerings for its energy and industrial customers. The deal is subject to customary closing conditions, and is expected to close promptly after receiving regulatory approval.

"Dresser is a great fit for the GE business model," said John Krenicki, vice chairman of GE and president and CEO of GE Energy. "Dresser's technology complements our existing gas engine portfolio, and adds offerings complementary to those of GE in the $45-billion flow technology industry, including product offerings in the highly engineered valve segment. Eighty-five percent of Dresser's revenue is from energy customers, and it has developed a large installed base of equipment, which is a big reason why 40% of its total revenue is derived from aftermarket service offerings, and there is a lot of room for future expansion."

David Clayton, senior analyst at ARC Advisory Group, commented on the acquisition: "With its acquisition of Dresser, GE immediately becomes one of the world's leading control valve suppliers. With 2009 revenues exceeding $500 million, Dresser is the second largest global control valve supplier. Dresser's portfolio includes final control elements for general service, engineered solutions for severe service applications,

> "GE now has the potential to address the full scope of process automation, from field instrumentation to process automation systems and software. Only a handful of companies in the industry can do all this."
> – Larry O'Brien, ARC.

and digital solutions that can communicate with nearly any control system. Dresser's Valscope Pro and ValVue OVD diagnostic tools enable Dresser to evaluate and diagnose nearly the entire spectrum of installed control valves still in service—intelligent or conventional. As the world's demand for both energy and predictive maintenance solutions continues to grow, gaining access to a key automation component in the energy markets and the ability to properly assess their health should enhance GE's position in the global energy markets."

Larry O'Brien, ARC's research director for automation, added, "Between the combined automation-related businesses of GE Energy and GE Intelligent Platforms, the company now has the potential to address the full scope of process automation, from field instrumentation and control valves to rotating equipment diagnostics, process automation systems and related software. Only a handful of companies in the industry can do all this."

Headquartered in Addison, Texas, Dresser operates in more than 100 countries, delivering compression, flow technology, measurement and distribution infrastructure and services to customers in more than 150 countries. Dresser had revenues of $2 billion and earnings of $318 million in 2009.

This deal is the latest in a series of moves by GE Energy to expand its business. On Sept. 27, it announced a joint venture in China to expand further into the world's largest wind market. On Oct. 1, it closed on its purchase of the assets of Calnetix Power Solutions, which expands GE's capabilities to recover waste heat from industrial processes for electricity generation, and will also complement GE's gas engine business. On Oct. 4, the company also signed a $700 million contract with Saudi Electricity Co. for a new, high-efficiency power plant in Riyadh, Saudi Arabia. ■

IOM Gets It Together

This year's Invensys Operations Management (IOM) user group meeting held in October in Orlando, Fla., demonstrated that the latest reinvention of Invensys has finally achieved what the company has been working on since the original British-owned Invensys kludged together several disparate companies to compete in the automation space in the 1980s and 1990s. It has been a struggle, but now it appears that the venerable brands of Foxboro, Eurotherm, Sim-Sci Esscor, Avantis and Wonderware have been brought together in such a way as to leverage their strengths and diminish their weaknesses.

In a year, IOM has completed the reorganization, finalized branding, and is working on leveraging the strengths of its varied distribution channels, from direct sales to manufacturers' reps to stocking distributors to control system integrators. Steve Blair, president of IOM-USA, said, "Our objective is to not mess up, and if we can do that, we'll come out of


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this with an immensely stronger distribution organization. We're working on the 'who does what' right now."

Sudipta Bhattacharya, IOM's CEO and president, presented a roadmap that indicates that InFusion, ArchestrA and InTouch are the future for the software part of I/A, and the 100 Series controllers will be upgraded and improved. IOM also introduced a new programmable automation controller (PAC) bearing the Foxboro name. The Foxboro PAC and I/O subsystems are integrated with Wonderware's software. He also noted that the Eurotherm control system that has mostly been treated as a red-headed stepchild by the true Foxboro believers will be going forward as the smaller control system it was intended to be.

The marketing term for Invensys going forward is "Enterprise Control System (ECS)." Invensys' Neil Cooper describes it as "a meta-integration of control, production control and business control with a real-time feedback system." In the case of Invensys, that's InFusion based on the ArchestrA software platform backbone.

An ECS component is any Invensys offering or any third-party offering that communicates with the ArchestrA backbone software. On the plant floor, that would be the DCS, SCADA, PAC, historian, HMI and safety systems from Foxboro, Triconex, Wonderware, Eurotherm or from third parties.

At the site-wide or multi-site level, the term ECS incompasses production and performance applications, such as quality, performance, batch, mobile worker management, MES, asset management, optimization, simulation and workflow, business process management and collaboration, EMI/intelligence, enterprise integration and visualization, with solutions available from Avantis, IMserv, Sim-Sci Esscor, Skelta and Wonderware. ■

Trade Shows Rebound

The death of the old mega-trade shows, which attracted thousands of exhibitors and even more thousands of attendees, may have been exaggerated. These week-long extravaganzas fell on hard times thanks to the double whammy of the Internet and economic hard times. But some of the venerable giants are stirring again.

For instance, SPS/IPC/Drives 2010—Electric Automation, Systems

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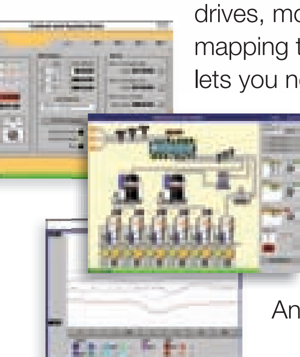

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and Components, the yearly gathering of European process automation vendors, is reporting exhibitor space bookings matching its pre-economic blowup numbers in 2008—a whopping 90,000 square meters. Conference organizers report that approximately 1300 exhibitors will present products and services at this year's event in Nuremberg, Germany, on Nov. 23-25.

Meanwhile, Deutsche Messe, organizers of Hannover Fair, the world's largest industrial technology trade fair, is adding Industrial Automation North America to its international expansion plans. For the last few years, Hannover Fair has included the Interkama Exhibition, which attracted 150,000 visitors this year.

This new show will be held Sept. 12-15, 2012, alongside the International Manufacturing Technology Show (IMTS) at McCormick Place in Chicago. It will showcase products and solutions for production automation, complementing the IMTS focus on machine tools, metalworking and precision manufacturing. The move stems from a strategic alliance with AMT—The Association for Manufacturing Technology, which organizes of IMTS. ■

ISA Announces the 2011 Testing Window Application Deadlines

ISA has announced the three testing dates and application deadlines in 2011 for its Certified Automation Professional (CAP) and Certified Control Systems Technician (CCST) certification awards.

To take the certification exam in the preferred testing window, applications must be postmarked or submitted online by that testing window's application deadline:

Window 1: To take the exam between March 1–April 30, 2011, the application postmark/online submission deadline is Friday, Jan. 14, 2011

Window 2: To take the exam between July 1– Aug. 31, 2011, the application postmark/online submission deadline is Friday, May 13, 2011

Window 3: To take the exam between Nov. 1–Dec. 31, 2011, the application Postmark/Online Submission Deadline is Thursday, Sept. 15, 2011

More information about the certifications and preparation for the tests can be found at www.isa.org. ■

On the Level about Level Measurement

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.

LEVEL MEASUREMENT BASICS

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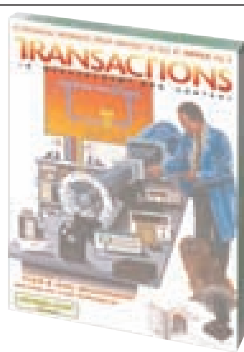
Transactions in Measurement & Control, Vol. 4, Flow and Level Measurement, from Omega Engineering, is a 113-page, free, downloadable PDF covering the basics of level measurement. Beginning on p.age 72, level topics include level sensor selection, pressure/density, RF/capacitance and radiation-based instrumentation, and speciality level switches. The direct link is www.omega.com/literature/transactions/Transactions_Vol_IV.pdf.



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"Methods of Detecting Water Level in Steam Boilers" is an online tutorial from Spirax Sarco that discusses the application of level controls and alarms, plus an overview of different level-detection methods, including float-type controls, conductivity probes and capacitance devices. The direct link is at http://preview.tinyurl.com/3al6ow9.

LEVEL BASICS—THE MOVIE

CONTROLGLOBAL
www.controlglobal.com

In this video, *Control*'s editor in chief, Walt Boyes, talks about the basics of measuring level and how to select the correct level technology for your applications. Topics include wireless standards, hydrostatic level measurement, level measurement basics and more. Watch the video at www.controlglobal.com/multimedia/2008/024.html.

LEVEL LIMIT SWITCHES

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This article discusses in detail the characteristics of a universal limit switch for liquids using a vibronic limit switch as an example. Starting with the general requirements of such an instrument, this switch may be used in approximately 80% of all applications occurring in practice. It demonstrates both the physical measurement principle and the electronic units for frequency evaluation and signal transmission. The focus is on using a limit switch for overspill protection to guarantee safe operation, even under extreme conditions. The direct link is http://preview.tinyurl.com/35yqvv8

LEVEL ADVICE

PLCS.NET
www.plcs.net

This is an online discussion that begins with a problem about horizontal-tank level measurement and logging. A customer has a horizontally mounted tank that is 144 in. long and 64 in. in diameter. The ends are flat. The customer would like to know the daily usage of the liquid in the tank via a measurement in the morning and another at the end of the day. The customer wants accuracy of up to 1 gallon changes in this tank measurement. Some say this is impossible, given it is a horizontally mounted tank and that the sensor cannot detect those extreme small changes. Follow the discussion and possible solutions at http://tinyurl.com/2fmlsju.

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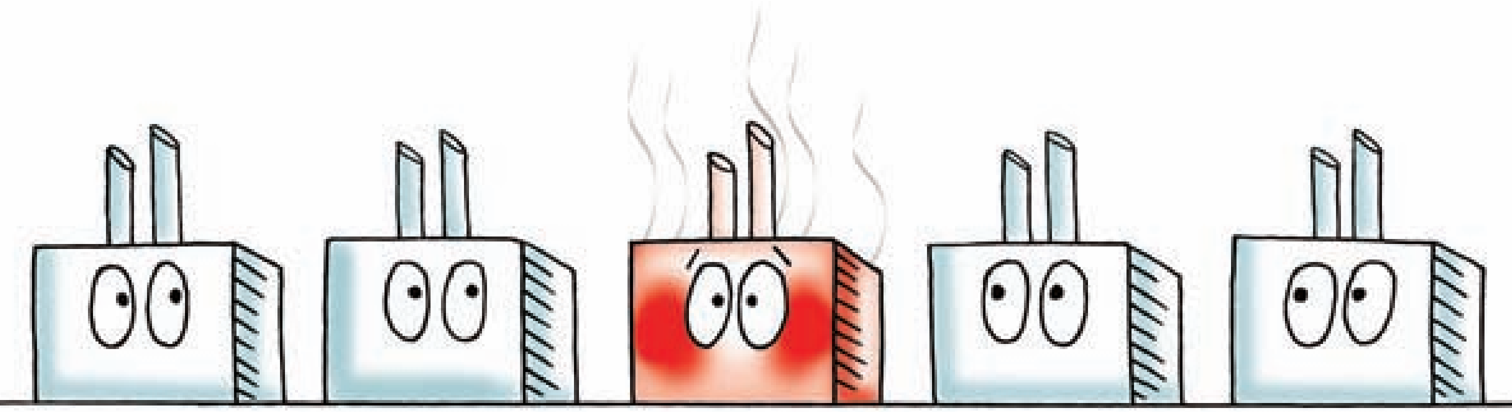
Continuous level measurement is about one thing, which is answering the question, "How much stuff do I have?" Usually the desired engineering unit is expressed in terms of volume or weight. "Measuring" volume or weight is not always the most practical approach. Sometimes it isn't even viable. This is where continuous level measurement sensors and systems come into play and offer a viable and cost-effective approach. "Application Considerations for Continuous Level and Inventory Monitoring of Powder and Bulk Solids" is a white paper from Blue Level Technologies that discusses the challenges of powder and bulk solid level measurement. The downloadable PDF is found at www.controlglobal.com/whitepapers/201%46.html.

BIG-TIME CONDITION MONITORING

CONDITION MONITORING IS MORE THAN WALKING AROUND THE PLANT WITH A DATA LOGGER AND A CLIPBOARD. DONE BIG TIME, IT CAN SAVE YOU MILLIONS OF DOLLARS.

BY DAN HEBERT, PE



To some, condition monitoring (CM) means installing vibration sensors on a few critical motors, and then having a maintenance technician with a handheld data logger check sensor readings on a more or less regular basis.

To others, such as Romel Bhullar, senior technical fellow/director at the engineering and construction giant Fluor (www.fluor.com), CM is a very big deal, requiring a systems approach. "At Fluor, working as systems integrators on mega projects, we routinely incorporate conditioning monitoring solutions to control and manage capital assets," says Bhullar. (Figure 1)

"Besides huge upfront capital layouts of several hundred million dollars or more, these assets are directly responsible for delivering very valuable products like several hundred thousands barrels per day of petroleum or billions of cubic feet of natural gas. Unplanned interruptions can shut down operations and cost companies millions," adds Bhullar.

Condition monitoring to keep modern process plants up and running are necessarily complex. "A conditioning monitoring project typically involves integrating and marrying diverse and competing commercial technologies, systems and parameters," explains Bhullar. "It also requires very high-speed, real-time input monitoring, signal conditioning and processing. We have to deal with different sensor suppliers, vibration systems and system integration problems—using a variety of networks, communication protocols, media, servers, and application hardware and software."

However, it pays off, especially in process industry applications, where plant shutdowns due to equipment failure can cost millions of dollars per day. The dollars and the challenges may seem daunting, but the rewards can be significant, and there are ways to cut the project down to a manageable size.

Getting Started

While a plant-wide CM and asset management system isn't a simple project, the approach to it can be fairly straightforward, according to Michael Gurney, co-CEO of Concept Systems (conceptsystemsinc.com), a systems integrator in Albany, Ore.

"When it comes to the actual implementation of a CM solution, there are two options," he advises. "The first is using control hardware already in place, and the second is equipping assets with new instrumentation and controls."

Much hardware installed in a plant already has diagnostic capabilities. "In virtually all cases we've looked at, there are capabilities already on the plant floor for capturing data on an asset, but most go underutilized," says Gurney.

Sometimes, you don't even have to install sensors, as everything you need may already be there. InduSoft (www.indusoft.com), for example, installed a SCADA system at the University of Texas in Austin. "The system monitors more than 1200 meters from more than 100 buildings on the campus," explains Fabio Terezinho, InduSoft's VP of Consulting Services. "The InduSoft system combines real-time data acquired from an OPC server with historical data retrieved from the historian, and displays information from electrical, chilled water, domestic water and steam on dashboards—and makes the information available to remote users anywhere via a web browser."

The system also generates reports with a log of events, such as calibration/verification of the meters, which is used to schedule preventive maintenance and check the integrity of the data. Alarm and remote notification allows the university to detect and fix defects in a timely manner. According to InduSoft, installation went smoothly. "Integration of the open architecture InduSoft Web Studio with third-party systems previously installed at the site was straightforward," says Terezinho.

Another example of a relatively easy condition monitoring implementation occurred at Centro Energia Teverola

Photo courtesy of Fluor

KEEPING THINGS HUMMING IS PART OF THE DEAL.

Figure 1: When Fluor designs and builds huge process plants for its clients, the condition-monitoring system is a key deliverable.

(www.centroenergia.it), a 150-MW combined-cycle cogeneration power plant in Teverola, Italy, about 20 miles north of Naples. The plant already had CM sensors installed on instruments and valves, all wired into the ex-

CONDITION MONITORING TELLS ALL

Fluor designs and builds huge process facilities such as chemical plants, refineries and power plants. Romel Bhullar, senior technical fellow/director at Fluor, says, "In almost every project we do—refineries, energy, petrochemical, biochemical, pharmaceutical or power—asset condition monitoring (CM) is an integral part."

One such project at Potomac Electric Power Co. (Pepco) involved a plant supplying power to the city of Washington, D.C. "It's critical that the power generation turbines, generators and auxiliary systems have a CM system that monitors impending failures and identifies reasons to do preventive maintenance."

Putting together such a system isn't easy. "Standard commercial off-the-shelf solutions weren't flexible and functional enough to match our needs," he says. "There were mountains of challenges: technical, people, commercial, multiple company cultures and organizations," he adds. "In these days of tough economic times, all vendors are protecting their markets and providing proprietary and expensive solutions. It makes integration very difficult."

Things are improving, but problems still exist when tying together different communication protocols. "There have been significant developments in networking technologies and communications equipment, but major issues in the bottom two layers of the OSI model still need lot of work," he notes. "Management may have different objectives than the people in operations, IT and control systems—not to mention suppliers. It's a maze out there." Bhullar says the cost to install the CM system at Potomac Power "…was several million dollars."

The data being gathered is extremely important to more than just the power company. EPRI (www.epri.org), a power industry consortium in Palo Alto, Calif., contributed to the project, so it could see the data.

"The conditioning monitoring system provides data in real time to all the EPRI stakeholders across the U.S.," Bhullar explains. "GE is looking at their new gas turbine/generator and collecting performance parameters to improve their design. Westinghouse/Mitsubishi is collecting data on their newest gas turbines/generators. Potomac Power's operations and maintenance staff are looking at impending failures. And Fluor is collecting data for validating our methods for predicting failures."

The system works, too. "The cooling system on one of the turbine blades had failed due to plugging of the passages," he says. "The system identified the problem, and Potomac was able to replace the blade in off peak hours without any loss in power."

It works for EPRI too. The information is being used by member utilities to make decisions relating to equipment selection, design configurations, maintenance and replacement policies. The data is also being used by these same utilities to validate supplier sales claims and promises of newer technologies before making the huge required capital outlays for a comprehensive CM system.

isting legacy control system. But it was experiencing unexpected performance degradation because of clogged filters on the gas turbines, and the legacy system wasn't helping.

To obtain the advanced analysis needed to identify the problems, Centro Energia installed Emerson Process Management's (www.emersonprocess.com) AMS Performance Monitor. Emerson wrote a macro to acquire the necessary data from the legacy control system's historian. (Figure 2)

Data is sent to Emerson's centralized service site in Teesside in northeastern England, where Emerson analyzes the data and provides Centro Energia with actionable information. Vincenzo Piscitelli, general manager at Centro Energia, reports, "The return on investment was very fast. A single filter change has already paid for this service for two years."

Improving Existing CM Systems

Some plants may already have a conditioning monitoring system that isn't doing the job. Vectren (www.vectren.com), a power company in southwest Indiana, wanted to monitor more than 500 existing assets. Vectren's engineers were using a combination of software and spreadsheets to analyze more than 15000 equipment readings. The trend analysis software checked for problems and reported instances when assets were broken or not running efficiently. Alarms indicated problems that needed im-

Photo courtesy of Emerson Process Management

TEVEROLA, THIS IS ENGLAND CALLING

Figure 2: Centro Energia's 150-MW, combined-cycle cogeneration power plant in Teverola, Italy, is monitored remotely by Emerson Process Management in the U.K.

ATTACKING THE PROBLEM

Systems integrator Concept Systems in Albany, Ore., has implemented many high-level asset condition monitoring (CM) solutions. Michael Gurney, co-CEO, says that a CM project takes a two-level approach: First, use control hardware already in place; next, equip assets with new instrumentation and controls.

Much of the equipment in a plant already has diagnostic capabilities. "A typical automation system will control the equipment, but stop short of pulling data off the controller or motor drives. With some simple programming, a system can collect key data such as motor start/stops, cylinder cycles, fault counts, drive current, downtime, cycle time/flow rates, valve position, pressure readings and more," says Gurney.

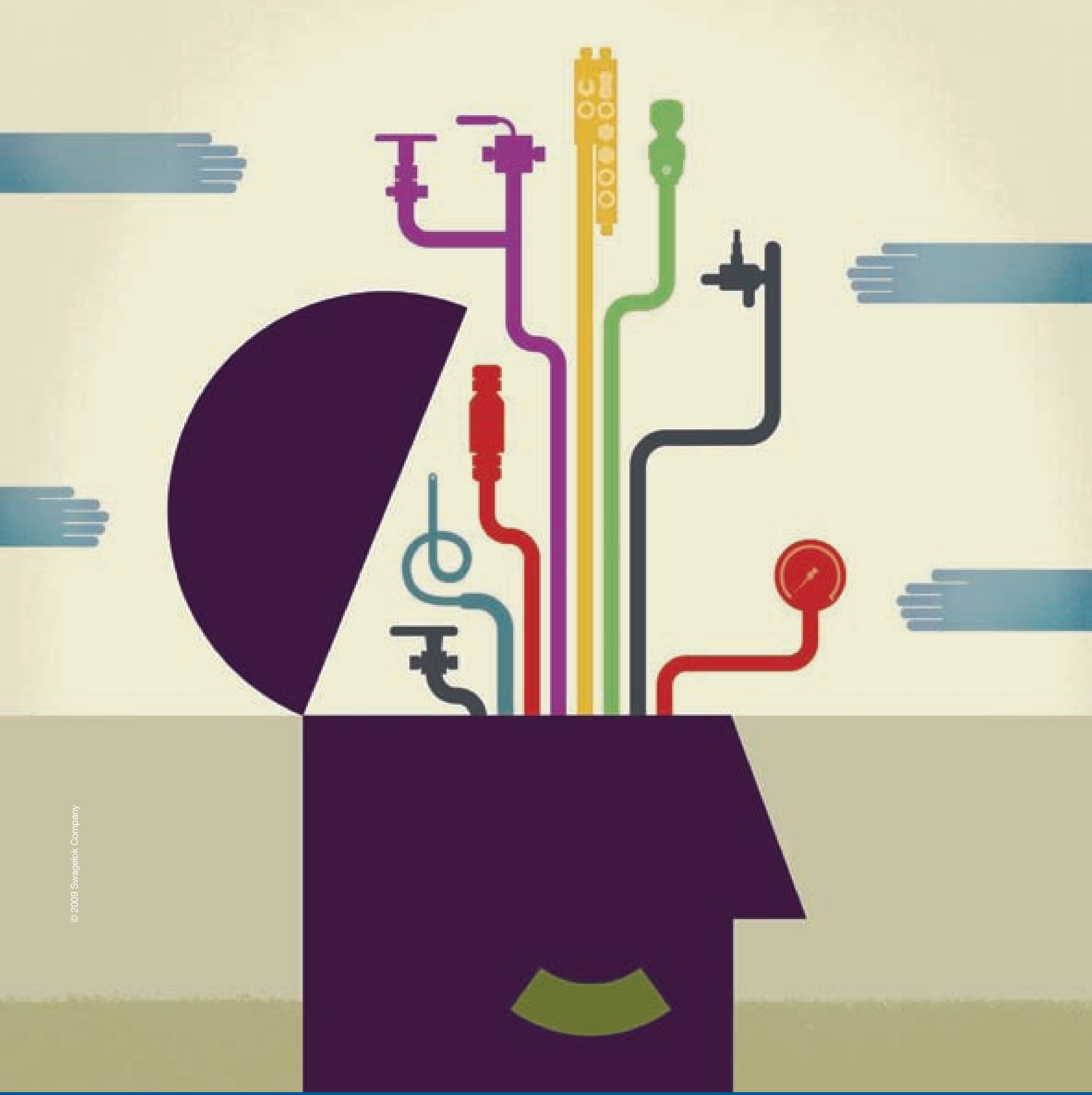
"Collecting and correlating this data finds problems," he explains. "For example, monitoring the flow rate at known valve positions will point to issues with the valve prior to catastrophic failure. All this information can be used to make better sense of the data and better manage that asset."

Some equipment may not have the sensors needed for CM. In this case, the asset has to be equipped with sensors and tied into the control system. "The possibilities are really endless and depend on the type of asset being monitored," points out Gurney. "Because of this, a crucial step is evaluating what assets really need to be monitored and how. The question is what assets put my processing line at greatest risk. In many cases this may not be known, and that is where data gathered from existing control hardware can help."

Critical areas where a CM solution could be usefully employed include: mechanical systems for vibration and current monitoring; pneumatic systems for temperature, pressure, condensation, air flow and filter monitoring; hydraulic systems for oil pressure, temperature, level, flow, accumulator and filter monitoring; and electrical systems for power quality and temperature monitoring.

Gurney says several options exist for analyzing data. "In many cases, data can be fed directly into a computerized maintenance management software system, and the data never needs to be directly presented to maintenance personnel," he says. "Companies will also offer to take on this function for customers—where they analyze the data directly and work with the maintenance staff or with third-party mechanical, pneumatic, hydraulic or electrical specialists."

The other critical element of a CM solution is measuring the results. "Overall equipment effectiveness determines gains recognized by a CM solution," he explains. "Having this data prior to the CM implementation will deliver quantifiable data on the improvements when viewed before and after the project."



mediate attention, but the existing approach had several drawbacks.

"Dangerous conditions could evolve quickly and undetected, increasing the likelihood of costly unplanned outages," notes Isauro Martinez-Cairo, director at Invensys Operations Management (www.invensys.com) "The monitoring procedures were time-consuming, and the cause of problems couldn't always be determined immediately. Alarms were also repetitive and didn't reflect problems that a combination of conditions might have triggered."

Invensys helped Vectren achieve a better solution by implementing Avantis Condition Manager, an automated CM software solution. It tracks the performance of assets to determine exactly when maintenance should be performed, generating alerts as conditions are triggered. Staff receive warnings when conditions begin to degrade, enabling them to perform maintenance as needed, rather than as dictated by an arbitrary schedule. This reduces unplanned downtime, and enables a highly effective predictive and proactive maintenance strategy.

"The preventive maintenance functionality alone provides enough savings to pay for the entire implementation," reports Scott Brown, a reliability engineer at Vectren. "Instead of wasting an engineer's time reviewing charts, that engineer is freed to do other tasks."

Marathon Oil (www.marathon.com) had a similar problem. Marathon operates the East Brae gas platform in the North Sea, 165 miles northeast of Aberdeen, Scotland, and it had an aging vibration monitoring system that monitored and reported on the condition of the equipment. The former system was rapidly becoming obsolete, so Marathon turned to Rockwell Automation (www.rockwellautomation.com) for an upgrade.

The first phase of the work was replacing the vibration systems on the three gas export compressors, and installing Allen-Bradley XM Series intelligent I/O modules (Figure 3). These modules process, in real-time, critical parameters used to assess the health of the rotating machinery on the platform. The condition monitoring system predicts the future health of the machines, providing machinery protection where needed. Results of the upgrade included more reliable vibration monitoring and improved reliability and availability of the compressors.

Advanced Monitoring

We've discussed a few examples of companies replacing older CM and

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POWERFUL CONDITION MONITORING

The installation at Centro Energia Teverola's 150-MW combined cycle cogeneration power plant in Teverola, Italy, near Naples, illustrates two key aspects of modern condition monitoring (CM) and asset management systems.

First, it may not matter what kind of new or legacy control system is installed at your plant because modern CM software packages can work with almost any system. Second, you don't have to develop specific knowledge about CM because outside services exist that will analyze the data and recommend best courses of action.

Centro Energia had a legacy Bailey Infi-90 control system with 5000 I/O, and it wanted to monitor clogging problems with inlet filters on its gas turbines as well as other operations. The data Centro Energia needed to analyze was already being collected by the control system, so all the company had to do was install Emerson Process Management's AMS Performance Monitor software and contract for Emerson's remote analysis services.

It's necessary to monitor the gradual deterioration in filter performance and calculate the cost of the resulting reduction in turbine performance. By comparing this with the cost of the maintenance required, the most appropriate point to replace the blocked filter can be determined.

But Centro Energia doesn't make the determination: Filter and other data from Teverola is transmitted to Emerson's performance monitoring center of expertise in Teesside, in northeastern England, where experienced engineers analyze the data and produce reports showing performance. These reports can be accessed via any standard web browser, and are based on thermodynamic models developed for each machine.

In addition to the online information, Emerson also provides advice about the operational efficiency of machinery. Existing or potential problems are highlighted, as well as new opportunities to improve overall efficiency.

Vincenzo Piscitelli, general manager, Centro Energia Teverola, says, "We can assess the effectiveness and economic return of our maintenance activities, which allows us to determine what maintenance work is required to improve equipment performance."

This improved planning has also enabled Centro Energia Teverola to reduce average repair times from seven hours to two hours.

manual systems, and the rush may be on. As asset management and CM hardware and software become less expensive and easier to use, it pays companies to invest in the technology.

For example, in our April 2010 cover story (www.controlglobal.com/articles/2010/WorkersUnchained1004.html), we discussed how wireless technology makes it easy to add assets to a CM system and eliminates the need for operators to walk around the plant with a data logger.

Most of the major process control system vendors understand the need for CM and offer packages that work with their control systems. Or, as we saw in the Centro Energia case, their software works with other vendors' new and legacy systems as well.

Some exotic technology is available to solve tough problems. Tony Amato, president of Swantech (www.swantech.cwfc.com), Falls Church, Va., a systems integrator and supplier of CM technology, explains how one company diagnosed problems with a stress wave energy (SWE) analyzer.

"The company detected increased stress wave energy on a bottoms pump for a distillation column. The system had been in place for more than a year, and the SWE had been trending low and consistent during that time. By correlating increases in SWE to historical process data, the customer found the increases in SWE coincided with decreased and/or erratic pump flow. Further analyzing the differential pressure and

Photo courtesy of Rockwell Automation

CM GOES TO SEA

Figure 3: Marathon Oil gathers data with Rockwell Automation's intelligent I/O modules to monitor the operation of gas compressors on this platform in the North Sea.


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ADVANTAGES OF CONDITION MONITORING

1. Reduces downtime
2. Improves performance
3. Allows proactive instead of reactive maintenance
4. Identifies problems before they occur
5. Uncovers difficult to discover issues
6. Pays for itself quickly

CHALLENGES OF CONDITION MONITORING

1. Finding time and personnel to implement and operate
2. Integrating different hardware systems
3. Integrating different software systems
4. Coordinating efforts across operations and maintenance departments
5. Obtaining initial and ongoing funding

the column level indicated the problem was fouling in the column packing or trays, leading to increased stress on the bottoms pump. The column was inspected and fouling was present. Following cleaning, SWE returned to normal levels," explains Amato.

Gurney of Concept Systems says companies should consider two underused technologies: statistical process control (SPC) and digital video recorders (DVRs). "SPC tools offer better data analysis and earlier, more accurate detection of problems," he explains. "Small variances, oftentimes operating within normal high/low limits, reveal equipment issues well before catastrophic failure."

As for DVRs, Gurney says they offer the ultimate troubleshooting device by giving personnel the ability to record processing lines when upset conditions or downtime are detected. "This way, plant personnel can go back and look at the video captured during these events and determine the root cause of the problem," he says.

As CM capabilities increase and costs come down, the challenge for many will be finding the time to install and operate these systems. Despite proven payback, plant personnel often are so burdened with day-to-day operation that they can't find the time to use proven CM tools.

Lack of skilled personnel to analyze and interpret condition monitoring data is another continuing challenge. A solution may be off-site analysis of CM data by third-party suppliers, with actionable data provided to plant personnel on an exception basis as is the case with Centro Energia's use of Emerson's off-site analysis services.

State-of-the-art CM is still not easy or inexpensive, but it's also not an insurmountable challenge, and the expense and effort are well-spent when weighed against the cost of downtime for critical assets. ■

Dan Hebert is Control's senior technical editor

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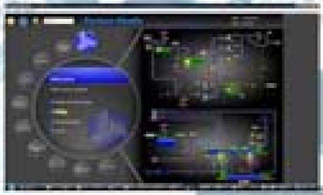

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Goodyear Gives Variability a ONE-TWO PUNCH

Advanced process control lets a refinery's staff optimize their isoprene unit's distillation process, balance operating parameters, save energy and reduce product loss.

by Jim Montague

It takes plenty of raw materials and energy to make rubber for tires but managing all those feedstocks and handling all that energy can be changeable and difficult. For example, Goodyear Tire & Rubber Co.'s largest U.S. chemical plant in Beaumont, Texas, produces huge amounts of rubber and C5 high-purity isoprene, but it had been facing ongoing hurdles in its high-purity monomer recovery unit, according to Kaylynn Johnston, Goodyear Chemical's senior engineer.

"We have fluctuations in feed composition, and this leads to variability in our operations, which means we may need to compensate with changes in temperature or other setpoints," says Johnston. "The Beaumont plant also is Goodyear's largest energy consumer, and our C5 refinery and its distillation columns are the plant's largest energy consumer, mainly due to the all the steam they use. Because of these challenges, we thought advanced process control (APC) could help."

Johnston and Jon Cimino, of Emerson sales representative Scallon Controls, presented "Sustaining and Extending Advanced Control Value in an Operating Plant" at Emerson Process Management's recent Global Users Exchange 2010.

Johnston reports that the C5 refinery's main operating challenges include:

- A product purification unit that involves multiple distillation trains with 11 columns, both conventional and extractive;
- Ultra-high purity product specifications that require very tight quality controls;
- Multiple large, 200+ tray columns that result in extremely long time constants;
- Different feedstock suppliers with different qualities;.
- Large energy demands and complex production requirements; and
- Safety margins required to compensate for disturbances in feed quality.

As part of a DeltaV migration project at the Beaumont plant, Goodyear also implemented Emerson's SmartProcess distillation optimizer, which uses embedded DeltaV APC, and has on-line key performance indicator (KPI) calculations. SmartProcess includes reusable applications that can be pre-engineered and used multiple times. They include a combination of DeltaV composite blocks, modules and templates, APC tools like PredictPro and Neural, DeltaV graphics, documentation tools, sample configurations, and a simple dynamic simulator. The project also included Emerson's APC Consulting Services, functional designs, control performance audits and implementation assistance.

First Project: Balancing Distillation

The initial phase only covered the first column in the series, to gradually give the plant's staff experience with APC technology, nurture operator acceptance, and show APC's value to Goodyear's management. APC will be added in later phases and other C5 columns by Goodyear's engineers themselves with support from Emerson's APC consultants.

"At first, the C5 refinery's operators were uncomfortable with APC, but the engineers explained its strategic value to them, and this helped their comfort level," says Cimino. "It also helped as the operators got more run-time experience with the APC tools. The dynamic simulator in SmartProcess was helpful, too. For example, we wanted to know ahead of time about controller loading issues, and the simulation showed us that controller loading wouldn't be a problem."

Goodyear also used SmartProcess' Distillation Control Module, which includes standard distillation calculations, module library, predict block and pre-configured neural blocks.

"The first column in the C5 refinery separates chemical components based on different boiling points. Tray temperatures reflect composition on that tray, but they need to be compensated for pressure. As a result, control strategies are based on 'what comes in must go out,' and so we need material balance of overhead and feed ratio and an energy balance of reflux and feed ratio," explains Johnston. (Figure 1)

To optimize the distillation column, Johnston and her colleagues use SmartProcess' function blocks to set objectives for manipulated variables (MVs), controlled variables (CVs) and constraints for overall objective functions, and then view them all in the software's optimizer window. "We were able to set minimums or maximums for critical variable, and also prioritize those variables," adds Johnston. "We also could establish target setpoints for the column, and calculate setpoint for multiple variables."

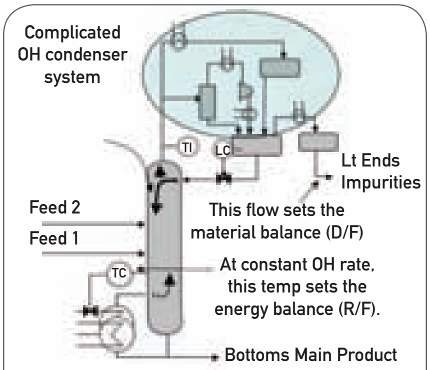
When Goodyear turned its newly optimized controllers on, it immediately gained positive results. "Because the column consumes so much energy, Goodyear's engineers wanted to minimize steam use and reduce the amount of product going out of the overhead," adds Johnson. "Once it was optimized, the controller immediately started reducing distillate rate and overhead (OH) concentration. Average product loss via OH was approximately 22%. Product impurities were within specifications, and there were new opportunities to reduce safety margin. And, we reduced overall steam use by 7%."

Second Project: Optimizing Extraction

The second project's challenge was to optimize the C5 column's extractive distillation system for isoprene, which involves four variables. "The temperature setpoint needs to be such that the sidedraw contains most of the impurities, but not too much product," says Johnston. "We first need good information for our manipulated variables, and then we can run tests in manual or automatic." (Figure 2)

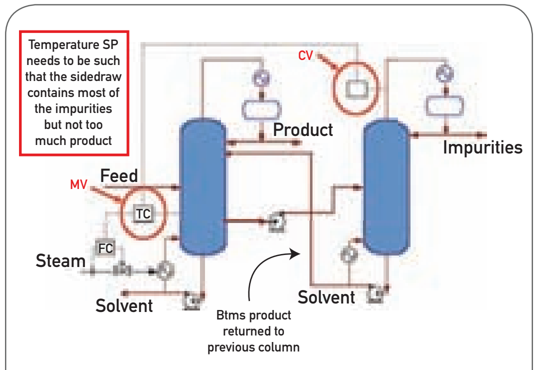
These process variables include MVs, CVs, disturbance variables (DVs) and constraints:

- MVs consist of controller setpoints written to by the model-predictive controller (MPC). For example, they can include first-column,



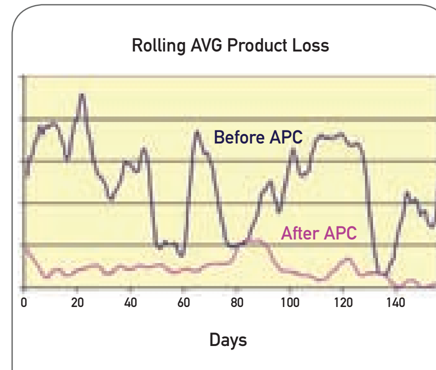
FIRST PROJECT PROCESS OVERVIEW

Figure 1: The first distillation column in the C5 refinery/isoprene unit at Goodyear's plant separates components based on different boiling points.



SECOND PROJECT PROCESS OVERVIEW

Figure 2: This process involves a very active, two-column extractive distillation system, which was optimized using manipulated variables (MVs), controlled variables (CVs) disturbance variables (DVs) and constraints.



BIG SAVINGS

Figure 3: Among the two projects' multiple gains, the second's advanced process control (APC) greatly reduced product loss in the C5 refinery/isoprene unit's distillation process.

side-draw temperature setpoints.

- CVs include process variables to be maintained at a specific value or set point, such as column OH pressure.
- DVs are measured variables that may also affect the value of controlled variables, such as solvent concentration, feed flowrate, reflux remperatures and first-column OH pressure.
- Constraints (LV) are variables that must be kept within an operating range, such as product stream impurity level and percent of product in the impurity stream.

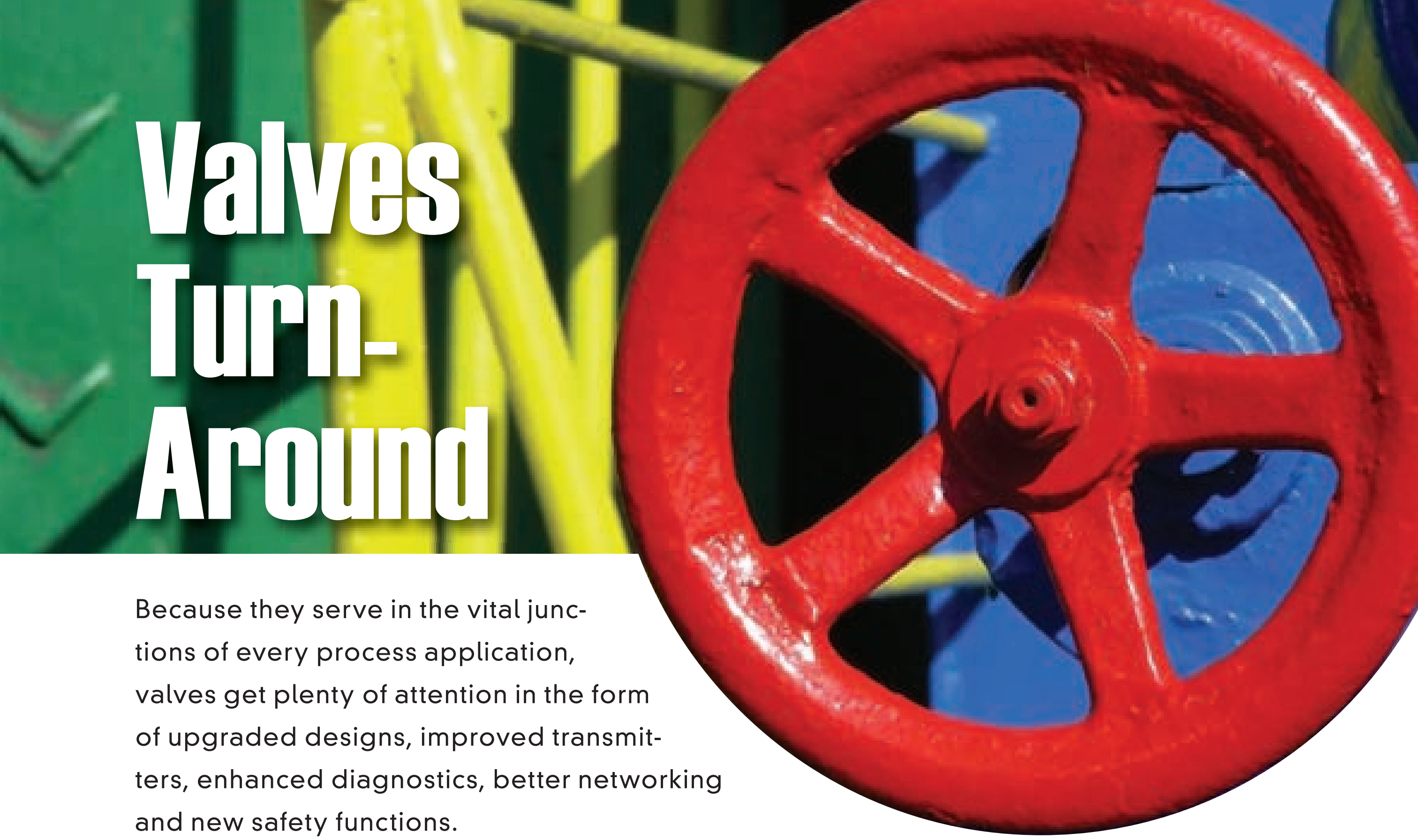
Models were developed for the four process variables, and Goodyear's engineers used their own knowledge to adjust the models' parameters. Actual process data were then used to validate the models.

Johnston said the modeling and tuning resulted in improved temperature control, further reduced product loss, and improved impurity levels. "The new control scheme in our second project also reduced the rate and the product concentration in the purge stream. Overhead product quality was not negatively impacted. We reduced product losses by 7,000 pounds per day. And we reduced energy consumption a moderate amount," adds Johnston. (Figure 3)

To maintain its new APC tools and system in the future, Goodyear may need to change the limit ranges of its manipulated, controlled or constraint variables if feed rate or composition change significantly. "We may also need to tweak or rebuild our models at some point, and we might need to regenerate the controller to adjust performance versus robustness, such as in 'penalty on move' versus 'penalty on error' situations," she concludes.

Goodyear plans to install SmartProcess Distillation module and APC models on its additional distillation columns in the C5 refinery process unit, and explore the potential for using APC in other units on non-distillation applications. ■

Jim Montague is Control's executive editor



Valves Turn-Around

Because they serve in the vital junctions of every process application, valves get plenty of attention in the form of upgraded designs, improved transmitters, enhanced diagnostics, better networking and new safety functions.

by Jim Montague

Everyone must love valves because they're always trying to help them out. As a result, for a basic and traditional piece of hardware, valves get more attention than your average starlet. Some fans bring technical fixes to the valves and actuators themselves, but more often than not, lately this parade of assistance includes more capable and wireless transmitters, improved diagnostics components and software and many other accessories.

Truth to tell, however, valves get so much affection because their users' applications and continued employment depend on them and because they also wear down, hinder performance and even break with startling regularity. Even valves that are less in the spotlight, such as those in safety or emergency-shutdown settings, usually get regular check-ups and updates for obvious reasons.

Butterfly to Rotary

Sometimes true devotion to valves is expressed in a simple redesign or shift to a new method that better serves a given application. For instance, E.ON's combined heat and power (CHP) plant in Northwich, Cheshire, U.K., used to have problems with backwash flows when air scouring and backwashing the six filters used to pre-treat feedwater for its make-up boiler. The original butterfly valve used in this process couldn't provide a steady flow rate, causing media to be lost through the filters. As a result, the filter media had to be replaced or refilled at an average cost of £3500 a year.

E.ON's CHP facility in Northwich is one of the largest of its type in the U.K. It generates 130 megawatts of electricity for local residents and can supply approximately 500 tons of steam per hour for two nearby soda-ash (sodium carbonate) production plants. (Figure 1). The feedwater is obtained from the River Dane, cooled and pre-treated to remove any algae or silt, then passed through one of the six filters before being sent to a holding tank.

Consequently, E.ON installed an 8-in. Fisher Control-Disk rotary valve from Emerson Process Management (www.emersonproces.com) to replace its original butterfly valve. Control-Disk's thicker disk profile and true equal-percentage characteristics enable it to adapt to changing process conditions and provide control over a wide range. The valve provides 15% to 70% travel without compromising capacity, which is a big improvement compared to standard butterfly valve designs that offer 25% to 50% of travel.

E.ON adds its new rotary valves dramatically improved its backwash flow control without compromising capacity at peak demand. Since it was installed, the plant hasn't lost any filter media or experienced any downtime due to water filter problems. "The Fisher Control-Disk valve not only controls the backwash flow rate more accurately, but when 100% open, it delivers a flow rate adequate to meet the water plant's demands without restrictions. Its performance and reliability led to savings of £3500 a year and enabled us to improve our customer service," says Neil Price, E.ON's improvement and performance coordinator.

Though necessary to maintain production, profitability and safety, valve redesigns and technical shifts still can be jarring to plant-floor staff, so they understandably avoid them as long as possible. To ease these transitions, K-Tork Actuators and Controls (www.ktork.com) reports that training remains vital to making sure users are comfortable with, believe in and can see improvements from their new valves. "The best way is to ship a new product and send a qualified technician to demonstrate it in the user's own pipeline," says Jeff Butler, K-Tork's field services technician and project manager. "Three or four years ago, I was at Pacificorp's coal-fired power station in Huntington, Utah, where they were changing out 88 actuators and drives on their combustion air control process, and the training impressed their staff with how easy the replacements were to set up. In fact, they were able to do it on their own from the first day. Traditional positions take about 15 minutes to calibrate, but the new smart positioners took about 5 minutes each."

Smarter Means Safer

One of the most significant evolutions in valve technology lately has been its growing links to more sophisticated diagnostics and supporting software via fieldbuses, Ethernet and now wireless networking. And, despite some initial reluctance, these ties are proving they can help valves function better and at least as safely as their traditional counterparts.

BATTLING BACKWASH

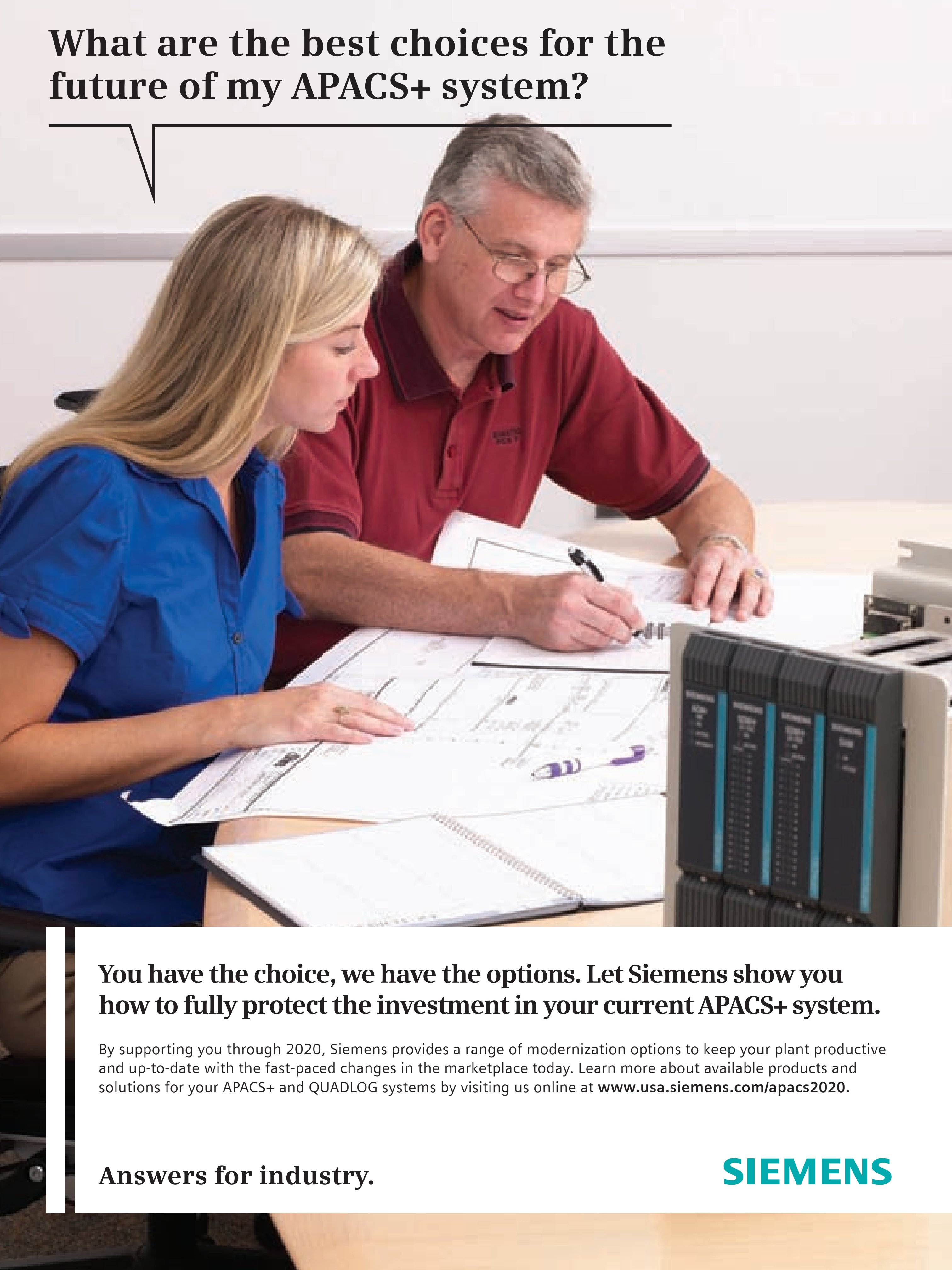
Figure 1: To better clean filters that pre-treat water from the River Dane, E.ON's combined heat and power (CHP) plant in Northwich, Cheshire, U.K., switched from butterfly to rotary valves in its air scouring and backwash process.

Historically speaking, Eric van Gemeren, vice president of R&D for Flowserve's (www.flowserve.com) valve division, says valve actuators and positioners are at an evolutionary inflection point because users are waking up to three major changes in their applications and businesses. "First, many petrochemical and power facilities are losing older technicians, so a lot of diagnostic competency and knowledge is walking out the door," says van Gemeren. "Second, there's more heightened awareness of the need for safety and security in process applications because of recent incidents. And, third, the technology and costs of valve technologies are changing dramatically, so that now it's possible to add awareness affordably to even the simple devices that move valves up and down. This allows more actuators and positioners to be placed in more critical points and then give users more useful information than before. As a result, many actuators and positioners are taking on roles that some operators and technicians used to do."

Likewise, when an automation upgrade project at La Vertiente gas plant in the Villamontes tropical zone in Bolivia required implementation of motorized valve equipment with Safety Integrity Level 2 (SIL 2) certification, the plant's engineers researched and settled on using 31 of Rotork Fluid Systems' (www.rotork.com) spring-return failsafe, quarter-turn, Scotch-yoke, pneumatic actuator packages with mechanical, partial-stroke test capabilities. Owned by BG Bolivia, La Vertiente processes gas from the remote Escondido, Los Suris, Palo Marcado and La Vertiente gas fields, and supplies natural gas and stabilized condensate to YPFB, the country's national hydrocarbon company.

The new actuators are installed on emergency shutdown (ESD) valves in La Vertiente's most critical processing areas. Their applications consist of hydrocarbon condensates and water, leaving the raw gas separators, glycol and hot oil in the regenerator, and natural gas throughout many of these processes, including the gas inlet manifold and the power gas for the compressors. Besides providing La Vertiente with its new, more capable actuators, Rotork also supplied 28 CP-range and three GP-range, SIL 2, actuated-ball-valve packages. These were delivered by Prosertec, Rotork's representative in Bolivia, which also provided on-site support with installation, commissioning and start-up. ■

Jim Montague is Control's executive editor.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Intrinsic Safety Often the Best Option

DAN HEBERT
SENIOR TECHNICAL EDITOR
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Installing electrical and automation panels in hazardous areas requires use of one of three protection methods: explosion-proofing (Exd), purge and pressurization (Exp) or intrinsic safety (IS). ● Exd contains the pressure of the explosion, and then cools it through a critical flame path to a level that will not ignite the surrounding environment.

Exp protects the environment by segregating hazardous material from the ignition source before equipment is powered. First, explosive mixtures are purged from the enclosure; then a positive pressure is maintained inside the enclosure to insure hazardous gasses do not propagate back in during operation.

IS protection limits the energy entering the hazardous area to a level incapable of igniting the easiest ignitable concentrations of gas/air mixtures under fault conditions.

"None of the protection methods can provide absolute certainty of preventing an explosion," observes Robert Schosker, product manager for intrinsic safety and HART at Pepperl+Fuchs (www.pepperl-fuchs.com). "However, statistically, the probabilities are so low that not even one incident of an explosion has been verified when a standardized protection method has been properly installed and maintained."

Joe Zullo, IS business unit manager for the Americas at Cooper Crouse-Hinds MTL (www.cooperindustries.com), adds that, "The common methods of IS are Exia (safe under two faults) and Exib (safe under one fault). Though the United States and Canada do have zone classifications on the books, most installations fall under the division concept, which requires Exia equipment."

IS is feasible only when total power requirements are relatively low. Electrical distribution panels aren't candidates for IS, nor are most analyzers and some instruments, all because of their relatively high power requirements. But, if the components in the panels have low power-needs, then IS is often the best solution.

"IS is the only method permissible in all classes, divisions and zones—and the only method accepted for Zone 0. No special wire, cable, enclosures, conduits, seal-offs or alarms are required. Hot maintenance is allowed. The flexibility and ease of installation and maintenance make it very effective for process control and measurement," explains Zullo.

Despite its advantages, IS isn't widely used in some parts of the world. "IS is very popular in Europe and Asia, but not so much in the United States or the Middle East," notes Rob Stockham, general manager of Moore Industries-Europe (www.miinet.com).

Many observers chalk up the relatively low use of IS to nothing more than greater familiarity with other protection methods. If so, this prevents an opportunity for money saving in these areas by thinking outside the explosion-proof and purged-enclosure boxes.

"Relative to maintenance costs, intrinsic safety is the most advantageous because it allows live maintenance with no need for plant shutdown. Intrinsic safety is also more reliable because of the use of de-rated components as prescribed by the standards," says Schosker. "Comparing the three most widely used protection methods, intrinsic safety is preferred for safety and reliability reasons. Intrinsic safety is also the most economical for installation and maintenance. The use of intrinsic safety provides the best mix of an affordable system and safety requirements."

Stockham seconds Schosker's opinion, but adds some caveats. "With IS, there is never enough energy to initiate an explosion, so conventional panels, wiring and glands can be used. The costs of devices and installations can be less, and the devices can be accessed and worked on live," explains Stockham. "However, IS systems have to be planned and designed using certified components matched to meet safe electrical system parameters. Not all devices can be made IS, and some site policies may prohibit mixing of protection methods to avoid confusion." ■

Not one incident of an explosion has been verified when a standardized protection method has been properly installed and maintained.

Microprocessor Control of Remote Pipeline Sites

"Ask the Experts" is moderated by Béla Lipták (http://belaliptakpe.com/), process control consultant and editor of the 3-volume *Instrument Engineer's Handbook* (IEH). He is recruiting co-authors for the 5th edition now and welcomes contribution offers from qualified colleagues. Also, if you have questions for our team of experts, please send them to liptakbela@aol.com.

Q I am working on a fun historical project and am trying to find information on the SCADA systems used on gas pipelines in the late 1970s and early 1980s. I have found a few articles, but because it is pre-Internet, information is sparse. In particular, I am looking for information on the RTU, MTU and compressor automation technologies used on projects that were installed on projects such as the Alaskan Pipeline:

- Who manufactured these systems? In those days, the players seem to be companies like AGTL/NOVA, Baker and DATAP, not the ones we see today.
- How was SCADA deployed and what were the design strategies? How active was the control at the MTU? How were critical systems like compressor control managed on the SCADA system?
- What were the underlying processors and operating systems? This was pre-PC, so I guess VAX and 8080, but there were also HP projects from around then. Were most of the RTUs "home-grown" or did companies like Siemens have their early S-Series processors in this market?
- What was considered leading-edge technology and who was working on it? Calgary had a very vibrant community of SCADA inventors. Does anyone know any of the people involved in those early projects?
- Does anyone have ideas where else to ask?

I was a very young engineer in those days and never really got involved in the SCADA technology from that period. After 1986, I have enough information, but by then the systems had started evolving to the PC-based systems we see today.

ERIC BYRES P.ENG
eric@byressecurity.com

A In the late 1970s and early 1980s, Modcomp computer systems were widely used in SCADA and pipeline systems. They are still in business, but no longer make computers. They competed against the Data General and Digital Equipment Co. (DEC). (Two more names that have not lasted.)

I did software support on the Modcomp II computers running the Max 2 operating systems on the Alaskan pipeline. The Modcomp systems were designed for real-time applications, including steel mills, nuclear power plants, refineries, chemical plants and pipelines. I had heard, but can't confirm, that Modcomp received the business because Digital did not want to take the liabilities for running in these risky applications.

In the SCADA system, the MTUs were PLCs that performed local control. They used radio transmitters and receivers connected to modems to send periodic updates (I seem to remember about 5 minutes or more) to the Modcomp II SCADA system. The SCADA system was implemented in Fortran (remember that language?), and was custom-built for the pipeline. The system provided pipeline operators with real-time visibility into the operation of the pumping stations and material flows and pressures. They could send commands to the MTUs and pumping stations using the same method for control. The Modcomp SCADA system sent its data to a corporate system that provided overall (across the U.S.) visibility of the status. I think this system was also custom-built for the company. Here is a link to information about Modcomp: www.cs.uiowa.edu/~jones/modcomp/

DENNIS BRANDL
DnBrandl@BRLConsulting.com

A I worked for ModComp in the late 1970s. That was before the PLC era really started. I don't know what equipment ModComp used for the RTUs then, but later they developed the Modex, a small ModComp CPU with integrated I/O. Before that, most of the RTUs were built from Computer Products I/O boards.

One of the largest SCADA projects that I worked on was for the Tennessee Valley Authority (TVA). They had RTUs with PDP-11 computers at every dam site. Each was equipped with a local control center, but connected by leased telephone lines to SCADA remote master stations. As I remember, this system with more than 100 remote and master nodes was supplied by a Swiss or German supplier with a proprietary communications protocol.

The other SCADA system I remember was made by EMC, and was based on the DEC PDP-11 at first and the VAX later. Eventually, the RTU for this SCADA system was built with the TI-550 PLC, but later was switched to use one of the Siemens Simatic series after Siemens purchased the PLC division of Texas Instruments.

RICHARD H. CARO, CAP
E-mail: RCaro@CMC.us

Q You wrote about the suitability of the process control principles to control the economy, the weather, the protection of our rivers, the stabilizing of global warming, etc. You also mentioned that the delayed conversion from exhaustible to inexhaustible energy sources can change the process of human evolution from a "continuous to a batch" one. What did you mean by that?

NICHOLAS WAGONER
nickwagoner@rogersa.com

A As you know, a batch process is one that has a beginning and an end. The figure on the right illustrates the "process of life" as it operated prior to the industrial age, during it, and how it should operate during the coming post-industrial age.

During the pre-industrial age, the food energy from the vegetation plus water and oxygen were sufficient to maintain the continuous process of life on the planet indefinitely.

In the present industrial age, more and more exhaustible energy is obtained from the diminishing fossil and uranium deposits (shown in red). This cannot continue forever, and therefore I call the present operation a batch process.

In the future, when the exhaustible deposits are gone, hopefully we will have converted to a solar-hydrogen based energy economy that depends on the free, clean and inexhaustible energy supply from the sun. You can find a detailed description of such a power plant and reversible fuel cell (RFC) at http://belaliptakpe.com/solar-hydrogen-power-plant/.

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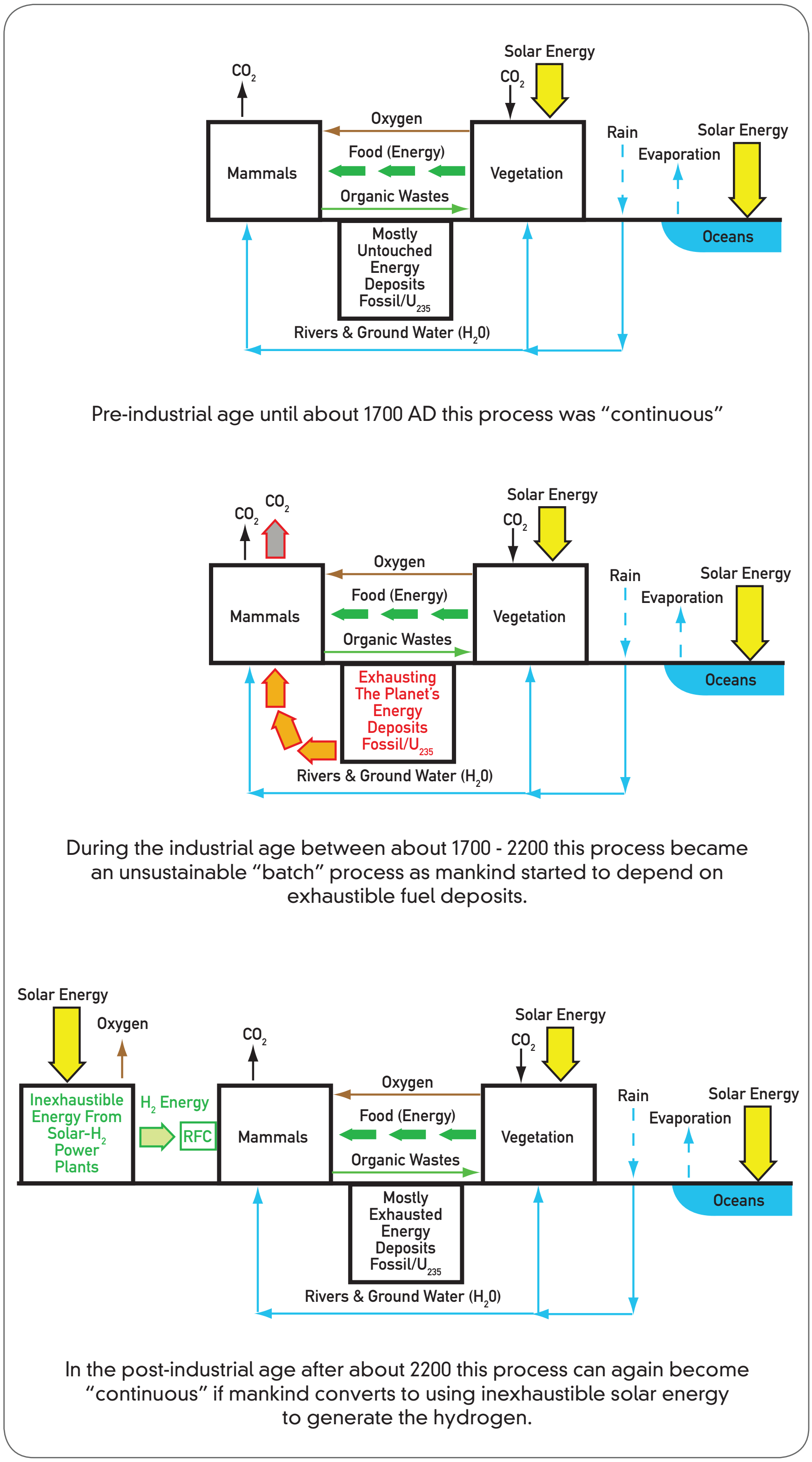

Pre-industrial age until about 1700 AD this process was "continuous"

During the industrial age between about 1700 - 2200 this process became an unsustainable "batch" process as mankind started to depend on exhaustible fuel deposits.

In the post-industrial age after about 2200 this process can again become "continuous" if mankind converts to using inexhaustible solar energy to generate the hydrogen.

Figure 1. The pre-industrial, the industrial and the post-industrial cycle of energy generation and consumption shown as batch and continuous processes.

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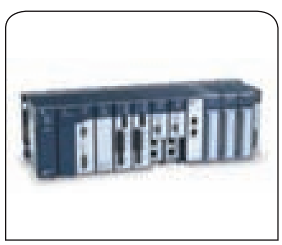

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800/433-2682; www.ge-ip.com.

SMART PAC

Smart SoftPLC includes a four-port managed Ethernet switch/router with PoE and fiber connection options, five serial ports and an option for an RS-485 or phone modem. It combines I/O control and logic, rich communications, an embedded firewall/VPN and an embedded web server in a small, value-priced package that can handle applications ranging from simple and small to large and challenging.

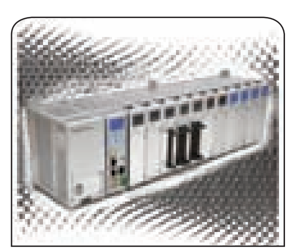
SoftPLC
512/264-8390; http://softplc.com

ePC LITE FANLESS PC

The ePC Lite is a low-cost, fanless version of the ePC-Series industrial computers. It has an Intel-based, fanless Atom N270 CPU board and solid-state drive. Its 1.6 GHz processor provides processing power to HMI and SCADA applications. Windows XP Pro, SATA 40-GB solid-state drive, 15-in. XGA LCD, 1-GB DRAM, analog resistive five-wire touchscreen, and a NEMA 4 front panel are standard.

Nematron
734/214-2000; www.nematron.com

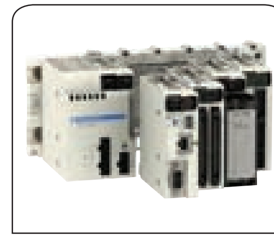
PRODUCTIVITY IN PAC FORM



The Productivity3000 PAC combines features and capabilities of a PC-based control system with that of a typical PLC. It is a modular, rack-based system of up to 116,000 I/O points with local, expansion and remote I/O bases and a full lineup of discrete, analog and specialty I/O modules. The high-performance CPU has 50Mb memory, fast scan times and seven communication ports.

Automation Direct
800/633-0405; www.automationdirect.com

COMPACT, BATTERY-LESS PLCS

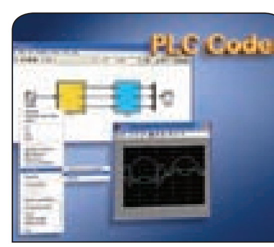


Simple, intuitive and exceptionally powerful, Modicon M340 PAC provides numerous cost and performance advantages over comparably priced PLCs. It requires no battery and is a compact 4 in. high and 3.7 in. deep with high-density, 64-point I/O cards, and is only 1.25 in. wide. It uses CANopen networks and USB cables. The PAC has 4 Mb of memory upgradeable to 16 Mb and a 70K instructions/ms execution speed.
Schneider Electric
847/397-2600: www.us.schneider-electric.com/PLC

WIRELESS PAC

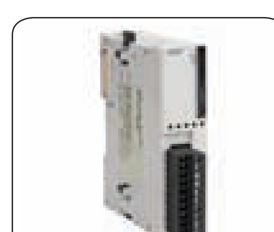
Snap-PAC-R1-W is a rack-mounted PAC with IEEE 802.11a/b/g Wi-Fi networking, two independent 10/100-Mbps wired interfaces for standard Ethernet networking, and one RS-232 serial port for PPP communication. It provides control, communication, I/O processing, remote monitoring and data acquisition, and is fully integrated with Opto 22's PAC Project software and all Snap-PAC brains and I/O modules.
Opto 22
951/695-3000; www.opto22.com

GENERATE IEC CODE AUTOMATICALLY



Simulink PLC Coder extends model-based design for the industrial automation segment by helping create source code in structured text (IEC 61131-3 ST) using Simulink models that can be easily integrated in B&R Automation Studio. It complements the Automation Studio Target for Simulink. Users can generate ANSI-C or structured text code alternatively, and automatically integrate it into the automation project.
B & R Automation
770/772-0400; www.br-automation.com

MICRO PLC WITH RS485 CAPABILITY



MicroSmart Pentra is now available with optional RS485 communications. It is the only micro PLC on the market that allows control systems to seamlessly communicate with up to seven serial devices via RS232C or RS485. Now, with the new RS485 communication module, it can talk multiple communication protocols on the same system. For fast transmission speed, this unit also supports communication baud rates up to 115Kbps.
IDEC
800/262-4332; www.IDEC.com/usa.

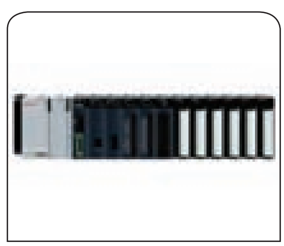
PACS FOR EXTREME APPLICATIONS

NI cRIO-9023 and NI cRIO-9025 real-time controllers are ideal for high-performance measurement and control applications operating at extended temperatures. They operate in a range from -40 °C to 70 °C and are available with conformal coating for additional protection in harsh conditions. The 9023 has a 533 MHz PowerPC processor. The 9025 has an 800 MHz PowerPC processor and dual Ethernet ports.
National Instruments
800/258-7022; www.ni.com/compactrio

FLAT-PANEL MONITORS FOR DUSTY SPACES

VisuNet Series industrial flat-panel LCD monitors have Class II Division 2 certification for use in dusty environments. They're also available as general-purpose displays, as UL-listed Class I/Div 2 devices, and can be combined with a Bebco EPS purge system for Class I/Div. 1 hazardous environment mounting. Touchscreen options are available. They come in 10-, 12- 15-, 18-, 19- and 20-in. sizes, and are rated for use from -10 °C to 55 °C.
Pepperl+Fuchs
330/486-0002; www.pepperl-fuchs.us

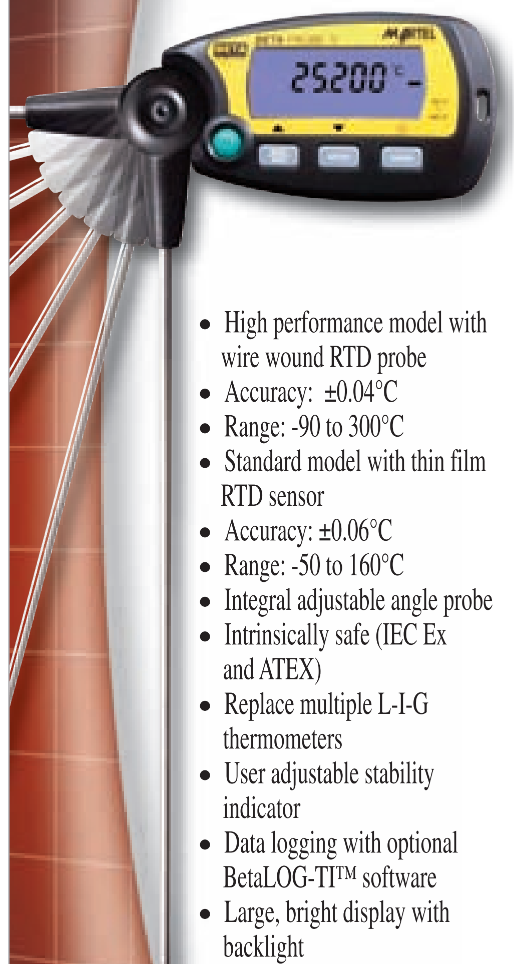
MASTERLOGIC PLC



MasterLogic PLCs bring power and robustness to high-speed logic, interlock and sequencing applications. They can be deployed in a standalone mode or used with the Experion Process Knowledge System architecture, and are compatible with Honeywell's portfolio of process control systems, including the recently released Experion LS. MasterLogic CPUs, power supplies, rack sizes and I/O selection are suited to many applications.
Honeywell
800/343-0228; www.honeywell.com/ps/hfs

INDUSTRIAL-STRENGTH MONITOR

NX Series enclosed industrial display system is a NEMA-sealed, commercial-grade, large monitor built in a rugged-steel 14-gauge enclosure. It can operate as a standalone monitor, or it can be integrated with a Modpak modular computer system, which allows easy serviceability, service removal and upgrading. It has a Lexan protective lens window and sealed connectors for power, Ethernet and USB ports.
Dynix
734/677-6100; www.dynics.com.

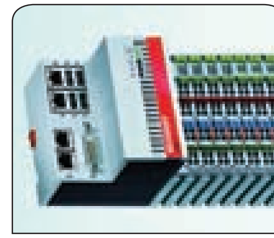


EXTREME-ENVIRONMENT PANEL PC

The Allen-Bradley Extreme Environment Panel PC combines intrinsic safety with the capacity to withstand extreme temperatures. With U.S. NEC Class 1, Division 2 hazardous location certification, it can be used in areas where explosive materials are present. It is rated to withstand temperatures from -20 °C to 70 °C inside the computer cabinet, and display side temperatures of -20 °C to 55 °C.

Rockwell Automation
www.ab.com/industrialcomputers/

ENERGY-SAVING EMBEDDED PC



The new CX5000 has Intel Atom technology and up to 1.6 GHz of processing power. It has a magnesium housing, making it lightweight, and improves its mechanical stability and resistance to EMC. The DIN rail-mountable PAC has a fanless design with a maximum power loss of 12.5 Watts. Just 3.9 x 3.9 x 3.6 in. (100 x 100 x 91mm), CX5000 also is exceptionally compact.

Beckhoff Automation
952/890-0000; www.beckhoffautomation.com

UPGRADED CONTROLLER BASE STATION

The upgraded base station for the Nanoline controller, nLC-055, is designed for small to mid-sized machines with limited I/O points. It can add, subtract, multiply and divide, as well as perform modulo (percentage) operations. Other new features include two analog inputs with 12-bit resolution, eight digital inputs, two high-speed counters, a built-in real-time clock and four relay outputs.

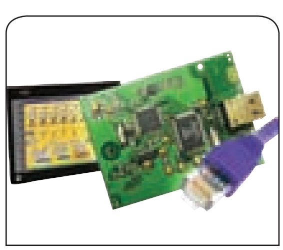
Phoenix Contact
800/322-3225; www.phoenixcontact.com/usa_home.htm

INDUSTRIAL PCS WITH HIGH-SPEED PROCESSOR

Siemens introduces four industrial PCs built with the Intel Core i7 (i series) processor. The Simatic IPC627C box PC and the HMI IPC677C panel PC are suitable for high-speed measurement, open- and closed-loop control tasks, and their HMI functions directly at machine level. The 19-in. IPC847C rack and compact IPC647C rack PCs are designed for continuous, 24-hour service.

Siemens Industry, Inc.
www.sea.siemens.com

TWO-NETWORK HMI



G3 Series HMI is available with the new Ethernet expansion card, G3Enet. Now users can add a second Ethernet port to increase bandwidth and separate networks. G3 Series HMIs with the G3Enet card provide communication with devices on two distinct Ethernet networks simultaneously—without an industrial router. The expansion card can be easily fitted to any G3 series HMI.

Red Lion Controls
717/767-6511; www.redlion.net

SENSOR DATA VIA THE INTERNET

RST-5001 network and web-enabled 4-20 mA input controller is compatible with any 4-20 mA device, and sends email and text message alerts when user-defined limits are reached. It can be powered via either a standard 24 VDC supply or PoE. Conversion options include volume, level, distance, weight or user-defined units. No special programming software is required.

Automation Products Group
888-525-7300; www.apgsensors.com

MANUAL VALVES WITH LIMIT SWITCHES

Online Configurator allows customers to build, view and price manual valve assemblies. Choices include two-way full-port valves, three-way diverter ball valves, flanged ball valves and resilient seated butterfly valves. Limit switch selection includes inductive proximity sensors, weatherproof and explosion-proof switches. Once virtual assembly is completed, users can view a color image of the final product, model number, product description and cost.

Assured Automation
800/899-0553; www.assuredautomation.com.

UNIVERAL TRANSMITTER FOR VIBRATION MONITORING

Model 682A16 universal transmitter for 24/7 vibration monitoring is designed to protect machinery by providing crucial information that avoids costly downtime. It's ideal for vibration monitoring applications with IMI's 4-20 mA sensors or its ICP accelerometers. It can be used with existing PLC, DCS and SCADA systems, leading to alarm, control or shutdown. It's DIN rail-mounted and has an optional detachable front panel LCD display.

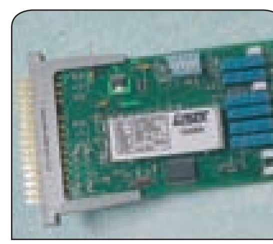
IMI Sensors
800/959-4464; www.imi-sensors.com

SUPER-FAST PROCESS TRANSMITTERS

JH5000 Series DIN-rail transmitters have been redesigned to allow a fast response option, while maintaining their full accuracy specifications. Option HS (high speed) provides 1 millisecond response (95% complete). Faster response (or slower) is readily available on special order. Input styles include DC, thermocouple, RTD, strain gauge/load cell and potentiometer/resistance. Also, math functions such as add/subtract, multiply/divide and square root are available.

JH Technology
800/808-0300; www.jhtechnology.com

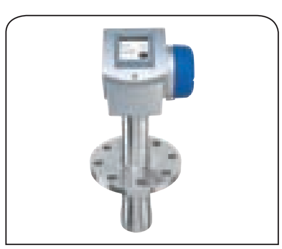
STRAIN GAGE SIGNAL CONDITIONER



Model 163MK strain gage signal conditioner accommodates ¼-, ½- and full-bridge strain gage applications. The unit offers ¼-bridge completion and calibration for applications such as materials and structural testing. It has two built-in precision ½-bridge completion resistors for ½-bridge applications, and can also handle full-bridge applications. It has a high-gain differential amplifier, two-pole Butterworth filter and built-in excitation supply.

Calex Mfg. Co.
800/-542-3355; www.calex.com

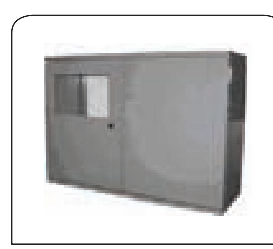
ON YOUR RADAR



The Optiwave 6300 C Radar instrument is ideal for solid measurement of uneven silo contents. It measures powder, granulates and bulk solids in buffer silos, hoppers, bulk storage containers and on conveyor belts. Choose a 3-in. diameter (DN 80) antenna made of polypropylene (PP) or Teflon (PTFE) or a 6-in. (DN150) PP antenna. Stainless-steel horn antennas up to 6 in. with a built-in horn purging feature are also available.

Krohne
800/FLOWING; www.krohne.com/northamerica

LIGHT-WEIGHT MODULAR CABINETS



Perfect for corrosion resistant applications and made from PVC or polycarbonate, this line of modular cabinets is available in sizes up to 72 in. Doors feature stainless-steel, lift-off hinges with a quarter-turn locking provision with single or double doors. The cabinets include wall- or floor-mount features. When the product is shipped flat, assembly at the job site is simplified with exploded view drawings and factory-supplied hardware. Factory assembly is available.

Midwest Plastic Fabricators
330/995/0992; www.midwestplasticfabricators.com

Interface Level: Two Technologies are Better than One!

Interface level is hard to do at all, and it is very hard to do well. This is because of the nature of interfaces and the physics and technology of the measurement of them. ● Roughly, an interface occurs when two fluids (or a gas and a fluid) meet that have dissimilar dielectric constants (Dk). Seldom is it this easy. There are gradients, rag layers, emulsions and other issues that make it difficult to measure interfaces. In fact, one vendor provides a camera-based system that looks through a thick Pyrex window to optically detect an interface.

Interfaces where the top level changes or where the dielectric constant of one of the interface layers changes (adding water to the bottom layer for a diluent, for example) are even more problematic than when the interface is two liquids of static composition and the top level is constant.

There are three basic technologies (other than the camera) that are used commonly to measure interface level in liquids. The first is capacitance or RF admittance, the second is TDR (guided wave radar), and the third is gamma nuclear gauging.

Gamma gauges require licensing, and usually, for interface detection, they require an insertion source or inserted detector. Most vessels aren't designed to permit this. Gamma gauges are also significantly expensive, costing approximately $1000 per foot of measured level. In addition, gamma gauges have other issues that make them prohibitive for all but the most difficult applications.

Capacitance (or RF admittance) probes, while they must be inserted in the vessel, are designed to penetrate a standard ¾-in opening in the top of the vessel. Most vessels have at least one extra tank nozzle that can be used. The overall or "top" level must remain constant, so that any change in the capacitance/admittance reading reflects only a change in the interface level. Capacitance technology is not affected by emulsion or rag layers in the application.

TDR radar provides the advantage of being able to measure both top level and interface level. But the technology requires the dielectric of the upper layer to be less than 10 Dk or not enough energy will get through the fluid to reflect off the interface itself. The one drawback of this technology is that it does not work well if the application has a rag or emulsion layer, as the signal gets lost and is not returned to the transmitter.

Realizing that no one technology provides optimum measurement, Endress+Hauser has introduced the Levelflex FMP55 Multiparameter Transmitter. This transmitter fuses the two technologies of capacitance and guided wave radar on the same rod or cable sensor, and provides the benefit of both technologies. The FMP55 is the first of a new series of instrumentation that Endress+Hauser is calling its Evolution Series.

The capacitance part of the transmitter is responsible for making the interface measurement, while the TDR radar section measures the overall level. This means rag or emulsion layers no longer affect the ability to read the interface, and the use of the radar device allows the overall level to vary if required.

The FMP55 features a multi-echo tracking algorithm that can track up to 20 tank echoes simultaneously as the tank level rises or lowers. This makes sure that the transmitter will not make a "jump" to an echo that is not the true level, such as a tank internal or a vapor blanket gradient.

The FMP55, like many Endress+Hauser transmitters, is equipped with a HistoROM built into the main housing of the transmitter. All of the setup parameters are stored on the HistoROM and, in the event of an electronics change-out, all of the information can be fed directly into the new electronics package. In the case of multiple units being set up at the same time for the same measurement parameters, the same HistoROM information can be transferred into a removable display that can be removed and installed in the next transmitter, greatly reducing setup time during field commissioning.

Endress+Hauser offers three different setup methods for the FMP55. The first method is the use of the removable display. Second, the device can be fully commissioned via the three buttons on the display itself, using a menu-guided six-step quick setup. Endress+Hauser's free FTD/DTM-based FieldCare software program allows for a very flexible method for setup, and the software can be integrated into a complete lifecycle management system. HART and Profibus PA outputs are available. ■

For more information, contact Endress+Hauser at www.us.endress.com, or by calling 1-888-ENDRESS.

Retrofit Projects — Getting Flows Right

GREG MCMILLAN
STAN WEINER, PE
controltalk@putman.net

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: In the 1970s and 1980s, we suspected valves and instruments were not delivering the performance listed in the catalogs. We got imaginative on how to shift loop setpoints and add biases to close material and energy balances. There was little published information on installation effects and drift. A few articles detailed the effects for a differential head orifice flow meter. One article in 1983 disclosed that total error for a 0.2% catalog accuracy DP was 2.1% due to zero and span shifts from process temperature and static pressure. The error introduced by changes in the tolerance of internal diameter and roughness of pipe and the wear on orifice edge can be 4%. If you consider changes in the fluid density and the deterioration in signal-to-noise ratio at low flows, the installed accuracy of these installations could be 5% to 10% even if the upstream piping run had enough straight lengths. Check out my November entry, "Secret Installation Effects," at http://modelingandcontrol.com/ for a list of vintage articles disclosing the real installed accuracy.

Stan One of my main objectives on projects was to use magnetic flowmeters and Coriolis mass flowmeters wherever feasible because they were largely unaffected by installation and operating conditions. Except for design and application mistakes, the calibration was not questioned whenever there was a problem in the control room. They also cost less to install and maintain.

Greg: Modern measurements are either inherently less affected by installation or operating conditions or have intelligence to compensate for these conditions. Coriolis meters are much less sensitive to pipe vibrations. DP transmitters are corrected for static pressure and temperature. DP flowmeters are corrected for changes in fluid density for a constant composition. New technologies such as radar level are independent of pressure, temperature, density and composition, and require no field calibration. The drift of these new sensor and transmitters technologies have often been reduced by a factor of five. Periodic calibration checks are not required for five years or more. If you have old technology, now is the time to upgrade.

Stan To help understand what is important in an instrument upgrade project, we continue our interview of Hunter Vegas, a senior project leader for Avid Solutions Inc., a system integrator in Winston Salem, N.C.

Greg: What are the biggest problems with getting the right control valves?

Hunter: Probably the hardest thing about control valves is getting the right information for sizing. The range of densities, flows, inlet and

outlet pressures, and vapor pressures are usually provided for "normal operating conditions." However it is the *abnormal* conditions (very high/low flow rates at high/low pressure drops) that dictate the sizing limitations of the valve. If it's in batch service, the range of operating conditions can be very wide. I make certain to ask enough questions of operations and process engineering to make sure I understand the true requirements of the valve.

Stan: When do you use vortex flowmeters?

Hunter: Unlike most other flow meters, a vortex meter's flow reading will fall to zero when the flow falls below the turbulent flow regime. Therefore, one has to be certain a vortex meter will never have to operate below the point where the reading will drop out. (This is the low-flow cutoff value cited in the meter specifications.)

I have also had problems with the plugging of the pressure sensor ports with some designs, and the meter is sensitive to the velocity profile and varying kinematic viscosity. Despite that, the vortex meter offers many cost advantages over head type meters, and is an excellent choice in the right application. One item worth noting is that any flowmeter will be worthless if it is installed incorrectly. Upstream and downstream meter runs, proper line bracing and line fill are critical for proper operation.

Greg: I think Coriolis meters offer the possibility of a live process flow diagram (PFD) in specialty chemical, food and pharmaceutical production. What is important in Coriolis meter selection?

Hunter: Coriolis meters are one of the few meters that measure mass directly, and provide a temperature and density signal as well as flow. However, there are some issues to consider. Straight-through tube designs are are less likely to plug and have reduced pressure drop; however, the tube length must be long, or the meter's sensitivity can be reduced. U-tube or other curved meters have high sensitivity, but often have higher pressure drops and are easier to plug. Liquids with entrained gas or foam can create high inaccuracies, but manufacturers are promising improved performance for these conditions in some higher-end product lines. The biggest deterrent against using Coriolis meters is their cost, especially in larger line sizes.

Stan What are the problems with magnetic flowmeters?

Hunter: Magmeters are an excellent meter with minimal pressure drop, but the liquid must have some conductivity for the meter to work. It is important to understand all of the conditions that the meter may experience to avoid problems. I had a magmeter measuring the blowdown on an ammonia vaporizer that worked well—provided there were trace amounts of water in the ammonia. When all of the water was blown down, the meter saw pure ammonia, and the very low conductivity made the meter stop working.

Another source of problems can be the possibility of steam-out on the lines. Some plants will steam out a line and then block it, creating a very strong vacuum as the steam condenses. Some magmeters employ a sleeve-like Teflon liner, and when heated by the steam and subjected to vacuum, the liner will collapse and ruin the meter. A liner reinforced with a metal backing can handle these conditions.

The last area of concern is using a magmeter in lined pipe. In this situation you must use ground rings to provide an electrical path for the meter to function.

Greg: When do you use differential head meters?

Hunter: In some cases, large line sizes or process conditions dictate the use of differential head meters. Their installed costs can be very high, but if installed correctly, they are extremely accurate and are often used for custody transfer.

You can use a pair of DP transmitters across a single orifice to get very high turndowns, and the addition of an RTD temperature and integral pressure measurement enables density compensation for a broad range of process conditions. A honed meter run can also eliminate the errors from differences in internal diameter and surface roughness.

Greg: I can relate to this Top 10 list from Randy Reiss, who moved from Austin to NYC for a graduate degree in math, because I live in Austin but visit NYC to see my daughter perform at the Metropolitan Opera.

Top 10 Reasons Why NYC is Friendlier than Austin

10. The subway rats tip their hats and say hello (where did they get the hats?)
9. Hell's Kitchen now rivals Austin in rainbow banners.
8. The Hudson River is a prettier shade of gray than Brushy Creek (but smells the same).
7. The Chrysler Building is like a big University of Texas tower.
6. Its easier to drive into Manhattan than downtown Austin—really it is! (Duh, the benefits of light rail!)
5. The graffiti on the buildings in NYC rivals most art I saw in galleries on South Congress (SoCo).
4. "Houseton" street only has one name.
3. The Brooklyn-Queens Expressway (BQE) moves faster than Loop 1 (Mopac).
2. We never needed the phrase "excuse me" anyway.
1. In-route subway stop schedule changes give your day that added extra variety that makes you smile! ■

AD INDEX

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The Long View and Valley Power

Time speeds up as we get older, but 10 years is still a big chunk of chronology. And in this stressed-out era of 24/7 news, showbiz fads, financial scandals and other distractions, it can be difficult to focus on unglamorous commitments—good marriages, raising families, consistent professionalism— or staying warm next to Lake Michigan.

Sure, global warming may one day turn Milwaukee into a tropical hotspot, but, for now, most of its downtown area by the lake needs the steam heat it gets from We Energies' Valley Power Plant. This venerable plant is the largest utility-owned, co-generation facility in the United States. It haa two 280-megawatt units, and its four coal-fired boilers produce 1.25 million pounds per hour (MLb/hr) of steam.

In the most recent decade of its continuing mission to provide and improve its service, Valley Power has steadily transitioned from using stand-alone laptop PCs and multiplexers and moved to using Emerson Process Management's online AMS Device Manager and its Ovation interface. This journey was described by Todd Gordon, We's instrument technician leader at Valley Power, at the recent Emerson Global Users Exchange in San Antonio, Texas.

"Now, we all have to love technology, but we know it can create an overload unless training and implementation are coordinated," says Gordon. "We've also learned that technology such as AMS can't solve every problem. If your hardware and mechanics aren't set up properly, then your overall system isn't going to work. Technology is only as good as the people that maintain, use it and interpret the data, so it also takes a time commitment for training, proper setup and implementation."

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Built in the 1960s, Valley Power initially used local, pneumatic controllers for pressure, temperature and level and an I/P converter, which was upgraded from E/P in 1993. Gordon reports the plant's journey to AMS really began when it installed its first "smart," non-HART transmitter in 1988. Then, in 1993-94, DCS controls were installed at Valley Power. Likewise, in 1993, the plant gained its first "smart," non-HART positioner, which used DOS-based software that required a Windows 98 laptop.

"The main question is can the newer, smart instrument do its job better than the older technology? We've usually found that the answer is yes," says Gordon. "Fisher DVC positioners also provided an input to DCS for valve position from the HART signal. These were on our two most critical valves. So when the positioners told us the valves were getting sticky, we decided to replace them, and this saved us from tripping out units three times."

Later, Valley Power added Base Station with Multiplexers in 2004. These enabled online, continuous monitoring when hardwired to HART devices. "The base station communication from the handhelds and laptops are very useful, but we still like to go and see the valves move," added Gordon. "There are still some things you can only see when you're there."

Even newer devices at Valley Power include its HART diagnostic transmitters, and it plans to add wireless devices soon. Most recently, the plant replaced its multiplexers with Emerson's Ovation interface and spent part of this year working on a new DCS controls upgrade, in which the base station will be integrated into the DCS controls.

"In general, our performance monitoring has given us better tuning of controls, improved heat rates for reduced fuel consumption, faster ramp rates for changing load demands, centralized performance monitoring and predictive maintenance," added Gordon. "All of this has been a journey, not a destination. We found that online capabilities increase effectiveness of smart instrumentation and supporting software. However, you can't maximize a plant's efficiency if you can't accurately control and effectively manage the final drive elements."

Pretty cool, that is, if you can wake up from present-day distractions, become aware of some important history and take that longer view. ■

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