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NOVEMBER 2021

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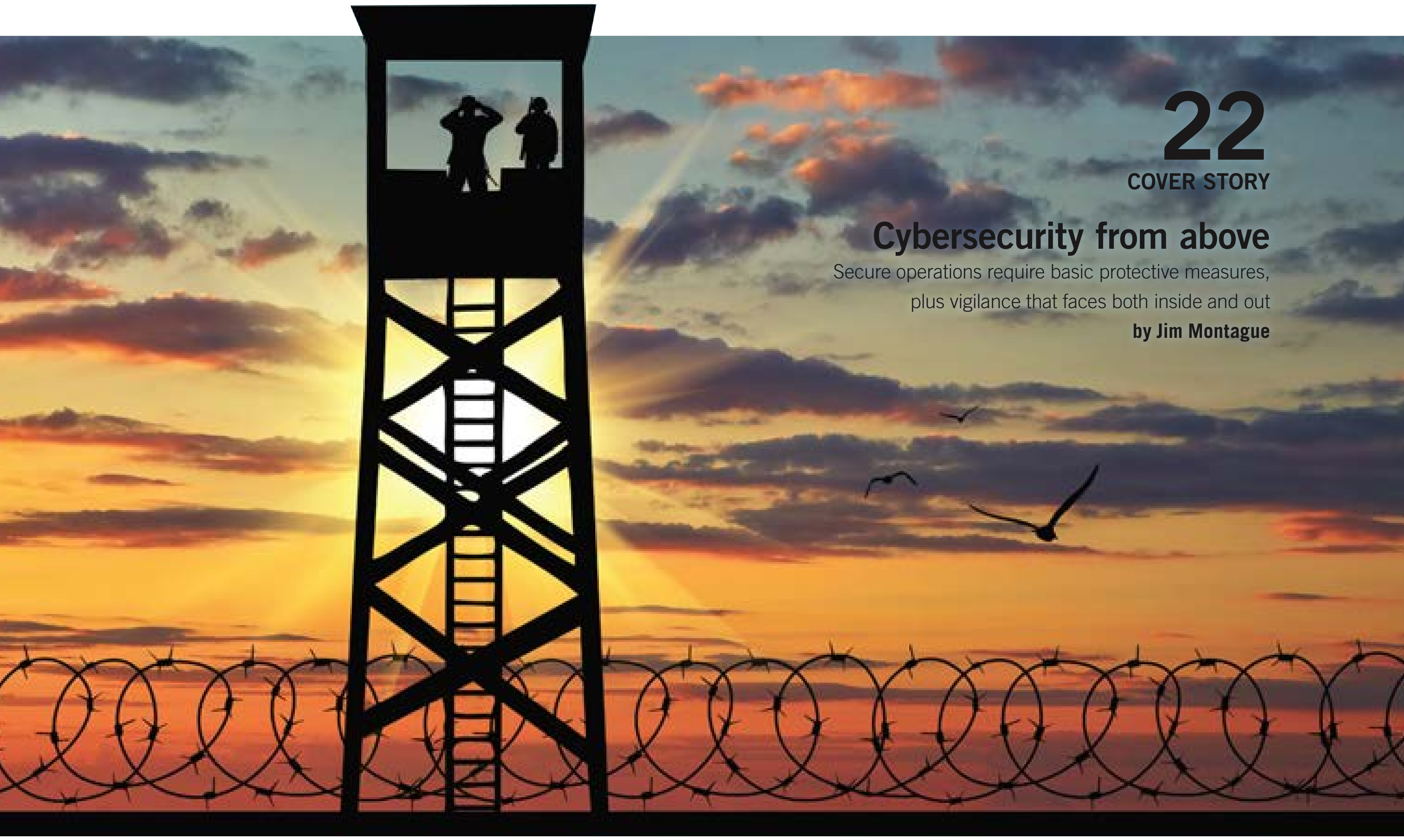

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CIRCULATION

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Primary Metal Industries	6,541
Electric, Gas & Sanitary Services	5,071
Petroleum Refining & Related Industries	1,992
Miscellaneous Manufacturers	3,222
Paper & Allied Products	2,784
Pharmaceuticals	4,533
Rubber & Miscellaneous Plastic Products	3,297
Stone, Clay, Glass & Concrete Products	1,690
Textile Mill Products	1,221
Tobacco Products	155
Total Circulation	60,020

What's in a title?

Newly created positions can reveal a lot about a company's priorities

I'M just back from my first business trip since February 2020, and boy was it great to renew relationships with colleagues and associates in a non-virtual context. The early November trip brought me to Houston, where I participated in Automation Fair 2021, Rockwell Automation's annual trade fair and conference, which this year was conducted as a hybrid event with both live and virtual components.

As a member of the press, I was privileged to participate in a series of media briefings that really gave me an inside look at how Rockwell itself is taking steps to deal with issues of central importance for all manufacturing organizations today: workforce—from both skills and DEI (diversity, equity and inclusion) perspectives—and sustainability, from the perspectives of efficiency, recycling and reuse, as well as greenhouse gas emissions.

Interestingly enough, three of the speakers had recently taken on new responsibilities in newly created positions within the organization, which I think is strongly correlated with how important company management, starting with Chairman and CEO Blake Moret, believes these initiatives are to the future of the company.

First up was Bobby Griffin, the company's first chief diversity, equity and inclusion officer. Together with Becky House, senior vice president and chief people and legal officer (another telling title), he discussed leveraging culture and DEI as competitive advantage. The company believes in this so strongly that it's elevated its commitment to developing a stronger culture of DEI as the organization's #1 strategic goal, by which the success of its managers is measured and compensated.

“This isn't just an enterprise approach," Griffin said. "We're integrating DEI at the micro-level of each business, so we can align globally, be relevant locally, help our leaders be more culturally competent, and take a broader approach to bringing in talent.”

The company tagline of “expanding human possibility” isn't just for Rockwell's customers and prospects. It's also about getting its employees excited about what the company is all about and performing at their highest level.

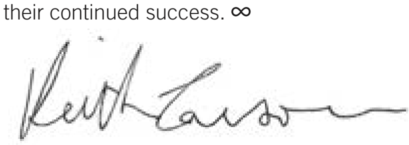
Another presenter sporting a newly created title was Sherman Joshua, global competency business director. In his new role, he's working within Rockwell's services group to create a more agile and flexible workforce. Speaking with Rachel Conrad, vice president in charge of the services organization, he's working to attract new employees to the organization, proactively plan for their success, and ensure they get the training and retraining that they need to keep their skills relevant.

Building a robust workforce starts with a plan, Joshua said. “It starts with your business strategy. Ask some questions. What do your customers need? What can we bring to the market? What are the skills and competencies needed?”

Last up was Tom O'Reilly, newly minted vice president of sustainability. He talked about how Rockwell was leveraging data to drive productivity *and* sustainability—both within Rockwell and on behalf of its customers. The ability of the Rockwell portfolio of hardware, software and services to increase efficiency and reduce waste on behalf of its customers is clear, but Rockwell itself has also improved energy efficiency, reduced waste of its manufacturing processes, and is targeted the increased recycling and reuse of its products.

Prompted by a question from the audience about common barriers to sustainable manufacturing processes, O'Reilly responded that many executives simply don't know where to start. “That's part of the reason Rockwell has partnered with Kalypso, which has a unique methodology about where to start to drive sustainability and find real value.”

Clearly, Rockwell Automation sees sustainability through a wide lens—including not only efficiency, waste reduction and recycling/re-use, but also its own continued relevance and viability through an engaged workforce. My hat's off to them and to their continued success. ∞



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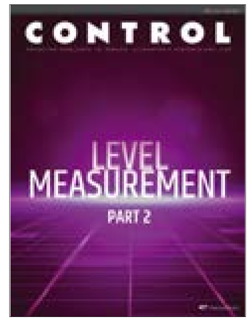
"Three of the speakers had recently taken on newly created positions—which I think is strongly correlated with how important company management believes these initiatives are to the future of the company."

The latest on level measurement



The latest trends, technology and implementations on the topic of level measurement are detailed in this new State of Technology Report compiled by the editors of *Control* and ControlGlobal.com. In the pages of this downloadable PDF, you'll learn the key considerations to keep top of mind for automatic tank gauging, how to stabilize a hunting tank level, how shining a light on underlying level measurement principles can clear up mysteries and misconceptions, and how an adaptive controller can be used in level applications.
https://info.controlglobal.com/state-of-technology-2021-level-measurement-part-2_proc

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Intelligent alarming leverages the Industrial Internet of Things to reduce risks and costs
In today's digital age, every organization can manage alarms. With intelligent alarming and the industrial Internet, companies can send alarms that matter, when they matter, to the right people. Engineers and operators can receive prioritized alerts with instructions, helping them react to and resolve alarms quickly. Learn more in this whitepaper from GE Digtial.
https://info.controlglobal.com/white-paper-2021-ge-intelligent-alarming-leverages-iiot-to-reduce-risks-and-costs_hmi_mgmt

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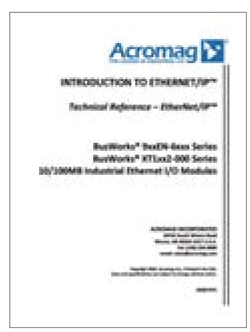

Introduction to EtherNet/IP
EtherNet/IP was first presented in March 2000 and is the result of a joint effort between ControlNet International (CI), the Open DeviceNet Vendor Association (ODVA) and the Industrial Ethernet Association (IEA) to produce a network protocol that addressed the high demand for using the widely popular Ethernet network in control applications. This whitepaper from Acromag explains EtherNet/IP, the OSI Network model, a sample EDS file and more.
https://info.controlglobal.com/white-paper-2021-acromag-introduction-to-ethernet-ip_ios

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Ethernet-APL: Why HART-IP will be critical to industry adoption
The introduction of Ethernet-APL technology earlier this year is an important technology milestone, enabling a new, high-performance paradigm of digital field communications for the process industry. We soon will have loop-powered, two-wire, intrinsically safe Ethernet that's orders of magnitude faster than past generations of field communications. But to make sure that Ethernet-APL doesn't underachieve like fieldbus before it, we need to make sure the impact on current work processes and associated tools is kept to a minimum. In this on-demand webinar, Keith Larson and Fieldcomm Group's Sean Vincent review the case for HART-IP over Ethernet-APL as the most expedient path to Ethernet-APL success.
https://info.controlglobal.com/webinars-2021-ethernet-apl-reaping-rewards-and-managing-risks_ce_ethernet

NEWS & BLOGS

The forces reshaping tomorrow's distributed control system
Control editor-in-chief Keith Larson talks with ABB's Mark Taft about the forces reshaping the distributed control system (DCS) landscape and how ABB is responding to them. Taft is ABB group vice president responsible for the company's process control systems offerings worldwide.
www.controlglobal.com/podcasts/control-amplified/the-forces-reshaping-tomorrows-distributed-control-system

Electric distribution reclosers can be cybersecurity-compromised to cause wildfires
In this blog post, Joe Weiss aruges there's a connection between extreme drought, wildfires and cyber-threats.
www.controlglobal.com/blogs/unfettered/electric-distribution-reclosers-can-be-cyber-compromised-to-cause-devastating-wildfires

Driving sustainable operations with advanced analytics
In this episode of Control Amplified: the Process Automation Podcast, *Control* editor-in-chief Keith Larson discusses how advanced analytics are being used in the process industries to advance the sustainability of their operations with Lindsey Wilcox, customer success manager at Seeq.
www.controlglobal.com/podcasts/control-amplified/driving-sustainable-operations-with-advanced-analytics

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Go to www.controlglobal.com and follow instructions to register for our free weekly e-newsletters.

Readers react to loss of former editor

I was so saddened to hear of the passing of Paul Studebaker [former editor-in-chief of *Control*]. The last time I saw Paul was at Automation Fair 2019 in Chicago. I had invited Paul to talk to me about the 25th anniversary of Fluke entering the process tools market.

While he was visiting our booth, I remember we had a new product on display that can acoustically see air leaks. I showed air leaks on a control valve on the device (ii900 Sonic Imager) to Paul, and he got so excited about the problems it would solve detecting leaks in process applications. He even dropped an F-bomb, which blew my mind. He was so passionate about solving process problems and giving technicians good tools to do their work.

I already missed Paul when he retired. I miss him more now. My thanks to Keith Larson for the nicely written article about his life. I feel for his family and coworkers, and was hoping to visit him some time when passing near his home in Valparaiso, Ind.

JIM SHIELDS
Product Program Manager
Fluke Process Calibration Tools

Nothing like learning of the loss of a mentor to make one reevaluate their impact on life's course forward—and become more grateful for all their support!

Today, I learned of the passing of Paul Studebaker, former editor of *Control* as well as *Plant Services.* For more than 20 years, I had a wonderful engineering media mentor, who helped me formulate my path forward to addressing what would become my life's mission to build the next generation of skilled technicians. Paul challenged me for over a decade to fill a monthly segment called the "Crisis Corner" by sharing details and strategies to address skills and maintenance crises. Paul's editorial prowess helped convert my poor grammar and spelling-challenged thoughts into coherent, value-added strategies to help guide readers to build the pipelines of skilled technicians.

The loss of Paul is further proof that we are losing not only practitioners, but also

industry advocates to nudge us forward to rebuild the pipelines of techs that we desperately need to advance society.

However, one of the most poignant memories of my time with Paul was when I debriefed him on my trip to the U.S. Congressional Forum, where I played the "Maintenance Crisis Song" and met with all kinds of government, business and media leaders. That debriefing became the column "Mr. Leonard Goes to Washington," which later won a gold award from the American Society of Business Publication Editors.

Paul at first wasn't aware of the Maintenance Crisis, but later became a key ally in helping leaders better appreciate the magnitude and need for workforce development. I never would have thought then that now that I'd be leading after-school programs with a $100,000 truck and mobile makerspaces in rural and underserved communities. I'm actually helping to plant seeds to grow the pipelines of talent to fuel future growth and prosperity.

Thank you, Paul, for your guidance and mentorship in helping me hone my thoughts toward a valued mission to impact our future! That is just a small part of your legacy Paul Studebaker! I only hope that more will be inspired to continue that mission too. Thank you!

JOEL LEONARD
Maker's Maker
MakesboroUSA.com

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In Memory of Julie Cappelletti-Lange, Vice President 1984-2012

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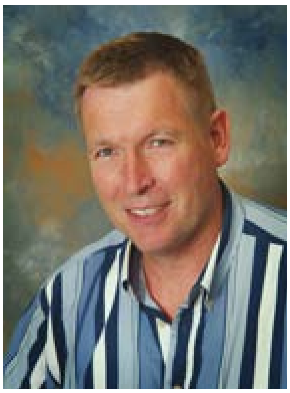
Please Recycle This Magazine

Carving up the technology turkey

Responsible solutions take into account the perspectives of key stakeholders



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Contributing Editor
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"If we don't engage the coming generations of measurement and controls professionals in the kitchen from an early age, their ability to make choices that optimize fitness for purpose will be greatly diminished."

WHEN you only prepare a feast once a year, serving your guests a roast that is as lovely to behold as it is to consume can be elusive. Even with Wi-Fi connected or Bluetooth capable temperature sensors strategically stabbed into the bird, we're likely stressed about duplicating the delicacy served by our forebears. Maybe we should have paid more attention when Grandma was in charge? Can technology be an impediment to developing rudimentary skills? In the delivery of useful measurements and controls, we've experienced similar challenges.

Not long ago a magnetic flowmeter—seemingly a wise choice for a weakly acidic stream—began fluctuating erratically, causing its associated control valve to also behave badly. As the secondary, a.k.a. "slave" loop of a cascaded level control, it was in manual for a week or so before the valve was just directly connected to the level controller. The question arose, "why was this configured as a cascade loop anyhow?" The answer was familiar: "Because we could." When adding a plethora of alarms to a control loop or creating a cascade pair requires only mouse clicks, we can be guilty of deploying technology for technology's sake.

Our propeller-head tendencies can lead to choices that sound nifty and clever, but end up adding little value for the end user. Do we need a $10,000 magmeter with self-checking diagnostics? Perhaps a close-coupled DP flowmeter will suffice at a fraction of the price. And if it's not part of the control scheme, i.e., indicate-only, its impact is lower if it freezes up or fails. When the boiler tripped on low steam drum level, the plant manager asked, "Didn't you train them on those controls?" Yes, but a split-range control scheme that cleverly supplements make-up boiler feedwater for recycled condensate could become befuddling to novice operators. Perhaps we should let them manage it manually.

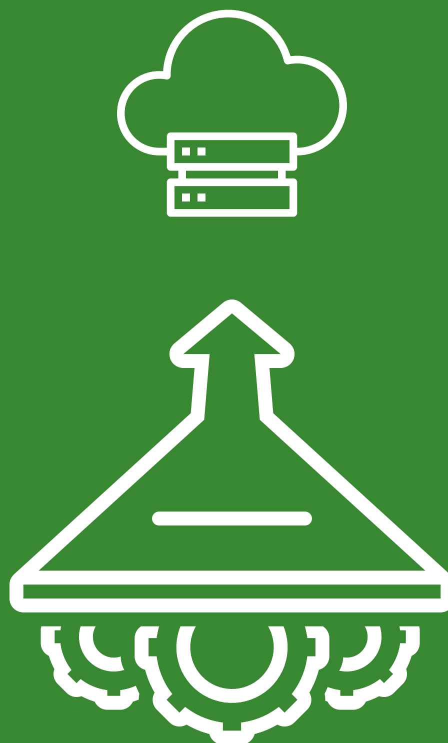
You can hire a $2,000/day consultant to make a stakeholder map for you, or just ask yourself, who will be impacted (i.e., suffer) most from my choices? In most instances, it's operations, but it's important to involve maintenance as well. Maintenance—your instrument specialists—might tip the scales toward a more mundane solution, something they know well. Process engineers, environmental specialists and accountants can also have meaningful input about reliability and accuracy. If we allow our hobbies and/or isolation to preempt or neglect their needs, our duty to wisely invest the company's capital is tarnished.

There are plenty of easy applications for which stock solutions are adequate, or even ripe for experiments or innovation. But making prudent choices for the remaining 10-20%, or the "once a year" challenges that are both consequential and expensive to remedy, that's when our depth is tested. If we're the individual on the team that the remainder trusts to prevent operational indigestion, we can't rely on blaming the vendor when pain ensues.

In some instances, a complex measurement technology can create a distraction regardless of its importance. The superheated steam overpressure vent is shut, but the flowmeter's output is erratic once the static line cools to saturation temperatures. Even after decades of experience, would anyone have foreseen that the sensor technology, effective in always-superheated service, would be subjected to saturated or even condensing conditions? Even long-time practitioners find themselves responsible for the occasional turkey.

If we don't engage the coming generations of measurement and controls professionals in the kitchen from an early age, their ability to make choices that optimize fitness for purpose will be greatly diminished. As corporations have cut in-house staff and outsourced non-core competencies, process control has not been immune.

Grandma didn't need a lot of instrumentation to roast a turkey, and would most likely find modern attempts to improve on basic kitchen skills useless, if not ridiculous. If she's still able to give us some guidance, let's learn while we can. In like manner, let's make the most of the experienced professionals among us before their combat-hardened experiences are out the door. ∞



How to keep your control system young

PETE DIFFLEY
Senior Manger,
Global Partnerships,
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As the pace of technology innovation races ever faster ahead, the notion of control system longevity is under pressure like never before. Virtualization has in some cases helped to liberate users from the short lifecycles of the general-purpose computer hardware and operating systems upon which they run, allowing the application software—and the intellectual property investment it represents—to be carried forward. But sometimes, it's the application software itself that proves vulnerable to the ravages of time. To learn more about the code-based risk factors that can shorten a control system's effective life, we sat down with Pete Diffley, senior manager, global partnerships, Trihedral Engineering.

Q: End users and machine builders spend a lot of money and effort tailoring what start out as relatively generic control system components, both hardware and software, into a system that fits their specific application requirements—and understandably, they want those investments to last. What sorts of things can go wrong?

A: Many risks to control system longevity can be traced back to early development decisions that prove to be unsupportable over the longer term. For example, choosing an automation platform that appears to offer *unlimited* flexibility may actually turn into a problem in later years. Don't be seduced by claims that a software package "can do anything you dream of." What that really means is a lot of custom-coding by you or your integrator to make things work as desired.

So, what happens when that code breaks down and the developer—your employee or your system integrator's—left town six months ago to pursue a new opportunity? One thing you can be sure of is the documentation that goes along with that custom code will be lacking—if it exists at all. All that custom code should also give you pause before considering a release upgrade of the software or operating system, because that new release was developed with no consideration for your custom code. The upgrade will likely break it. So, you're stuck limping along with the old version of the software, and can't take advantage of any new features that come with that latest update or, for that matter, security fixes, leaving your system extremely vulnerable.

Choose automation software that has the functionality you need with a strong look towards the future, as well as established and tested drivers for the devices to which you'll need to connect. In all cases, prioritize configuration over coding. Follow these guidelines, and when a responsible control system provider issues a new release of that software, the upgrade should be relatively uneventful.

Q: Doesn't this sort of mindset limit one's ability to take advantage of innovative new technologies, such as those represented by the IoT or Industrial IoT?

A: I think the answer to that question really goes back to a focus on functionality. If you're talking about a SCADA, or supervisory control and data acquisition, software package, then you should expect focused, functional performance around reliably acquiring data, visualizing data and historicizing data. The providers of systems that are being used in critical infrastructure tend to have a continuous improvement mindset, and pack extremely useful, often highly innovative features in their solutions that provide an excellent level of flexibility.

This doesn't preclude well defined interfaces with other innovative applications such as for advanced analytics—locally or in the cloud. But we're talking about SCADA software, not predictive diagnostics. Sure, you should be able to make that data available to these sorts of systems, but rely on interoperable interfaces that can be readily maintained over time.

Q: Are there other things that users should be aware of when it comes to creating a control system that will stand the test of time?

A: In addition to the hazards of third-party custom code that I described earlier, there are little-understood hazards presented by third-party code that's often embedded in the software that you're purchasing. As software packages have become more complex, they often include open-source or licensed code from other developers.

This can be risky from several perspectives. First, embedded code may not have been submitted to the same level of testing and scrutiny that a responsible developer would apply to its own code. And when the supplier of your software has internal, third-party dependencies, they have no control over that ecosystem of software subsystems. What happens when that code goes south? Or its developer goes out of business?

Even scarier are the potential cybersecurity risks, such as were borne out in the Sunburst malware attack discovered late last year. In an attack attributed to Russian operatives, the malware was snuck into a third-party, embedded piece of software that was used by network management software provider SolarWinds. Then, using a signed software update to the company's Orion network management software as its Trojan horse, the malware was welcomed into some 18,000 government and corporate clients' networks. It had most of the year to make itself at home before it was first identified in December 2020 by cybersecurity firm FireEye, upon investigating suspicious activity around its own network's two-factor authentication process.

The attack was particularly diabolical for a couple of reasons. First, by being inserted into a legitimate, digitally signed software upgrade, it easily cleared organizations' defenses. Second, since it effectively became part-and-parcel of the network management software package, it could "hide in plain sight," while probing all the various connected devices that the network management software was credentialed to manage. This meant it could—and likely has—spread laterally, establishing footholds in those connected assets and applications.

Q: Is there anything that users can do to protect themselves from this sort of development?

A: The clearest path to understanding how much third-party code is embedded in a piece of application software is to carefully read the license agreement before you blindly check the "I agree" box. Some packages include a lengthy list of software components from other providers and the licensing agreement essentially waives any responsibility for how these components behave, and whether they continue to be supported or not.

A control system that promises a long and useful life will be based on core software that is tightly controlled by a responsible provider. At Trihedral Engineering, for example, the code upon which our VTScada software is based is our own. Along with thorough, automated testing, multiple pairs of eyes scrutinize it before release. That's why our customers' applications developed even decades ago will always run on the latest version of our software. We call this 'forward compatible for life.' Reducing or eliminating third-party software code dependencies is the best way to minimize exposure to these sorts of risks. ∞

Decisions made very early in the development process will often determine whether your control system quickly becomes brittle and inflexible, or can stay continuously current and secure.

Endress+Hauser opens Houston tech center

112,000-sq ft facility in Pearland features new process training unit, supports U.S. Gulf Coast customers

ONSCREEN meetings have proven their value lately, but in-person gatherings and interactions are still better—just like live sports, music and theater. To give its customers in Texas and the other Gulf Coast states the benefits of face-to-face experiences, Endress+Hauser (www.us.endress.com) unveiled its new USA Customer Center on Oct. 26, in Pearland, on Houston's south side.

"The Houston area is the single largest process industry market in the world," said Klaus Endress, president of the supervisory board at Endress+Hauser. "We've already been here for decades, but this new facility will let us serve our customers as they deserve to be served."

Completed on time and under budget despite COVID-19, the $35 million, 125,000-sq ft facility has 125 staffers serving the region's energy market in oil and gas, liquefied natural gas, hydrogen and other applications. It was designed with customers in mind, and is equipped for training, repair and calibration services. Endress+Hauser support teams, including inside sales and application engineering teams, provide localized technical expertise for customers. Its training services include a new Process Training Unit (PTU), where customers can learn about IIoT capabilities, Bluetooth-enabled components and more. With 200 Endress+Hauser devices and seven tanks set up for live training sessions, the Houston PTU is the largest training unit of its kind in the U.S.

"This expansion reflects our strong foothold in the U.S. and connection to our customers," added Matthias Altendorf, CEO of Endress+Hauser Group. "It enables us to provide the best service to our customers, strengthen our relationships with strategic partners, and grow our presence in the Gulf region.

The new facility can also perform accredited instrument calibration in up to 12-in lines across a variety of measuring principles, including flow, level, temperature and pressure. These accredited calibrations can be performed at the Houston laboratory and at customer sites with a mobile calibration rig.

RIBBON CUTTERS

Endress+Hauser's new USA Customer Center in Pearland, Texas, was officially opened Oct. 26 by (l. to r.) Jim Johnson, president and CEO, Pearland Chamber of Commerce; Bill Poland, construction VP, Genesis Property Development; John Schnake, corporate process analyzers director and GM, SpectraSensors; Matthias Altendorf, CEO, Endress+Hauser Group; Klaus Endress, supervisory board president, Endress+Hauser; Dr. Monde Qhobosheane, president and CEO, Analytik Jena USA; Todd Lucey, GM, Endress+Hauser USA and corporate sales director, North America, Endress+Hauser; Jared Boudreaux, president, Vector CAG; Pat Irwin, area VP, Endress+Hauser USA; and Kevin Cole, mayor of Pearland.

One campus for one team

To make related technologies and collaborative opportunities even more available to its regional customers, Endress+Hauser's new campus also provides a home for:

- SpectraSensors' (www.spectrasensors.com) global marketing and applications division. Its 25-year-old tunable diode laser (TDL) spectroscopy for gas analysis business is an Endress+Hauser company. Spectra will combine its TDL spectroscopy technology with Kaiser Optical Systems Inc. (kosi.com) and its Raman spectroscopy technology on Jan. 1 to form Endress+Hauser Optical Analysis division;
- Analytik Jena's (AJ, www.analytik-jena.us) measurement, testing, analytical, bioanalytical and optical systems product lines for laboratory instrumentation; and
- Vector Controls & Automation Group (vectorcag.com), a local Endress+Hauser sales and service provider.

"End users and suppliers can't be creative if they can't come together. This campus accelerates that ability," added Altendorf. "Each of the four initiatives on the campus, Endress+Hauser USA, Vector CAG, SpectraSensors and Analytik Jena, has is own area, but they're also together for better discussions, instead of being across town. We've already seen new opportunities created by this togetherness because customers can visit several partners at once."

Yokogawa sees automation turning into autonomy

To help end users get ahead of and take advantage of digitalization, Yokogawa staged its Y Now 2021 (www.ynowlive.com) online event starting on Nov. 1. Its theme was "realizing autonomous operations," and it featured a variety of technical sessions that are still viewable as on-demand videos.

"Yokogawa's traditional ability is measuring and connecting in the oil and gas processes, but these core competencies can add value across other industries," said Kevin McMillen, president and CEO of Yokogawa North America. "This is why Yokogawa reorganized it business structure in April into segments based on industries and how to help customers sustain their growth."

The three industry-based segments, and two add-ons, are:

- Energy and sustainability, including oil and gas, petrochemicals, renewable energy, electric power, energy management systems (EMS) and energy storage;
- Materials, including functional chemicals, biomaterials, pulp and paper, textiles., steel, non-ferrous metals, mining, mobility, electrical and electronics;
- Life, including pharmaceuticals, healthcare, food and water;
- Measuring instruments, including energy, information and communications, and healthcare; and
- New businesses, including bio-related, aviation and others.

McMillen reported that Yokogawa's realignment is based on its new Industrial Automation 2 Industrial Autonomy (IA2IA) approach that employs a system of systems to connect sites and users, and create value through optimization. Related sessions at Y Now 2021 included:

- Tom Fiske, principal technology strategist at Yokogawa, who traced the evolution of IA2IA;
- Joseph Ting, VP of digital customer experience at Yokogawa, who showed how the Yokogawa Cloud platform can enable process operations and maintenance on the edge;
- Hiroaki Kanokogi, control center GM for Yokogawa Products, who described how AI softare modules can enable autonomous plant operations; and
- Penny Chen, senior principal technology strategist at Yokogawa, who reported how robotic equipment can serve as the five senses of autonomous processes.

For Y Now 2021 content and videos, visit www.ynowlive.com.

Electrocomponents leads with sustainability

Electrocomponents plc, a global, multi-channel products and services supplier and parent of Allied Electronics & Automation www.alliedelec.com), launched Nov. 4 its "For a better world" environmental, social and governance (ESG) action plan to support a more sustainable and inclusive world by 2030. The ESG action plan (www.electrocomponents.com/esg) is integrated into the company's Destination 2025 strategy, supporting its vision to be the first choice for stakeholders by creating profitable growth, and lead the global industrial sector as a truly responsible, sustainable and inclusive business. The plan has four main goals:

- Advance sustainability by developing sustainable operations and products and services that reduce environmental impacts and tackle climate change. Electrocomponents has committed to reach net-zero greenhouse gas emissions across its global operations by 2030 and across its wider value chain by 2050.
- Champion education and innovation by building skills and fostering solutions with 1.5 million young engineers.
- Empower employees by enabling them to reach their full potential, and thrive in a safe, inclusive and dynamic culture. This includes working towards 40% of the company's leaders being women and 25% being ethnically diverse.
- Do business responsibly by ensuring the highest ethical and environmental standards throughout the company's business and global value chain by introducing ESG objectives to be embedded in employee rewards, supplier objectives and a new sustainability-linked loan. ∞

SIGNALS AND INDICATORS

- **Schneider Electric** (www.se.com) reported Nov. 11 that it's joined other industrial leaders to form **UniversalAutomation.org** (UAO), an independent, not-for-profit association managing the reference implementation of a shared-source runtime. IT and OT software vendors, end users, OEMs and academics will share a common automation software layer across their automation technology—regardless of brand.
- Sixty-year-old, China-based **Peric Hydrogen Technologies Co.** (http://en.perichtec.com) reported Sept.28 that it's partnering with **ABB** (www.abb/com) to enhance its capabilities for manufacturing highly efficient electrolyzers.
- **Emerson** (www.emerson.com) reported Sept. 27 that it's collaborating with **Colgate-Palmolive Co.** (colgatepalmolive.com) to reduce wasted energy in Colgate's product packaging facilities, and contribute to its goal of achieving net-zero carbon emissions in operations by 2040. The project uses specialized Aventics pneumatic sensors and an IIoT-enabled software architecture.
- **Moxa Inc.** (www.moxa.com) announced Nov. 3 that Chad Chesney has been appointed as president of Moxa Americas. His leadership background spans nearly 30 years, and includes leading cross-functional and strategic teams at NI (formerly National Instruments). Chesney succeeds Frank Hou, who is taking on a new role at Moxa's headquarters.
- **Honeywell** (www.honeywell.com) announced Oct. 28 that it will work with **IGEL** (igel.com) to deploy solutions for Experion Process Knowledge System (PKS) users through the IGEL Ready program. This Linux-based solution, known as Honeywell's Universal Thin Client Operating System, will allow Experion PKS users to securely deploy a thin-client operating system, and give endpoint devices peripheral and connectivity features.
- **Digi-Key Electronics** (www.digikey.com) launched Oct. 14 new features for its cloud-based Scheme-it tool (www.digikey.com/schemeit/home), which is a free online schematics and diagramming solution. Scheme-it is used to design and share electronic circuit diagrams and schematics.

Temperature and pressure stand the heat

From videos to white papers, a compendium of industrial temperature and pressure measurement knowledge

THERMOCOUPLES AND RTDS

This one-hour video, "Temperature measurement basics," shows how temperature is measured with thermocouples and platinum resistance thermometers, and includes a practical look at how they work and how to identify each type. It's at www.youtube.com/watch?v=tYA0PetHOOY

RTDOLOGY
www.burnsengineering.com

Q&A ON INSTALLATION

This online article, "Prevent pressure transmitter problems" by Greg McMillan, is part of his monthly Control Talk series in *Control*, and includes DP and PT installation advice from Daniel Warren of D.M.W. Instrumentation and Consulting Services Ltd. and Hunter Vegas of Wunderlich-Malec. They also cover measurement of gases, liquids and steam lines, piping and sloping issues, transmitter calibration requirements, skid issues and examples. It's at www.controlglobal.com/articles/2018/prevent-pressure-transmitter-problems

CONTROL
www.controlglobal.com

MEASUREMENT FOR ENGINEERS

This online publication, "The Engineer's Guide to Industrial Temperature Measurement," explores recommendations, pitfalls and tradeoffs for various temperature measurement systems. It shows how to select among sensor and signal conditioner alternatives, and covers design of high-reliability systems. It's available with a brief registration at http://go.emersonprocess.com/rmt-us-t-free-temperature-guide s

EMERSON
www.emerson.com

PRESSURE MEASUREMENT 101

This one-hour video, "Pressure measurement basics" by Lou DiNapoli, application engineer at Siemens, covers definitions, essential concepts, transmitter types, installation considerations, application situations and other issues. It's at www.youtube.com/watch?v=knqxua6aEz8

GILSON ENGINEERING
www.gilsoneng.com

SENSING AND CONTROL ONLINE

This online article, "Temperature controllers," covers definitions, principles, characteristics, configuration, control methods and sensors. It's at www.ia.omron.com/support/guide/53/introduction.html

OMRON INDUSTRIAL AUTOMATION
www.omron.com

PRESSURE TYPES AND DEVICES

This 19-minute video, "Pressure and pressure measurement" by Jim Pytel of Big Bad Tech, covers atmospheric, vacuum, differential, head and gauge pressure, and examines devices including the Bourdon tube, spring-loaded piston gauge, pressure switch, and pressure sensors or transducers. It's at www.youtube.com/watch?v=xq6Ax94R72I

BIG BAD TECH
www.patreon.com/bigbadtech

TEMPERATURE HANDBOOK

This online publication, "Temperature controller basics handbook" from Danaher Industrial Controls Group includes common applications and uses, parts, functions, features, types and characteristics. It's at www.instrumart.com/pages/283/temperature-controller-basics-handbook

INSTRUMART
www.instrumart.com

HISTORY AND REFERENCES

This 49-page white paper, "Temperature measurement" from the Missouri University of Science and Technology, covers the history of industrial temperature measurement, basic devices and controls, probes, packaging, resistance temperature detectors (RTD), thermopiles, themocouples, camera field devices, control outputs and networking. It also gathers useful data sheets and reference charts. It's at web.mst.edu/~cottrell/ME240/Resources/Temperature/Temperature.pdf

MISSOURI S&T
web.mst.edu

WEBPAGE ON CONTROLLERS

This classic webpage, "Temperature controllers," includes FAQs and advice on evaluating and selecting the right temperature controller, provides an introduction to numerous temperature control concepts, technologies and products, and has links to many related resources. It's at www.omega.com/en-us/resources/temperature-controllers

OMEGA ENGINEERING
www.omega.com

STATE OF TECHNOLOGY REPORT

This compilation of articles, "2021 State of Technology Report: Temperature and Pressure Measurement, Part II" by the editors of *Control*, covers preventing pressure transmitter problems, redefining temperature and calibration processes by a major brewer, how to size and select pressure relief valves, and even controlling global warming. It's at info.controlglobal.com/state-of-technology-2021-temperature-pressure-measurement-part-two_procs

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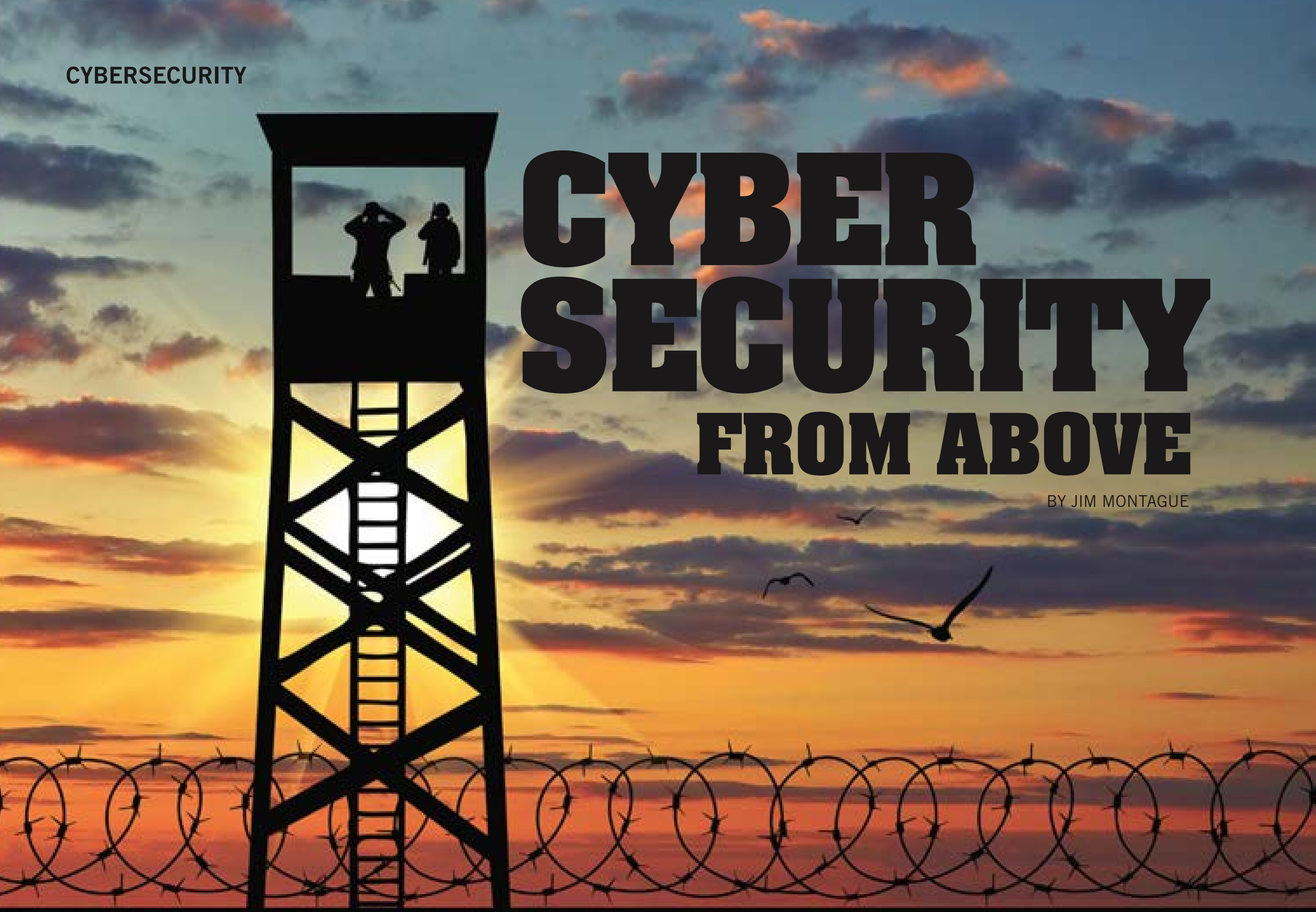
If you know of any tools and resources we didn't include, send them to ControlMagazine@Putman.net with "Resource" in the subject line, and we'll add them to the website.



CYBER SECURITY FROM ABOVE

BY JIM MONTAGUE

Secure operations demand basic protective measures, plus vigilance that faces both inside and out

IT'S true that cyber-probes, -intrusions and -attacks are always evolving, with new threats emerging all the time. However, it's also true that the most effective protections and responses have remained remarkably consistent over the years. Passwords and authentications, segmenting networks with firewalls, and regularly examining data and communications traffic for anomalies already shield many process applications against breaches and damage, but these best practices can also lead to new protections and effective responses to new threats.

Upgrade to open security

Because of traditional barrier concepts and locked-down mindsets, "open" isn't a word that usually goes with cybersecurity. This is where the physical world and its walls and locks fall short of covering the virtual world of software, networking and information technology that increasingly need openness to implement and maintain effective cybersecurity.

For instance, when the East Cherry Creek Valley Water and Sanitation District (www.ECCV.org) needed to upgrade its potable water treatment facilities and pump stations from their increasingly obsolete PLCs, its managers saw an opportunity to improve their cybersecurity, too. Located in Aurora, Colo., ECCV serves about 60,000 resident on the outskirts of Denver.

"Like most public utilities, we must adapt to an ever-changing world and that includes cybersecurity," says Shay Geisler, I&C administrator at ECCV. "We've always had robust physical security, and required usernames and passwords for access to critical systems and controls, but we're seeing the world around us changing quickly."

Besides its old PLCs, ECCV used desktops and a dedicated Windows Server OS running its SCADA software with an OPC Server driver, which communicated with the PLCs via legacy Bristol standard asynchronous protocol (BSAP) and some Ethernet IP devices. Data concentrators above the PLC network manage data communications and aggregation over a serial radio network linking about 80 sites, running a mix of RTUs and PLCs handling about 9,000 I/O points. The radios worked like firewalls, separating the SCADA network from PLCs in the field, even though their signals weren't encrypted.

"We knew security couldn't be limited to only the SCADA software. There were too many downstream systems and assets that would be hugely vulnerable if left untouched," explains Geisler.

"We determined most of these vulnerabilities could be solved by addressing PLC and SCADA communications."

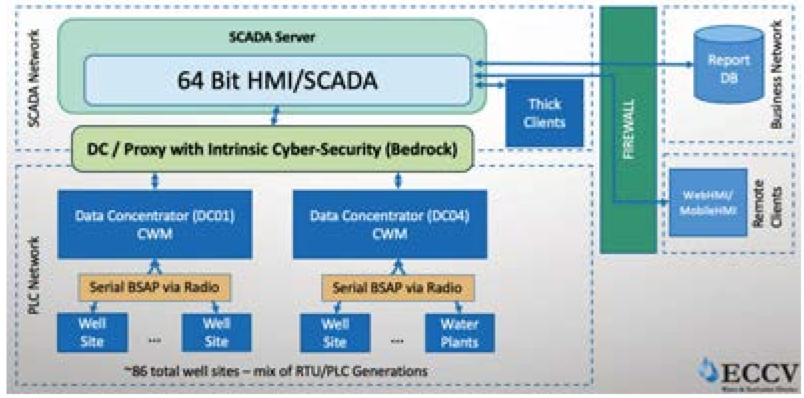
Geisler and his team determined that achieving enough security required upgrading the PLCs, RTUs and radios. They worked with supplier Process Control Dynamics (pcdsales.com) and system consultant RSI Co. (rsicompany.com), and selected Bedrock Automation's (www.bedrockautomation.com) Open Secure Automation (OSA) units to provide PLC/RTU capabilities and serve as proxy servers because of their intrinsic security and ability to work with an Ethernet-based radio for data encryption (Figure 1).

"We're slowly upgrading the remote sites that were serviced by legacy data concentrators, and converting each to use the secure Bedrock controller," says Russ Ropken, VP and automation specialist at RSI, which developed the new architecture and its seamless transition at ECCV. "The new controllers at the remote sites bypass the legacy concentrators, and now report directly to the Bedrock proxy. Once all sites are converted, we'll remove the legacy concentrators."

Because the OSA Remote units support BSAP, ECCV could communicate with its remaining legacy devices, while transitioning to new controls and avoiding service interruptions. With the Bedrock units installed, ECCV's operators employed SCADA features that extended a root of trust from the PLCs to the HMI/SCADA system, which limits communications with the PLCs and other controllers to only securely certificated programs and users. This enables the utility to easily execute standard IT certificate practices, such as time limitation and revocation to individual users or groups. The result is secure, certificated communications from the SCADA software down to the remote PLCs and RTUs.

Overcoming (human) inertia

Beyond using passwords and authentication, segmenting networks, and monitoring communications and data traffic, the most crucial cybersecurity task is motivating and training staff to follow good cybersecurity practices—even though it remains difficult to accomplish.



POTABLE PROTECTION

Figure 1: East Cherry Creek Valley Water and Sanitation District in Colorado is upgrading the PLCs, RTUs, radios and SCADA system for more than 80 well sites, pump stations and other equipment with about 9,000 I/O points in its potable water treatment system with Open Secure Automation (OSA) units from Bedrock Automation. These provide PLC/RTU capabilities, and serve as proxy servers because of their intrinsic security and ability to work with an encrypted, Ethernet-based, peer-to-peer radio network. The new OSA controllers at 12 remote sites bypass the legacy concentrators, and report field data directly to the Bedrock proxy, but the concentrators will be removed once the remaining 74 sites are converted. Source: ECCV and Bedrock

"Everyone is told about cybersecurity, and it's gaining traction, but many individuals still aren't complying with good practices," says Bruce Billedeaux, senior consultant at system integrator Maverick Technologies (www.mavtechglobal.com), a Rockwell Automation company.

Robert Henderson, principal engineer at Maverick, adds, "Anyone can pay attention to cybersecurity and some know what they should do, but there are many facilities and networks that are 30-40 years old, and many users don't know how to approach cybersecurity for those processes. Plus, they usually have very few staff to do cybersecurity, especially because more people are working remotely. This is creating more network connections and more vulnerabilities, but most users don't address cybersecurity until their board says to do it or there's an incident in the news."

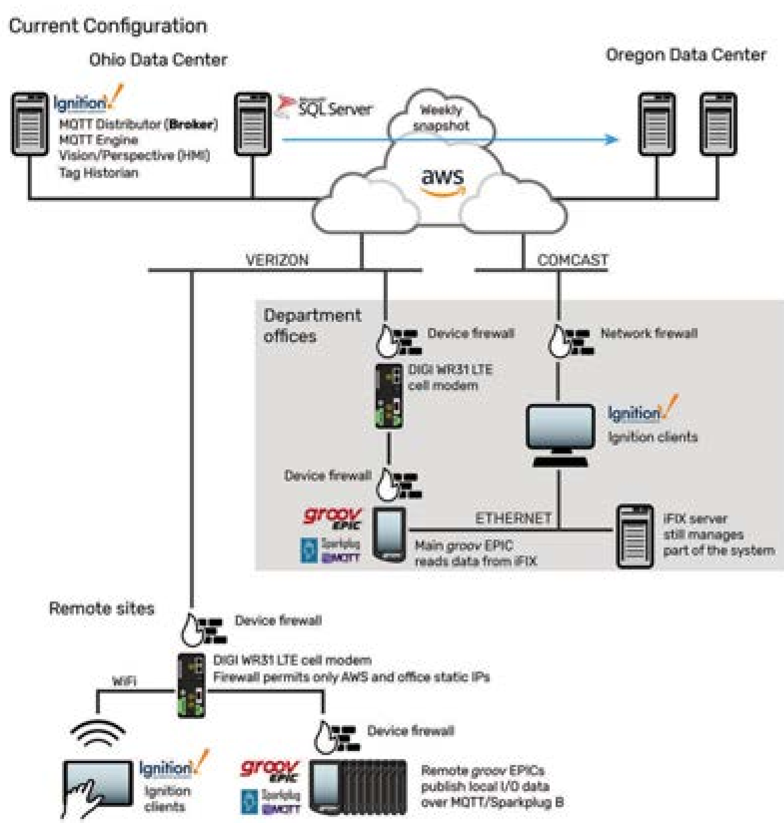
Henderson reports the basic cybersecurity list is the same for everyone. "Inventory and document assets and networks, basically anything with an Internet protocol (IP) address. Build and test backups, which is where rookie efforts usually start," he says. "However, if earlier cybersecurity efforts were done and thought to be safe, they probably aren't by now. For example, users may think they're protected by air gaps, which are defeated when they use USB sticks for patches or software updates to equipment, or antivirus scanners that identified IT-related changes before but may not find them now. This is how an outside audit can show users they're often not doing what they think they're doing."

Billedeaux reports these problems multiplied during the COVID-19 pandemic, when many cybersecurity requirements were relaxed and more access points were added because more staff needed to work remotely. "Now, these points need to be properly implemented and secured, or closed off again," says Billedeaux. "However, many continue to be left open and aren't auto-scanned."

Henderson adds the remedy to these cybersecurity issues is paying attention and giving cybersecurity the same consideration as other plant-floor tasks. "We need to think about cybersecurity differently and approach it with the same methodology and mindset we've used for 70 years to deliver power, water, compressed air or other services on the plant floor," explains Henderson. "When an engineer is asked to add a 5-hp motor that needs 480 V power, do they just splice it in wherever? No. They wouldn't consider adding it without creating engineering drawings, identifying the bucket it will be in, checking the load on the motor control center (MCC), adding a starter or disconnect, labeling wires, and following their change management procedure. When we put in a new Ethernet switch, its bandwidth and place in the network must be verified, and engineering drawings are needed for labeling wires. The same steps must be followed for cybersecurity, but they usually aren't because networking is a newer discipline."

To give users the best chance of running securely with the fewest difficulties, Henderson adds they should learn and develop their networks based on several major standards and common, non-prescriptive directives, including:

- Converged Plantwide Ethernet (CPwE) Design and Implementation Guide (https://literature.rockwellautomation.com/idc/groups/literature/documents/td/enet-td001_-en-p.pdf) by Rockwell Automation and Cisco, which includes an overview, solutions, network designs, manufacturing and demilitarized zones (DMZ), implementation and configuration, testing, motion and synchronization and other issues.
- The National Institute of Standards and Technology's (NIST) Guide to Industrial Control Systems (ICS) Security (https://csrc.nist.gov/publications/detail/sp/800-82/rev-2/final) is part of its special publication (SP) 800 series. It provides "guidance on how to secure ICSs, including supervisory control and data acquisition (SCADA) systems, distributed control systems (DCS) and other control system configurations, such as programmable logic controllers (PLC), while addressing their unique performance, reliability, and safety requirements."
- ISA/IEC 62443 standards (https://gca.isa.org/blog/download-the-new-guide-to-the-isa/iec-62443-cybersecurity-standards), developed by the ISA99 committee and adopted by the International Electrotechnical Commission (www.iec.ch/blog/understanding-iec-62443), provide a framework for



Waterford DPW's modernized communication infrastructure

SIMPLICITY = SECURITY

Figure 2: Michigan-based Waterford Township's Dept. of Public Works is upgrading its water/wastewater controls and SCADA system for 63 sewer lift station and 11 drinking water plants with MQTT publish-subscribe protocol running on Opto 22's groov EPIC controllers. MQTT sends data on a change-of-state basis, which uses less bandwidth, achieves sub-second latency, and provides more useful information more quickly. The utility adopted a cloud-based AWS server, and is securing it and the new SCADA system with passwords, firewalls with whitelisted IP addresses, security certificates, TLS data encryption, and multi-location server backup. Source: Waterford Township and Opto 22

addressing security vulnerabilities in industrial automation and control systems (IACS). For example, ISA/IEC 62443-3-2 standardizes how to conduct ICS cybersecurity risk assessments.

Simplify with publish-subscribe

Similar to training and retraining staff, one of the latest and best ways to instill protections is to make them simple, so users will be more likely to get in the habit of using them, maintain them over the long-term, and seek updates when available. Until recently, many cybersecurity solutions were bolted onto existing processes, which was often technically complex due to old, dedicated and rigid network infrastructures. This made them less likely to be adopted and maintained. Fortunately, using publish-subscribe protocols like MQTT and others not only simplifies networking, it can also streamline cybersecurity.

For example, Waterford Township's Dept. of Public Works (DPW, www.waterfordmi.gov/199/Public-Works) began upgrading its 1990s-era SCADA system, field controllers, radios and other components in 2017, but decided to reevaluate its entire control strategy. Located in the center of Oakland County, Mich., the township has 34 lakes, and DPW serves more than 73,000 residents by operating 360 miles of water mains, 355 miles of sanitary sewers, nine production wells, three storage tanks, 11 treatment plants and 63 sewer lift stations.

"Polling times weren't great, and it was taking three or four minutes to cycle the whole township," says Frank Fisher, engineering superintendent at DPW. "We'd already modernized our field controls and update our in-office SCADA/HMI and back-end, but we evaluated a hardware upgrade in 2018, and found that MQTT protocol running on a groov EPIC controller from Opto 22 (www.opto22.com) would allow faster data transfers with no central polling required, instead providing data on change. So, we added groov EPICs to a pilot project in 2019, consisting of three of our sewer lift stations with help from system integrator Perceptive Controls (www.perceptivecontrols.com) in Plainwell, Mich. We just added the last of our 63 stations two months ago, and upgraded six of our 11 drinking water treatment plants. Three more are converting now, and we'll finish them and the rest by 2022."

Instead of polling every two or three minutes, even when nothing is happening, Fisher reports MQTT monitors the water/wastewater system's overall heartbeat every few seconds, but only sends data when process values change. This gets more useful data across at sub-second latency and reduced bandwidth, so alerts and alarms aren't missed, and diagnostics are improved. DPW also adopted an Amazon Web Services (AWS) server. This cloud-computing service hosts Ignition software from Inductive Automation (www.inductiveautomation.com) as the utility's MQTT broker and SCADA.

To protect DPW's new cloud-based SCADA system and its additional, potentially vulnerable connections, Fisher reports that DPW limits electronic access to its lift stations and other

CYBERSECURITY STAPLES

The basic steps in a successful cybersecurity program are often well-known and should be increasingly obvious, but frequent reminders make certain that essential tasks are performed, and that as many gaps as possible are closed, particularly as existing threats and potential attacks evolve and new ones emerge.

- Investigate, audit, risk assess and relearn process applications, equipment, settings and facilities, and identify security vulnerabilities.
- Secure management and staff buy-in for cybersecurity program, and recruit system integrators, suppliers, clients and other partners to develop risk scenarios, responses and a united cybersecurity front.
- Comply with common cybersecurity recommendations, such as the ISA/IEC 62443 series of standards and the National Institute of Standards and Technology's (NIST) Guide to Industrial Control Systems Security.
- Replace default passwords and replace existing passwords every two or three months with longer versions (12-16 characters) that are harder to solve. Don't allow shared passwords, demand a unique authentication for each user, and employ two-factor authentication.
- Limit internal and offsite access to authorized users only based on the data, processes and network areas that staff, contractors and suppliers need to complete their tasks. Don't allow guest accounts, which often use default passwords, and limit login attempts.
- Isolate production devices, operating processes and functionally defined sub-networks with Ethernet gateways employed as firewalls from higher-level, IT-based and enterprise networks. Configure firewalls with access-control lists that define rules for who is allowed access and what information they can release.
- Implement read-only functions in components, so equipment and processes can only deliver outgoing information, and prevent any inward bound requests or orders. MQTT or AMQP publish-subscribe protocols or data diode devices can perform these tasks;
- Install, maintain and refresh patching procedures from software vendors and other organizations, even if some isolation time is required before implementing them;
- Instruct in-house personnel and external contractors, clients and other partners how to practice good cybersecurity hygiene and follow common cybersecurity procedures. Foster an overall cybersecurity culture by also developing relationships and a common language between OT and IT personnel.
- Set up routine network traffic examinations using a cloud-level service or similar IT-style software, which can find, stop and mitigate cyber-probes and attacks.
- Routinely reevaluate and revise existing cybersecurity procedures to address new vulnerabilities and counter evolving cyber-threats.

equipment. These layers of protection include login passwords for its virtual server and controllers, and continues with firewalls on the AWS side, as well as cellular modems with predefined IP addresses for which communications are permitted (Figure 2).

"We also use security certificates to encrypt data before sending it, so even if traffic is intercepted, it can't be read," explains Fisher. "Previously, our radios transmitted data openly, but not much cybersecurity was required because we had lockouts on the buildings, and we still have them. They only talked to our onsite server and only certain PCs could access them."

Each groov EPIC also uses a certificate authority (CA)-signed transport layer security (TLS) certificate to establish a secure broker connection. Also, with MQTT's device-originating connections, groov EPIC's device firewall in each lift station can be closed to outside connections. Based on this foundation, Fisher reports DPW made other infrastructure changes to enable management, security and resilience. For instance, its Ignition SCADA/MQTT server is hosted in a data center in Ohio, but if any issues arise, in 30 minutes, Fisher or his colleagues can have their entire system up and running on a snapshot of the same server hosted by a data center in Oregon. In the future, DPW will likely set up full server redundancy that also avoids potential single-point-of-failure problems.

"Cybersecurity begins with each user researching and deciding internally what they need," adds Fisher. "Plus, as we use the Industrial Internet of Things (IIoT) to communicate with edge devices we haven't talked to before, such as sensors and flowmeters, cybersecurity will be even more important. MQTT opens all of this, but it's also like a web browser, so users have to turn on its security functions, such as requiring security certificates and encryption. This is similar to turning hypertext transfer protocol (HTTP) into hypertext transfer protocol secure (HTTPS)."

Software enables security

To gain its secure control capabilities back in Colorado, ECCV needed to upgrade its existing 32-bit SCADA software to 64 bits, which addressed some security issues, but it wasn't enough. "We still saw possible security holes downstream from the SCADA system, and we wanted to address them," says Geisler.

Geisler and his team decided the most secure, cost-effective approach would be connecting the SCADA and control networks with a secure communications channel. Instead of a costly and disruptive rip-and-replace, they settled on a phased-in approach with Bedrock's OSA Remote control units in the role of proxy server between the data concentrators and the SCADA server. “A cyber-secure data concentrator functions as a proxy server that secures communications from the SCADA software and the PLC network," explains Geisler. "Downstream, the data concentrator speaks BSAP or Modbus to the existing field unit, as well as some Ethernet/IP for smart devices.”

The upgrade's next phase was to secure a direct connection between the SCADA software and the well sites, pump stations and water treatment facilities with PLCs and controllers with intrinsic cybersecurity, along with new Ethernet radios. Covering so many I/O points required using the OSA platform, which scales infinitely by adding five, 10 and 20 I/O control module racks, depending on the I/O at each site. In addition, the 64-bit SCADA software connects directly and securely to a peer-to-peer network of scalable OSA controls connected to the encrypted radio network.

The intention was to complete the final architecture in five years, but COVID-19-related delays may extend this schedule. As it continues to build the system out, ECCV can keep the OSA Remote concentrator/proxy nodes in place or remove them because the system will remain secure to the field-level PLC/RTU devices due to its secure Bedrock controllers.

The result of implementing Bedrock's OSA platform was secure, certificated communications from the SCADA software down to the utility's remote PLCs and RTUs. The OSA Remote proxy units are switching over to a peer-to-peer network of scalable, secure Bedrock control units connected by an encrypted radio network. ECCV is presently running field data through 12 of its target sites, with about 74 left to be added.

“With this open architecture and technology, we can continually improve and upgrade, so we don’t have to face this type of wholesale transition again,” says Geisler, who adds that ECCV expects to get more than 30 years of useful life from its new PLC/RTU systems. ∞

Flexibility redefining I/O expectations

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WAGO USA

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FROM the perspective of speed and responsiveness of automation, the process industry's packaging, paper, plastics and textile manufacturing applications are among its most challenging. Conveyors, continuous sheets and webs are moving faster than ever, even as the volume of real-time data needed to feed industry's digital transformation ambitions continues to mount. So, how can a maker of the industrial networks and input/output (I/O) systems that make all this happen continue to keep pace with the mounting demands of end users and machine builders? To find out, *Control* caught up with Charlie Norz, product manager for I/O systems at WAGO USA.

Q: Over the past several years, more and more machine I/O has been migrating out of the protection of control enclosures and onto the machine itself, closer to the action and the tough conditions that often entails. What technologies and product features have made this migration possible and what are the benefits to be gained?

A: The migration of I/O from the control panel to the machine is made possible by networking technologies that reduce the cost of distributed I/O while increasing system performance. The proliferation of high-performance yet relatively economical Ethernet-based distributed I/O is one factor. These devices offer the low latency required for more and more applications. We've also seen IO-Link protocol becoming more accepted for connecting with sensors, actuators and other industrial components. IO-Link delivers high performance with the bonus of device health data that can be used to increase productivity. In this age of digitalization, end users are implementing strategies to take advantage of device data to help increase production rates, while reducing downtime and, of course, increasing quality.

Q: WAGO's I/O System Field also features Bluetooth connectivity, which I believe is a first among I/O modules. What new possibilities does Bluetooth bring to the party?

A: Everybody's used to using mobile applications in their daily lives, and with remote devices like sensors and actuators becoming smarter all the time and using technologies like IO-Link, an instrument now provides a wealth of information in real-time about what it's measuring as well as about itself. This also means these devices are becoming more complex, often requiring configuration during commissioning.

So, we've added Bluetooth to our IP67-rated distributed devices, so technicians and engineers can stand in line of sight of the I/O block and the sensor, while using their cell phone or tablet to configure the device or monitor the data in real-time. This is much more convenient than trying to commission a device over a wired network from an engineering station a few rooms away. And we see that using a mobile app to configure or monitor real-time data helps speed commissioning and troubleshooting.

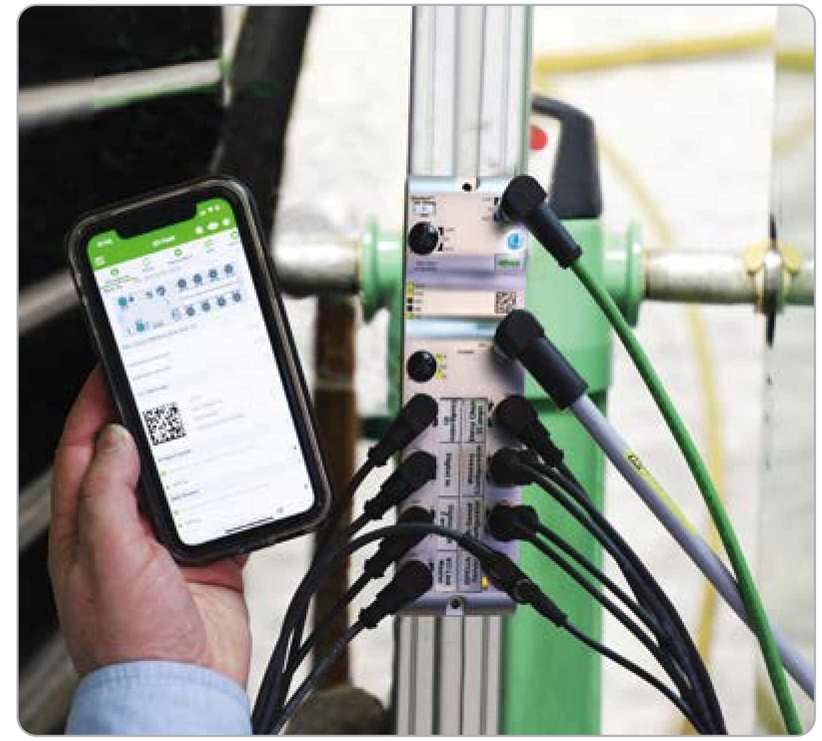
Q: One key aspect of I/O system flexibility is in the variety of options available for connecting to field devices and supervisory systems. Besides IO-Link, are there any significant usage trends among the device connectivity options preferred by users and machine builders?

A: It's no surprise that traditional industrial Ethernet protocols like EtherNet/IP and Profinet are most used for distributed I/O. However, we're seeing more users moving to OPC UA and MQTT over Ethernet for SCADA and even cloud-based applications. These two protocols offer benefits for IoT applications and are becoming the de facto standard for plant-floor-to-enterprise connectivity. We see users still deploying traditional fieldbus protocols, but they're also converging with that IT layer, and using technologies like OPC UA and MQTT.

Ethernet is also flexible and can run more than one protocol at the same time over the same wire. So, PLCs and HMIs can tap real-time information for their basic control functions via Ethernet-based fieldbuses, even as higher-level, top-side systems can exchange data via OPC UA at the same time. In this way, data can be routed at the same time to multiple systems, and the systems can each use the protocols they prefer.

Q: With a decided move toward converged IT/OT architectures that feature Ethernet-based protocols—including IP-addressable I/O modules and the risks that can represent—how do you go about ensuring that those devices remain secure from cyber-threats?

A: Network security is paramount today for plant-floor devices. We recommend that our customers use defense-in-depth methods to help prevent cyber-attacks. A good start is to zone the plant floor with different network segments to isolate systems. A second way to manage risks is by reducing physical and network access to your network devices. For example, using WAGO's lean managed switches in lieu of unmanaged switches enables users to turn off unused ports to help reduce unwanted access to a network. Lean managed switches can also enable users to set up rules that allow only approved devices to be used in the network. And in those cases, when it's just not possible to secure your network cabling or infrastructure, we recommend encrypting plant-floor data using a technology like MACsec security.



WAGO's System Field distributed I/O modules are sealed to IP67 standards (waterproof when immersed for up to 30 minutes at a depth of one meter) and feature Bluetooth connectivity for local configuration, commissioning and troubleshooting.

Q: Talk of MQTT and cloud connectivity for an I/O module certainly makes sense from the perspective of emerging Industrial IoT applications, but how do you make sure those secondary communications don't bog down the primary business of real-time execution of control tasks?

A: With digitalization of the plant floor in full swing, it might seem that sending all that real-time data to the cloud would be necessary and desirable. However, many users find that sending all that plant-floor data to the cloud is unproductive—plus, it's really expensive. So, we're now seeing architectures designed with edge-of-network devices like WAGO's Edge Controllers and Edge Computers that are on-premise to contextualize and summarize data before sending it to the cloud.

These edge devices are running analytics locally to reduce latency, as well as reducing data storage costs. The amount of data transmitted and stored is greatly reduced. And the information that's sent to the cloud is enriched, so that those top-side applications still perform at a high level. ∞

BY JIM MONTAGUE

Compressing gases, decompressing operators

HIP-PetroHemija automates turbomachinery on its ethylene unit with controls from Schneider Electric

OPERATORS with the longtime competence and dedication necessary to manually manage complex industrial processes are priceless. But just because they've coped in the past doesn't mean they can't benefit from some assistance, automation and well-deserved peace of mind.

This was the case with the staff running the turbomachinery on the ethylene unit at Serbia-based HIP-PetroHemija (www.hip-petrohemija.com). With an annual production capacity of more than 600,000 tonnes, the company is Serbia's largest producer of petrochemicals, polymers and synthetic rubber, has 40 years of production expertise, employs more than 1,400 staffers, and is one of its nation's largest exporters, contributing 1-3% of its total exports.

However, despite their historical achievements and ongoing successes, operators, engineers and managers running PetroHemija's ethylene unit dealt mainly with equipment that was installed in the 1970s and was manually controlled. Turbine speed was driven by mechanical governors; actuators were positioned by pressure-controlled pilots and worn linkages; and operators had to deal with obsolete, manual controllers, most of which had difficulty or no way to interface with the distributed control system (DCS). There was some limited vibration data, but it was on an isolated system, and not easy to access. These issues caused the ethylene unit to experience instability, high energy consumption, and high risk of unplanned trips or shutdowns.

MIGRATE FROM MANUAL INSTABILITY

Figure 1: With annual capacity of more than 600,000 tonnes, HIP-PetroHemija is Serbia's largest producer of petrochemicals, polymers and synthetic rubber, but its ethylene unit needed to upgrade from 1970s-era, manually controlled equipment that was causing instability, high energy consumption, and high risk of unplanned trips or shutdowns. These devices included a crack gas compressor with four stages and two recycle valves driven by one extraction steam turbine; propylene refrigeration compressor with two stages and two recycle valves also driven by one extraction steam turbine; and an ethylene refrigeration compressor with three stages and two recycle valves driven by one steam valve turbine. Source: HIP-PetroHemija and Schneider Electric

"We started this project in 2019 with the main goals of improving stability of process control and enhancing surge protection, and all of this was achieved," says Aleksander Subotin, ethylene plant assistant director for production at PetroHemija. "Process parameters with upgrades from Schneider Electric (www.se.com) were very stable, process disturbances are in the expected range, and there was no problem with operating our compressors at maximum capacity. It's working as it should work."

Greg Hanson, senior consultant with Schneider Electric's Process Automation business, adds, "The amazing part is, even with all the production unit's former obstacles, the team at PetroHemija did an incredible job of keeping it operating day after day. We were excited to have the opportunity to upgrade this unit earlier this year, and give the extraordinary team at PetroHemija the peace of mind they needed and deserved."

Subotin, Hanson and PetroHemija's senior project manager, Bojan Janjic, presented "How have HIP-PetroHemija improved the performance of their critical assets?" at Innovation Talks: 2021 Foxboro and Triconex user groups in mid-September. *[For articles on other event presentations, visit www.controlglobal.com/articles/2021/schneider-innovation-talks-2021]*

Rundown on upgrades

Janjic reported that PetroHemija faced many challenges during its ethylene upgrade project, such as limited timeframes for installing equipment in its potentially explosive areas; achieving sufficient project team diversity; and performing remote factory acceptance test (FAT) to integrate its new systems with the plant's existing, old-fashioned hardware. "We had team members from countries on three continents, including Slovakia, Egypt, U.S., Czech Republic, Hungary,

EASIER CONTROL, OPTIMIZED PRODUCTION

Figure 2: To upgrade its ethylene unit, PetroHemija implemented Schneider Electric's Triconex triple-modular redundant (TMR) controllers with refined turbomachinery libraries and Aveva's InTouch HMI software, and integrated them with its existing Bently Nevada vibration monitoring system and DCS. Benefits gained include easier control with automated startups and shutdowns and user-friendly operator interfaces; enhanced control stability; increased plant production; optimized energy consumption; reduced chance of unplanned shutdowns; reduced operating and maintenance costs; and improved compliance with local environmental regulations. Source: HIP-PetroHemija and Schneider Electric

Poland, Croatia, Greece and Serbia," says Janjic. "Different business cultures, mindsets, social standards and time differences had to combine perfectly to guarantee successful project completion, and that's what we got."

The specific processes and equipment upgraded in PetroHemija's ethylene unit included:

- Crack gas compressor with four stages and two recycle valves driven by one extraction steam turbine;
- Propylene refrigeration compressor with two stages and two recycle valves also driven by one extraction steam turbine; and,
- Ethylene refrigeration compressor with three stages and two recycle valves driven by one steam valve turbine (Figure 1).

These processes and their devices gained new control cabinets housing Schneider Electric's Triconex triple-modular redundant (TMR) controllers, which feature decades of refined turbomachinery libraries. The unit's modernized controls were assigned to handle: standard turbine sequencing; speed controls; anti-surge detection and process surge decoupling for optimized surge prevention; extraction pressure and two-valve interactive control for the propylene refrigeration and crack gas processes; and various auxiliary controls for control oil, silicone oil and solenoid-operated check valves for all applicable machines. The unit also implemented Aveva's InTouch HMI software for its operator interfaces.

"These upgrades required a lot of patience and coordination from everyone, especially during relocation of the redundant, high-pressure (RHP) hydraulic unit, when we had to bridge a gap between design and reality," explains Janjic. "We also faced schedule slippage that threatened to jeopardize the project, so we all got together, and pooled our knowledge, experience and available resources to

> "Replacing the redundant, high-pressure (RHP) hydraulic unit was one of the biggest challenges. It was originally planned to be in the elevated compressor hall. However, tests showed it had to be at ground level, and once we learned this, we were able to get it done fast."

solve this issue. We improved the project's dynamics, picked the best execution strategy, and worked 24 hours on-site, so we could maximize our efficiency whenever possible."

Hanson adds the upgraded ethylene unit is fully integrated with its existing Bently Nevada vibration monitoring system and DCS. "New instrumentation was provided for the turbine controls, trip and throttles, valve actuators and anti-surge valves," says Hanson.

For instance, each of the three turbines was also retrofitted with added speed probes, some dedicated to the control system and others for electronic over-speed protection. In addition, there are no more mechanical over-speed bolts to deal with, and each turbine now has a Schneider Electric Quadvoter trip block to facilitate API-compliant, electronic over-speed protection. Likewise, the unit's T&T valves were retrofitted with position feedback, servos for remote throttling, and solenoid-operated valves to enable remote, partial-stroke valve testing. Also, the former governor and extraction control actuators were replaced with modern, high-pressure actuators, including an integrated servo and redundant position feedback. All of these devices were powered by the new RHP unit that had to be installed at grade-level.

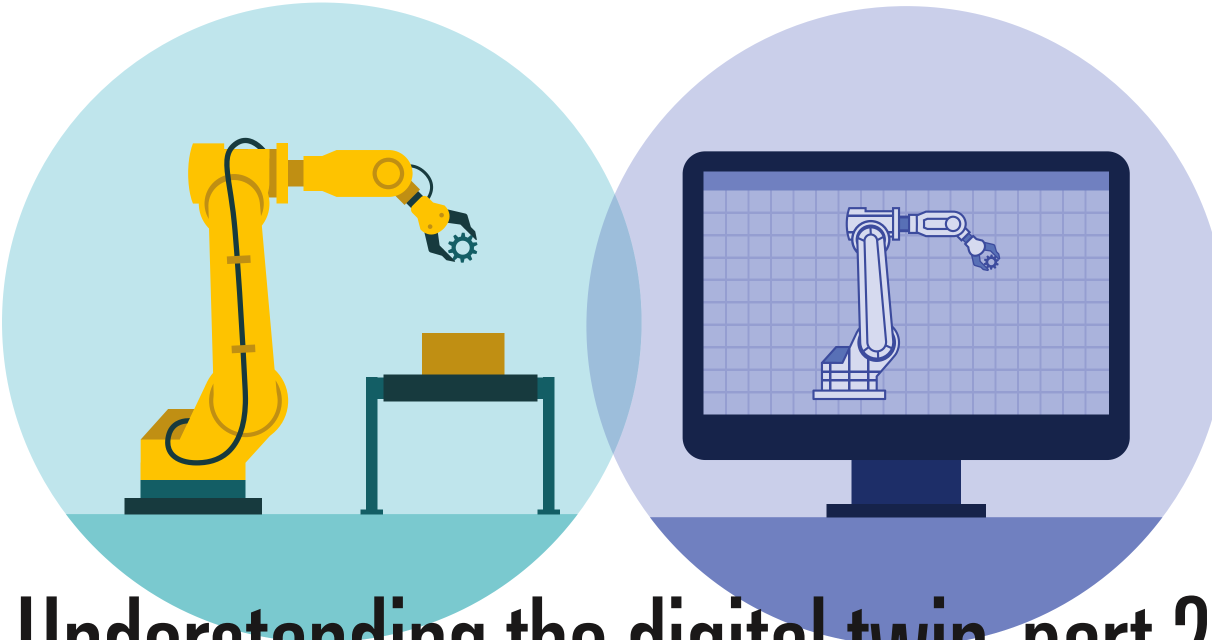
"Replacing the RHP unit was one of the biggest challenges," agrees Subotin. "It was originally planned to be in the elevated compressor hall. However, tests showed they had to be at ground level, and once we learned this, we were able to get it done fast."

Benefits gained, results achieved

Following installation and startup, Janjic and Subotin report the upgrades to the ethylene unit's machines provided a host of advantages in its control room and in the field. These include:

- Easier control with automated startups and shutdowns and user-friendly operator interfaces;
- Enhanced control stability;
- Increased plant production;
- Optimized energy consumption;
- Reduced chance of unplanned shutdowns;
- Reduced operating and maintenance costs; and
- Improved compliance with local environmental regulations (Figure 2).

"In all, this project installed about 18 kilometers of different cables, so I just want to appreciate the patience of everyone involved that allowed us to complete this project successfully, and made us proud to watch the ethylene turbines and compressors come to life in a more efficient and effective way," concludes Janjic. "The business flexibility, transparency and mutual trust were just amazing, and represent the main pillars of this achievement. Having had this experience, I believe our teams could accomplish any project, especially those involving digital transformation. Lastly, we accomplished this project with no individual injury." ∞



Understanding the digital twin, part 2

Digital twins require that relationships and coefficients be updated to reflect changing conditions

BY R. RUSSELL RHINEHART

THE digital twin begins life as a prototype model, intended to match the process, but possessing ideal attributes that need to be adapted to the actual process. First, one must adjust model coefficients and constituent relations to best match the model to actual process operation. Second, over time as the process is reconfigured or substantially altered, reflect those process changes in the model. This may also require adjustment of model coefficients. Third, as the process operates, there will be continual changes in features such as ambient heat losses, heat exchanger fouling, catalyst reactivity, friction losses in piping, raw material properties, etc. Incrementally adapt the model to match the local reality.

This is part 2 of a three-part series on the digital twin. Part 1, in the October issue, defined a digital twin as a model of the process that's frequently adapted to match data from the process. This keeps it useful for its intended purpose. Here, part 2 discusses how to adapt the model. And part 3, in the December issue, will discuss tempering adaptation in response to noise.

Do not attempt to code the entire composite model at once. Make the model modular. Construct each elementary object as its own model, coded as its own subroutine or function block. Use its output as the input for another sequential object module. Build the process digital twin as a collection of interconnected subroutines. This permits the individual models to be easily adapted with limited data, to be edited, and to be understood.

Adjust coefficients and relationships

Begin by adjusting the component models individually. There are two aspects to this adjustment step: 1) changing internal models and 2) adapting model coefficient values. The first stage is to change internal models that are not quite right. For example, the model may have been initially developed with an ideal Bernoulli square-root relationship for friction losses in a line, but data might indicate that a power law gives a better representation. A reactor may have been initially modeled as an ideal plug flow device, but data might reveal that a series of continuously stirred tanks (CST) might be a better model. A reaction may have been modeled with an ideal homogeneous model, but process data might suggest that a mass transfer limited kinetic model is better. Change the modeled functionalities to match the process behavior.

The second stage is to adjust model coefficient values to make the model best fit the data. Many model coefficient values have high uncertainty (friction factors, reactivity, yield, ambient losses) which also change in time as the process is used. Here, classic least squares minimization of the model-to-process data difference (the residual) is justified. This would probably be a nonlinear optimization [1]; and although it could be automated, often human intuition and choices regarding which model coefficients should be changed, and which sections of the data are most important, might make human-guided model adjustment more appropriate than sophisticated algorithms.

Normal historical operating data might have enough information to permit such adjustment, but historian data will probably not have the richness required, and some purposeful input changes may be needed to get the required data. Further, old historical data could very well represent equipment and procedures that are no longer in practice. Such data should not be used to create a twin of current practice, so be prepared to not respect the treasured historian database.

Over time, the process will be reconfigured or substantially altered. Piping paths will be rerouted. Old units will be replaced with not-quite identical ones. Five units operating in parallel will be reduced to four when one is taken offline for upgrading. Reflect those changes in the model. This may also require re-adjustment of model coefficients.

Incrementally update the model

The prior model adaptations can be considered as one-time changes in response to a batch of data. However, as the process operates, there will be continual changes in ambient heat losses, heat exchanger fouling, catalyst reactivity, friction losses in piping, raw material properties, distillation tray efficiency, etc. Use process data to incrementally adapt the model to match the local reality

The processes might be classified as either continuous or batch. However, as they operate in time, attributes change in time, and values for those attributes are needed for analysis or control.

In such cases, the coefficient of interest changes in time. If one were to collect all historical data for regression, earlier data would express one value of the time-changing coefficient, and recent data will express a different value. Rather than adjusting a model on old data, and reflect an outdated property value, models are often incrementally adjusted to match the most recent data.

Process features or attributes that change with time, require the model coefficient values to change in time. Such models are termed non-stationary. Process owners observe that the model coefficient values that reflect such factors to inferentially monitor process condition, performance or health, and use that information to trigger events, schedule maintenance, predict operating constraints, and bottleneck capacity, etc.

The choice of which model coefficient is to be adjusted should be compatible with the following five principles:

1. The model coefficient must represent a process feature of uncertain value. (If the value could be known or otherwise calculated, incremental adjustment wouldn't be needed.)
2. The process feature must change in time. (If it didn't change in time, adaptation would be unnecessary.)
3. The model coefficient value must have a significant impact on the modeled input-output relation. (If it has an inconsequential impact, there's no justification to adjust it.)
4. The model coefficient should have a steady-state impact if data are to come from steady-state periods. (If it doesn't, if for instance the coefficient is a time-constant, then when the process is at, or nearly at, a steady-state, the model coefficient value will be irrationally adjusted in response to process noise. Since continuous processes mostly operate at steady conditions, this is important.)
5. Each coefficient to be adjusted needs an independent response variable.

If one or more of the five principles aren't true, there's no sense in adapting that model coefficient online.

There are many ways to update model coefficient values, to adapt models in real-time, which have led to a variety of adaptive control methods. If you're lucky, you'll be able to rearrange the model equation and explicitly calculate the model coefficient value from data. However, you might not be able to do that for any of many reasons, one being that the model is calculated from a procedure hidden in a function. What follows is a summary from a simple and effective approach to incremental adjustment of a phenomenological model [1].

The desire is to adjust a model coefficient representing steady-state response, so the process-to-model mismatch (*pmm*) approaches zero in a first-order manner when the process is near steady conditions. The mathematical statement of that desire is:

$$\tau_{pmm}\frac{dpmm_{ss}}{dt} + pmm_{ss} = 0 \qquad (1)$$

Where:

$$pmm = y - \tilde{y} \qquad (2)$$

Representing the steady state process as:

$$\tilde{y}_{ss} = g\,(u,d,p) \qquad (3)$$

in which $\tilde{y}$ is the modeled response and $\tilde{y}_{ss}$ is the steady-state modeled response, u is the modeled controller influence on the process, d represents measureable disturbances, and p represents the coefficient that will be incrementally adjusted.

As indicated, equation (3) might be an explicit equation. More likely, it will be calculated as a procedure (function or subroutine) and the result will be a numerical value for $\tilde{y}_{ss}$.

If p, the coefficient value changes, then $\tilde{y}_{ss}$ will change. If near to a steady-state condition, the y, d and u values are not changing. Then, using the calculus chain rule on Equation (3), the change in $\tilde{y}_{ss}$ with respect to time is:

$$\frac{d\,\tilde{y}_{ss}}{dt} = \frac{\partial g}{\partial p}\frac{dp}{dt} \qquad (4)$$

Substituting Equation (4) into (1) and rearranging:

$$\frac{\partial g}{\partial p}\frac{dp}{dt} = \frac{pmm}{\tau_{pmm}} \qquad (5)$$

Rearranging for incremental model coefficient adjustment using a simple numerical solution (Euler's explicit finite difference):

$$P_{new} = P_{prior} + \left[\frac{\Delta t}{\tau_{pmm}}\right] \frac{pmm}{\partial g/\partial p} \qquad (6)$$

Equation (6) is a Newton's method of incremental, recursive coefficient updating (root finding), with the bracketed term as a tempering factor. The user's choice of the value of τ_{pmm} prevents excessive changes in the model coefficient value and tempers measurement noise effects. The sampling interval, Δt, has the same time units as the time-constant, and provides a normalizing factor for the frequency that the model is updated.

In computer assignment statements, the subscripts *new* and *prior* are unnecessary because the past values are used to assign the new value.

The value of τ_{pmm} should be large compared to model dynamics (so that model adjustment doesn't interact with control calculations), but small compared to the time period over which the process attribute changes (for rapid tracking of the process).

Don't let the derivative representation be off-putting. It just means sensitivity. And it doesn't require calculus. It can be easily evaluated numerically. The term [$\partial g/\partial p$] means the sensitivity of the modeled steady state response, $\tilde{y}_{ss}$, to the value of the adjustable coefficient, p. You could calculate the sensitivity numerically as:

$$\frac{\tilde{y}_{ss}(p + \Delta p) - \tilde{y}_{ss}(p)}{\Delta p}$$

This can be calculated from equations, if you have them, or from using the subroutine procedure to calculate the $\tilde{y}_{ss}$ values for two p-values.

Example calculations

As a relatively simple process example, consider the overall heat transfer coefficient on an ideal counterflow heat exchanger using first-principles, constitutive models. The steady state design equation is [2]:

$$\dot{Q} = UA\Delta T_{lm} = F_c \rho_c Cp_c \Delta T_c = F_h \rho_h Cp_h \Delta T_h \qquad (7)$$

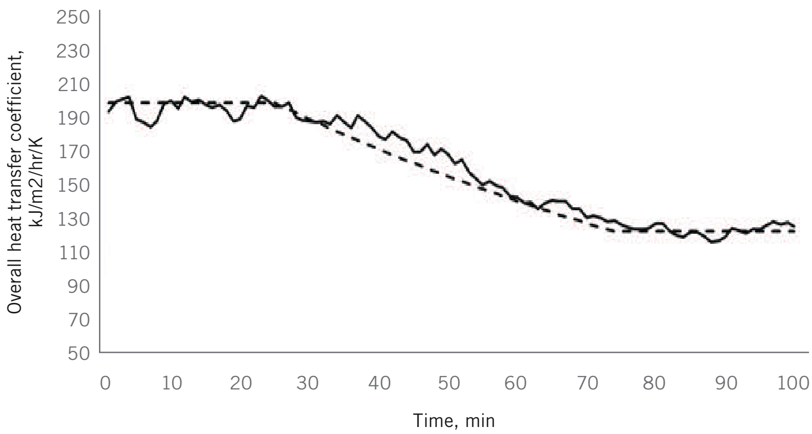
$$\Delta T_{lm} = \frac{(T_{h,in} - T_{c,out}) - (T_{h,out} - T_{C,in})}{ln\left(\dfrac{T_{h,in} - T_{c,out}}{T_{h,out} - T_{C,in}}\right)} \qquad (8)$$

Here, $\dot{Q}$ is the rate of heat exchanged, $UA\Delta T_{lm}$ is the model for heat transfer, U is the overall heat transfer coefficient (which will change in time with fouling), A is the heat transfer area, and ΔT_{lm} is termed delta-T-log-mean, representing the characteristic temperature driving force for heat transfer. The heat transferred is the same as the heat picked up by the cold fluid, $F_c \rho_c Cp_c \Delta T_c$ with $\Delta T_c = (T_{c,out} - T_{c,in})$ and that lost by the hot fluid, $F_h \rho_h Cp_h \Delta T_h$ with $\Delta T_h = (T_{h,in} - T_{h,out})$.

Given inputs to the heat exchanger and heat exchanger properties, U and A, the model can be used to calculate the two outcomes $T_{c,out}$ and $T_{h,out}$. I haven't figured how to get an explicit arrangement, so I use a trial-and-error procedure: Guess at the value of $T_{c,out}$, use the relation $F_c \rho_c Cp_c \Delta T_c = F_h \rho_h Cp_h \Delta T_h$ to solve for an associated value for $T_{h,out}$, then search for a $T_{c,out}$ value that makes $UA\Delta T_{lm} = F_c \rho_c Cp_c \Delta T_c$. Although represented by the single Equation (3), calculating $T_{c,out}$ from the inputs is a procedure, not a single line equation.

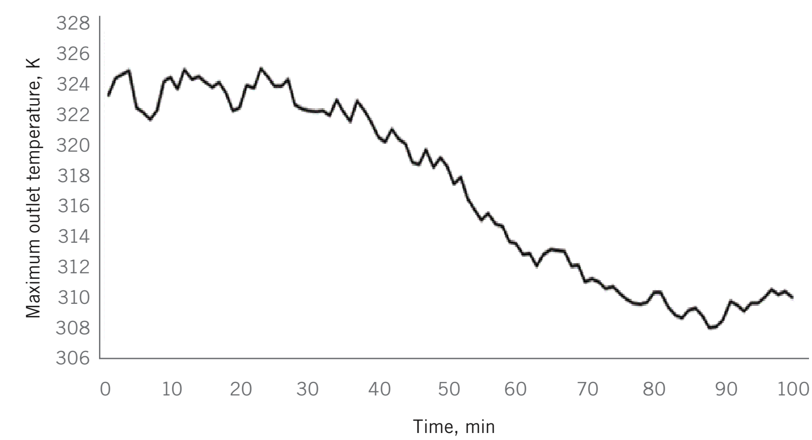
The overall heat transfer coefficient will change in time with fouling. In Equation (7), the variable p represents U in the example, and $\tilde{y}_{ss}$ represents T_c, out. The required sensitivity in Equation (7), is the sensitivity of $T_{c,out}$ to U and will be calculated numerically by comparing the calculated value of $T_{c,out}$ with two U-values $[T_{c,out}(U + \Delta U) - T_{c,out}(U)]/\Delta U$.

Figure 1 indicates how the incremental updating of the Twin coefficient tracks the process value. In a simulation, we can



U ACTUAL AND INCREMENTALLY UPDATED

Figure 1: Illustration of using process data to incrementally update a model coefficient.



CONSTRAINED $T_{C,OUT}$

Figure 2: Illustration of predicting constrained operating ability.

know the true value of *U*, which is represented by the dashed line that starts at a value of about 200, then ramps down to a value of about 130. During this simulation, inlet flow rates and temperatures are continually changing, and there's also noise on all measured values. The solid line in the figure represents the Equation (6) procedure to incrementally update the model *U*, with a τ_{pmm} = 3 minutes. It tracks the actual very well. The variation in the estimated value of U is due to the measurement noise on the flow rates and also on the temperatures.

One benefit of this procedure is monitoring critical process attributes, such as a heat transfer coefficient, possibly to be able to schedule maintenance.

Another benefit is to be able to forecast constrained operations, which is illustrated in Figure 2, for the same period simulated in Figure 1. In Figure 2, the twin is asked, "What's the possible outlet temperature for the fluid being heated given the maximum heating conditions and a target process fluid flow rate?" With the clean heat exchanger, this estimate fluctuates at about 324K, but as fouling happens, the maximum achievable temperature drops to about 308K. Alternately, the twin could be asked, "What's the maximum process flow rate for which the heat exchanger could maintain a setpoint temperature?" This forecast of constrained conditions would be useful for supervisory optimization and planning.

To keep a model true to the process, to create a digital twin, start with the prototype models as a collection of sub models. Collect data to compare model to process. Adjust model equations to best match actual process phenomena. Adjust model coefficient values to best match models to process data. Reconfigure the models anytime the process is reconfigured. Continually adapt the model coefficients in time as process characteristics drift.

The legitimacy of process analysis using models depends on the fidelity of the model to the actual process behavior. It takes a lot of work to nurture twins. ∞

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Behind the byline

Russ Rhinehart started his career in the process industry. After 13 years and rising to engineering supervision, he transferred to a 31-year academic career. Now "retired," he enjoys coaching professionals through books, articles, short courses and postings at his website www.r3eda.com.

The sum of all direct, reverse actions

How valve failure modes interact with controller actions and process loads

This column is moderated by Béla Lipták (http://belaliptakpe.com/), automation and safety consultant and editor of the Instrument and Automation Engineers' Handbook (IAEH). If you have an automation-related question for this column, write to liptakbela@aol.com.

I found the following statement in an engineering manual: "In order to function at all, a feedback control loop must have a negative feedback, a 180° phase shift somewhere in the loop."

Can you please explain the meaning of this statement? And how does it impact the controller action (direct/reverse) of a feedback loop?

BODHISATYA
bodhi.che@gmail.com

A1: Feedback loops operate the same way as most doctors do: by waiting until the patient gets sick, develops the symptoms of a sickness (error), and takes corrective action only after that. Since you asked only about that, I will not discuss feedforward control, which is similar to what Dr. Fauci is trying to practice.

All feedback control loops consist of three main components: 1) the process, 2) the control valve and 3) the controller (Figure 1). Each component can be either direct acting (DA), in which case its output changes in the same direction as its input, or reverse acting (RA) in which case the output responds to an input change by moving in the opposite, or reverse, direction.

A process is DA if a change in the process load (Q) results in a change in its controlled variable (C) in the same direction as Q. Conversely, if Q and C move in the opposite directions, the process is RA. For example, heating is a DA process and cooling is an RA process. Similarly, the control valve is DA if the flow (F) through it increases when the controller output M (manipulated variable) rises, and it's RA if F drops in response to a rise in M. For safety reasons, heating valves are usually DA (fail closed, FC), and cooling ones are RA (fail open, FO).

The controller action is selected for the total loop (Figure 1) to always have negative feedback (RA). Each RA (180° phase shift) in the loop causes a sign reversal, while each DA results in no phase shift. In terms of the total loop, this means that if both the valve and the process are DA (phase shift = 0) or if both are RA (phase shift -180° - 180° = -360°), the phase shifts cancel out. Therefore, for the controller to provide nevagive feedback, it must be RA. If on the other hand they differ (one DA with 0°, the other RA with 180°), for the loop to be RA, the controller must be DA.

It's the general practice for energy supply valves (steam, hot oil, etc) to fail closed (FC), and energy-removing valves (cold or chilled water) to fail open (FO). Here I'll make some general comments about the causes of valve failure and the selection of valve failure positions, but will only discuss the valve response when power supply to the actuator fails (loss of instrument air or electricity supply) because it would take too much space to discuss other failures, such as spring, diaphragm or piston failures.

When globe valves are used with pneumatic, spring-loaded actuators and direct-acting positioners or no positioners, the ultimate valve position will not only be a function of the actuator design, but also of process fluid forces acting on the valve itself. The valve design choices are FTO (flow to open), FTC (flow to close) or FB (friction bound) when the valve stays in it's last position (FL). FTO action is available with globe valves. FTC action can be obtained from butterfly, globe and conventional ball valves. Rotary plug, floating ball and segmented ball valves tend to be FB and the flow direction through them can possibly affect the torque required to open the valve.

Spring-loaded actuators are the most convenient means of providing FC or FO action, while two-directional air or electric motors will tend to fail in their last positions (FL).

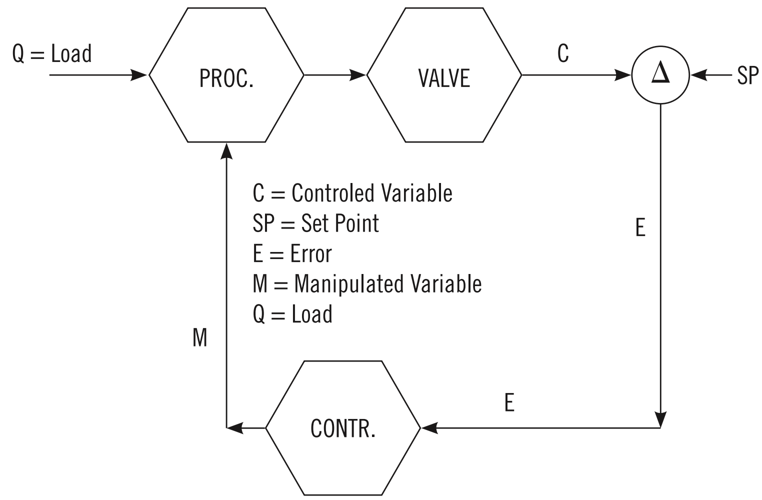
BÉLA LIPTÁK
liptakbela@aol.com.

A2: Integral-only control can work, which upends the 180° phase shift requirement.

Yes, a feedback controller seeking to keep or return a controlled variable to the setpoint needs negative feedback, as it needs to take control action to counter the deviation. But the question of direct or reverse action isn't so simple. Consider temperature control of hot and cold water mixing. If a hot water valve is used to control the temperature and the actuator is air-to-open (fail closed), then increasing the controller output opens the valve and increases the temperature. But, if the same valve is on the cold line and it's used for temperature control, then increasing controller output reduces the temperature. And, if it's a fail-open valve, the opposite is true again. Opposite again, that is, if overflow is used to adjust the process.

One must see all cause-and-effect mechanisms in the control system and process to determine which is right. The ISA definition of direct and reverse acting is based on regulatory mode; direct action means if the measurement increases, then controller output rises to fix it. Reverse action means if the measurement rises, then the controller output drops to fix it.

R. RUSSELL RHINEHART
russ@r3eda.com



PROCESS, CONTROLLER AND VALVE INTERACTIONS

Figure 1: Each 180° phase shift in the loop causes a sign reversal at the signal junction. The total loop has three junctions—process, controller and the valve.

A3: Yes, this does impact proper setting of the controller action, direct or reverse. However, unless you're trained in engineering mathematics, don't let the words "phase shift" fool you. All you need to know is the relative direction of change of process element inputs and outputs. If, when the input to a process element increases, the output also increases, that is 0° phase shift, but let's call it something simpler: "no sign reversal." If on the other hand, when the input to a process element increases, the output decreases, that's a 180° phase shift, so let's call that a "sign reversal."

Now, let’s replace the statement that "there must be 180° phase shift around the loop" with the statement that "there must be an odd number of sign reversals around the loop.”

Examples:

1. Consider a normally open valve, which controls the flow of a heating medium to a heat exchanger. If the valve is normally open, a decrease in signal to the valve (i.e., controller output) will cause the valve to open. Consequently, the flow through the valve will increase. That's a sign reversal. When the flow of heating medium increases, the outlet temperature increases. That's no sign reversal. Since we already have one sign reversal, we don't need any at the controller. Therefore, we want an increase in PV (measured temp) to cause an increase in controller output. That is to say, we want error (difference between SP and PV) to be calculated Error = PV - SP. That's direct acting.
2. Consider a case that's the same as above, but the valve happens to be normally closed. That removes the sign reversal of the normally open valve in the example above. Since neither the valve nor the process provide a sign revesral, it's up to the controller. It must be set for reverse acting, or Error = SP - PV. An increase in PV will cause the controller output to decrease. That's the required sign reversal.
3. This case is similar to the process loop described above, except that the valve is normally open (that's one sign reveral). In this case, the purpose of the heat exchanger is to reduce the temperature of a hot incoming fluid, so an increase in flow rate of the cooling medium reduces the heat exchanger outlet temperature. That's another sign reversal. Consequently, we have two sign reverals, and we need an odd number. The next odd number is three, so the controller must provide the third sign reversal in the loop. In this example, the controller must be set for reverse acting.

In summary, to determine whether the controller should be set for DA or RA, think of all of the places where there will be an input-output sign reversal around the loop, and set the controller, so it provides an odd number of sign reversals.

HAROLD WADE
hlwade@aol.com

I/O, terminal blocks add forms, better functions

Improved configurations, networking and even programming expand device capabilities

ROUND-FORM CABLE ENTRY THROUGH SURFACES

KDL/D Mono series cable entry system in a round frame form from MurrplastiK allows cables to be installed through an enclosure or bulkhead surfaces, with the benefit that pre-made, terminated cables can be installed without disassembling connectors. KDP/X cable entry system also allows many non-terminated cables to be installed through a small opening. KDL/D Mono series comes in three frame sizes; KDL/D series comes in four frame sizes; and KDP/X is available in one frame size with bolt-in or snap-on mounting.

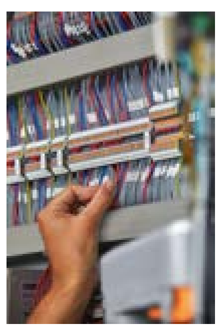
AUTOMATIONDIRECT
www.automationdirect.com/cable-entry-system

PUSH-IN WIRING WITH LEVERS, PUSHBUTTONS

TopJob S series terminal blocks have Push-in Cage Clamps from Wago, which first introduced push-in wiring for rail-mount blocks. The family offers levers and pushbuttons for convenient, intuitive wire termination, while maintaining vibration-proof, gas-tight, corrosion and thermal-cycling resistant connections, which industrial users expect for solid, stranded and ferruled conductors. All three TopJob versions share the same Push-in Cage Clamps and profiles. Testing and troubleshooting is simplified with built-in test ports.

DIGI-KEY ELECTRONICS
www.digikey.com

SIDE ENTRY TERMINALS, PUSH-IN CONNECTIONS



PTV terminal blocks combine the ease of push-in connections with popular side-entry terminals. The series allows clear marking and wire identification, less bending of wires, and space savings, especially in shallow cabinets. PTV blocks are available in a wide portfolio, including feed-through designs, component holders, fuse, multi-level and more. Compared with screw terminal blocks, PTV offers a reliable, drop-in replacement.

PHOENIX CONTACT
www.phoenixcontact.com/PTV

COMPACT BLOCKS SIMPLIFY WITH IO-LINK

FEN20 I/O industrial Ethernet I/O modules use four channels of IO-Link protocol networking to improve device configuration, monitoring and replacement. The compact block also functions as an IO-Link master, so each IO-Link (C/Q) pin can optionally be configured as digital input or output. FEN20-4IOL is also a field logic controller (FLC) that lets it perform control tasks at the field level, and allows users to implement simpler applications without an additional PLC. FEN20 measures just 55 x 62.5 x 30 mm, and carries an IP20 rating.

TURCK
www.turck.us

PIN AND SOCKET TERMINAL JUNCTION MODULES

Series I Terminal Junction modules and Series II Socket Junction modules by Amphenol PCD are robust, reliable, and perform to M81714 electrical and mechanical standards. Series I uses standard M39029/1 pin contacts. Series II uses M39029/22 socket contacts. Both accommodate 12-26 AWG wires. Mounting rail, installation/termination accessories and customization are available.

NEWARK, AN AVNET COMPANY
800-463-9275; www.newark.com/c/connectors/terminal-junction-modules

SCREW BARRIERS UPGRADED FOR CABLE LUGS

DKU series barrier, screw-type terminal blocks have been upgraded for easier use with cable lugs, and are specially suited for high-vibration applications. They employ a spring-guided system in which the screws are integrated and captive in the terminal enclosure. These screws can be backed out, so ring- or U-shaped cable lugs can be inserted, without losing the screw. DKUs come in five sizes from 15A for M3 and 26-14 AWG, up to 60 A for M5 and 20-6 AWG, which are all rated for use up to 600 V.

DINKLE
www.dinkle.com

ZONE 2/DIV 2 MOUNTABLE IN SMALL SPACES

LB remote I/O system is Division 2/Zone 2 mountable, and provides maximum performance in the smallest spaces, offering modules for non-explosive and Division 1/Zone 0, intrinsically safe field connections. These high-performance modules simply plug into a backplane for easy commissioning and expansion. LB remote's energy-saving power management system and low power dissipation allow for high packing density.

PEPPERL+FUCHS
www.pepperl-fuchs.com

REMOTE I/O WITH UP TO 64 CHANNELS

BusWorks NT2000 series Ethernet remote I/O modules interface up to 64 channels with a mix of signal types on a single IP address, and provide Modbus TCP/IP communications of analog voltage, current, thermocouple and discrete signals. NTE Ethernet I/O models are 25-mm wide with dual RJ45 ports, a web server, and up to 16 I/O channels. An integrated DIN rail bus can connect three NTX expansion I/O modules, each adding up to 16 more I/O channels.

ACROMAG
877-295-7057, http://bit.ly/AcromagNT

BLOCK WITH ADJUSTABLE SPRING

Spring clamp terminal blocks have a patented cage-clamp design, are available with 2.5 mm to 10 mm centerlines, and offer high-quality, reliable wire terminations. They're delivered "wire ready" with an open terminal chamber. The spring automatically adjusts for differently sized wires, and provides a consistent connection force. A wide range of spring-clamp terminal blocks is also available in reflow-compatible designs. Customization is possible, including color sequencing and printing, such as figures or symbols.

METZ CONNECT USA
732-389-1300; https://bit.ly/2XAlc7E

SERVER AND SOFTWARE FOR I/O SYSTEM

U-remote modular I/O system has IP20 and IP67 modules, so users can combine them in one I/O system. It also has added u-control web, an open, platform-independent web technology with pre-installed web server. This includes u-create web software that integrates software modules, such as an automation development environment, Node-RED software, visualization software and an OPC UA server. With its integrated container technology, u-create also lets users run their own or third-party software.

WEIDMULLER
www.weidmuller.com

MINI BLOCKS: 60% LESS SPACE, ALL FEATURES

TopJob S Mini terminal blocks have all the advantages of standard TopJob blocks, but have a 60% smaller footprint. They feature the same industry-proven, Push-in Cage Clamp connection technology used throughout the TopJob series, and are available with open-tool slots or easy-to-identify orange pushbuttons that can be easily actuated with any standard tool. TopJob S Minis can be mounted in various ways: miniature rail, snap-in mounting foot for chassis mounting, or direct-mount with fixing flange.

WAGO
www.wago.com/us/discover-terminal-blocks/mini-rail-mount-terminal-blocks

GATEWAY FROM HART TO IIoT

HES HART-to-Ethernet gateway has a single-channel configuration that converts signals from up to 16 wired HART devices in digital, multi-drop mode to Modbus/TCP and HART-IP, and a four-channel version that handles up to 64 wired HART devices. It lets HART transmitters and smart valves interface directly with Modbus/TCP-based monitoring and control systems via Ethernet, and with field device data viewable in a web browser via its built-in web server. HES also supports normal and burst-mode communications.

MOORE INDUSTRIES-INTERNATIONAL INC.
www.miinet.com/hes

HIGH PERFORMANCE ETHERNET TESTER

NetXpert XG2 Ethernet tester offers many of the same benefits and capabilities as Softing's NetXpert XG with the addition of several new hardware features, including 5 gigahertz (GHz) wireless local-area network (WLAN) support. Other new features include USB-A port and small form-factor pluggable (SFP) bays. As an all-in-one Ethernet tester, NetXpert XG2 helps users to verify support of bandwidth requirements.

SOFTING AG
itnetworks.softing.com/us

SMART ACTUATOR SENSES AND CONTROLS

New motor/actuators with integral controls include the Exlar SA-R080 rotary and SA-L080 linear actuators. The SA series actuators offer force, precision, energy efficiency and control, while minimizing additional cabling, external servo controls and integration necessary with traditional solutions. SA-L080 is capable of continuous force up to 2,330 lb-ft (linear), and SA-R080 is capable of torque up to 24.7 lb-in (rotary).

CURTISS-WRIGHT CORP.
cw-actuation.com

INDUSTRIAL PC FOR HAZARDOUS AREAS

Model 4093 industrial PC features IEC Ex Zone 1 transferable and field maintainable explosion-proof technology, enhancing operator control through real-time data monitoring and machine control in hazardous environments. The 4093 features a 15-in., sunlight-readable, anti-glare, LCD display with 1,027 x 768 resolution integrated with an easy-to-use, impact resistant, multi-touch, PCT/PCAP touchscreen.

DAISY DATA
daisydata.com

WIRELESS SYSTEM SIMPLIFIES IOT CONNECTIVITY

Industrial Wireless Systems are designed to eliminate the installation and maintenance costs associated with wired systems for continuous asset monitoring. The breadth and configurability of system devices, which include wireless pressure and temperature sensors, gateways, receivers and transmitters, gives it scalability and adaptability. To simplify setup, Sensata's wireless systems feature out-of-the-box configurations.

SENSATA TECHNOLOGIES
sensata.com/wireless-systems

5G WIRELESS, POWER-OVER-ETHERNET INJECTOR

EKI-2701MPI-5G PoE injector delivers Wi-Fi 6 network infrastructure, power over Ethernet (PoE) and advanced connectivity to out-of-date, extant infrastructure. It supports multiple data rates (10M/100M/1G/2.5G/5G) and IEEE802.3bt 90W PoE output. The device also features a compact, palm-sized form factor adaptable to network infrastructure upgrade applications with limited space.

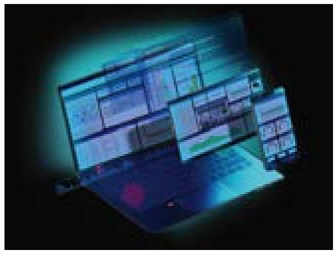
ADVANTECH
advantech.com

REAL-TIME REMOTE MONITORING OF BOILERS

Muira Connect web portal enables users of the company's industrial steam boilers to set notification preferences and receive real-time boiler room alerts directly to their smartphones. Further, it allows users to access relevant technical documentation quickly and easily, generate custom historical data reports for trend analysis,, as well as view multiple boiler rooms from one centralized location.

MIURA
miuraboiler.com

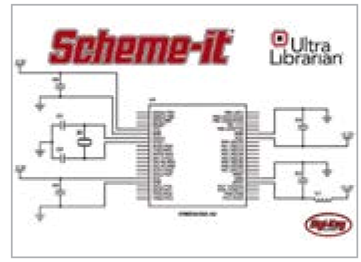
NO CODE IIoT FOR MACHINE BUILDERS



UniCloud is a simple, affordable, no-code approach to cloud that makes it easy for any machine builder to benefit from secure IIoT. Now open to all devices that support Modbus, UniCloud opens the door to the benefits of cloud technology: increased profits, effortless monitoring, easily-implemented business intelligence and much more—all with zero investment in programmers, cloud infrastructure or IT professionals.

UNITRONICS
unitronics.cloud

NEW FEATURES FOR FREE SCHEMATICS TOOL



New features for Digi-Key's popular Scheme-it tool, a free online schematics and diagramming solution for engineers, educators and students, include Ultra Librarian symbol integration which brings in approximately 2 million detailed symbols and images from Digi-Key's product catalog. Other enhancements include symbol editing and mathematics markup to insert mathematical formulas directly on schematics.

DIGI-KEY
digi-key.com

CONDUCTIVE LIQUID LEVEL CONTROLLERS

ProSense CLC series conductive, liquid-level controllers detect and control levels of conductive liquids (tap water, seawater, sewage, chemical solutions, coffee, milk, etc) in dual-probe pump-up (fill) and/or pump-down (drain) applications. A widely adjustable sensitivity range is included to meet the needs of a large variety of liquid types. ProSense CLC controllers also feature a one-year warranty.

AUTOMATIONDIRECT.COM
automationdirect.com/level-controller

ROTARY ENCODER FEATURES COMPACT HOUSING

IXARC rotary encoders includes housings that are only 27-mm long. This reduced length, combined with a diameter of only 36 mm, means that this line of super-compact devices are well-suited for installation and service in tight spaces. Their radial cable entry and shaft seal have protection ratings of IP65, ensuring reliable operations under wet and dirty conditions. A wide variety of flange and shaft configurations are also available.

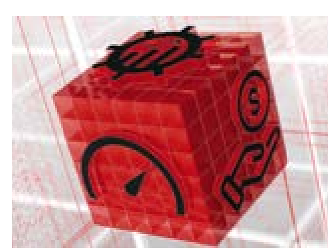
POSITAL
posital.com

½-DIN PROCESS PANEL CONTROLLER

3x6-in. (½-DIN) Panelicity panel controller features pre-defined displays, alarms, trends and standard control strategy templates. Benefits include easy installation and configuration, intuitive menu options, small footprint, and low total cost. "Panelicity simplifies controlling one or two control loops through easy configuration, installation and operation,", says Fritz Ruebeck, CEO of Classic Automation LLC.

CLASSIC AUTOMATION
classicautomation.com

AI COMES TO ASSET PERFORMANCE MANAGEMENT



Ability Genix asset performance management suite brings next-generation, AI-based predictive maintenance, asset reliability and integrity insights to process and utility industries. Genix APM is an enterprise-grade application to monitor assets, prescribe maintenance actions, improve equipment utilization, and support lifecycle analysis and capital planning, enabling customers to reduce machine downtime by up to 50%.

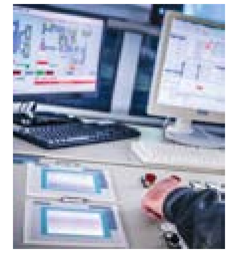
ABB
go.abb/processautomation

CABLE ENTRY FOR CLEAN ENVIRONMENTS

Tried and tested cable entry frames KEL-ER and KEL-U with their matching KT grommets are designed for cables with connectors. For cables without plugs, KEL-DPZ cable entry plates are also available in a cleanroom version. All icotek cable entry systems for cleanrooms have been tested and certified by Fraunhofer IPA, and are suitable and certified for Class 1 in accordance with DIN EN ISO 14644-1: 2015.

ICOTEK
icotek.com/en-us/products/cleanroom-cable-entry

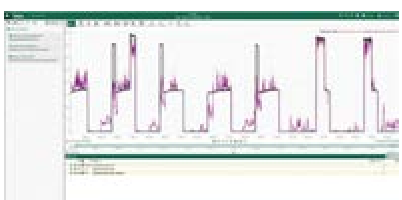
NEW TOOL EXECUTES ALARM RATIONALIZATION



aeAlarm is control system platform-agnostic, and is adaptable across all industrial sectors. It's effective for projects of all types and sizes, including small project rationalizations and large site-wide efforts. Additionally, the tool creates a platform to compile process safety information, and generates customized reports and tables to expedite data tracking for site-specific key performance indicators (KPIs).

AESOLUTIONS
aesolutions.com/alarm-management

ANALYTICS TOOL ADDS AZURE MACHINE LEARNING



New Seeq Azure Add-on enables process manufacturing organizations to deploy machine learning models from Azure Machine Learning as Add-ons in Seeq Workbench. The result is machine learning algorithms and innovations developed by IT departments that can be operationalized, so frontline OT employees can enhance their decision-making and improve production, sustainability indicators and business outcomes.

SEEQ
seeq.com

NEXT-GENERATION TOUCHSCREEN PANEL METERS

PM-50 panel meter is available with a 3.5-in. or 4.3-in. graphical touchscreen display. Using a simple swipe, users can easily switch between relevant screens, and receive comprehensive operational data for monitoring equipment and production. Visual alerts notify users that immediate action is necessary, either on the unit itself or via the PM-50 app, available on Google Play or at the Apple Store.

RED LION CONTROLS
redlion.net

NEW RELEASE OF ELECTROTECHNICAL PLATFORM

Platform 2022 software includes a newly designed user interface, improved workflows and many additional functions in connection with complementary cloud services. Overall, the new engineering software is characterized by its ease of use and high performance. This can be seen in the integrated ribbon bars, backstage view users may recognize from many other established software solutions, and significantly improved user ergonomics.

EPLAN
eplan-software.com/inyourhands

LARGER WIRING FOR MINI TERMINAL BLOCKS

TopJob S Mini terminal block series includes a version for 12 AWG wires. Like the rest of the Mini family, this version shares features with the rest of Wago's TopJob S terminal block line, but comes in at 60% smaller. The 12 AWG variant is able to operate at up to 600 V and 20 A, and has UL 1059 approval, as well as AEx, ATEX and IECEx for hazardous locations. It also features push-in Cage Clamp connection technology.

WAGO USA
wago.com/us

United States Postal Service
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Remembering Shinskey

Stories from those whose careers were shaped by the process control legend

GREG MCMILLAN

Gregory K. McMillan captures the wisdom of talented leaders in process control, and adds his perspective based on more than 50 years of experience, cartoons by Ted Williams, and (web-only) Top 10 lists. Find more of Greg's conceptual and principle-based knowledge in his Control Talk blog. Greg welcomes comments and column suggestions at ControlTalk@putman.net

GREG: As a followup to Keith Larson's tribute to process control legend F. Greg Shinskey in last month's issue, we wanted to give a more detailed view of the knowledge he shared and how it played such a critical role in the success of the PID controller. Here we ask prominent leaders in the use of process control, Karl Astrom, George Buckbee, Mark Darby, Peter Morgan, Sigifredo Nino, Michel Ruel, Nick Sands, Jacques Smuts and Terry Tolliver, to share impact Shinskey had on their careers through examples.

Their responses were so overwhelming that they had to be edited for space. Please seek out the online version of this column for a more complete picture, as well as my own discussion of the deeper understandings I gained from him that played a key role in my career.

KARL: I knew early that Greg was an expert in process control. When I became professor of a new department in 1965, I asked him for advice on course content and particularly about building a student laboratory. Greg was tremendously helpful and recommended level control as a simple example accessible to all engineers. It was very useful since we give courses to students in many branches of engineering: mechanical, electrical and chemical. On Greg's advice, we built a two-tank system that's been highly appreciated by our students ever since.

GEORGE: In my mind, Greg Shinskey was the exemplar of a process control engineer. He was fully steeped in the theory of control, yet grounded in the experience and practicalities of the industrial environment. I was most impressed by his ability to quickly whittle any problem down to its pure fundamentals, and state the "obvious" solution in just one or two short sentences. He was also very dedicated to the need to codify his knowledge and pass it on to coming generations. I'll be forever grateful that Greg chose to devote some of his time to share his insights with the rest of us in the process control world.

MARK: I was fortunate to start my control career in 1980 after developing an interest in process control during college. This was a time when distributed control systems and supervisory computers were coming into greater use. These systems readily allowed the implementation of more advanced techniques, compared to what was previously feasible with analog controls, many of which were developed and/or described by Greg Shinskey in his articles and books. His writings were a major resource for me in developing control applications. A common refrain when discussing an application among my colleagues at the time was: "What does Shinskey say?"

Greg's advice was particularly helpful to me in designing distillation column controls, techniques I continue to use today in model predictive control applications. One of the key takeaways from Greg was, of course, the importance of understanding the process. But further, how much additional knowledge can be gleaned from applying basic chemical engineering fundamentals to better understand the process or to use them directly in control design. Greg's insights are timeless—we need to make sure they're passed along to future generations of control engineers.

PETER: Regrettably, I never met Greg Shinskey, and because my formation as a control engineer (or systems engineer as I was called in the 1970s) took place in the U.K., I didn't learn of Greg Shinskey's work until the 1980s, when I hit the North American shore. His ideas minted in the 1960s are still the currency of today.

To give just one example, Shinskey recognized that the alternative implementation of PID using filtered, positive feedback simplified override strategies, and made possible the implementation of external reset feedback to improve loop stability and performance when external dynamic and static limits are present, and when the final element resolution is non-zero. Today, we seek to promote the wider use of this method, trusting in his approval. Thank you, Greg, for your inspiration!

SIGIFREDO: On Nov. 16, 1993, Greg wrote in the first blank page of his *Process Control Systems - 3rd Edition,* "Sigifredo it was a pleasure meeting you in Atlanta," followed by his signature.

I was so fascinated by what I had learned during his three-day course that, as soon as I had the opportunity to do it, I implemented his shrink-and-swell compensator in a boiler that was commissioned at the plant where I was working. The strategy appears in Figure 9.12 of the fourth edition of his book.

Greg was also a great force behind the practical use of E. H. Bristol's interaction measure that Shinskey labeled Relative Gain Analysis (RGA). What's less known is that his use of RGA in distillation control was beyond what's typical; in pairings for dual-composition control, he recommended not only associated to minimum interaction, but more importantly on the concept that values higher than 1.0 give better dynamic response. The details can be found in his book, *Distillation Control, 2nd Edition*.

MICHEL: Greg was my idol, a guru, an icon, a remarkable author, a process controls passionate! It started when I was a student at university, end of 1970s. My process control professor was very critical of a book by Greg Shinskey—too practical. I was a fan and was surprised by his comments. Later, when I was teaching at the same university, I recommended Greg Shinskey's book to passionate future engineers (the books were not recommended by my colleagues). Later, at Top Control, every time I hired a new process control engineer, asking them to study Greg Shinskey's book was one of the first steps in their training. Every one of them became a Shinskey fan. Eight years ago, I called Greg to ask him permission to name our main conference room after him. Greg agreed. Then I took three graphics from his books to display in the room, and he told me, "Michel, these three graphics are a perfect summary of my whole career." We trained many engineers in that room, and we always started with a story about Greg.

NICK: As an aspiring control engineer, I started to build a library that's grown to be quite large over 30 years. The early books were critical in helping me better understand the processes I worked with and how to control them. Chief among my favorite authors were Shinskey, Bill Luyben and Greg McMillan. My first copy of *Process Control Systems* was the 3rd edition, which I wore out and replaced with the 4th. A strategy for controlling total flow and ratio solved some critical control problems, both in distillation and mixing applications. When a senior engineer wanted an explanation of the strategy, it was there in the book. It was an honor to meet Greg at some ISA conferences, where he was always encouraging and willing to share his knowledge. His works will endure. He will be missed.

JACQUES: My first practical book on process control was the 3rd edition of Shinskey's *Process Control Systems*. I was inspired and enlightened by his crisp and insightful explanations. Remember? "The Difficult Element – Dead Time; The Easy Element – Capacity." Stuff just made sense the way Greg explained it. Although we never met in person, I really benefitted from the wealth of information in his books and other contributions. Three topics he covered that come to mind as being directly helpful to me are steam plant, chemical reactor and distillation column control. He was a great asset to the field and will be greatly missed.

TERRY: Greg Shinskey had a significant impact on my career in process control. In 1976, shortly after I transferred to Engineering Technology at Monsanto headquarters as a process control specialist, I was allowed to attend the course he presented on distillation control at Foxboro. The emphasis he placed on understanding the process while designing the control system served as my guiding principle throughout my career. This was at a time when microprocessor-based controllers were beginning to allow easier implementation of process characteristics into the control strategy. Feedforward control and constraint control were two of the more successful techniques he encouraged, and were widely adopted. ∞

See the online version of this article on ControlGlobal.com for more reflections on Shinskey's contributions to the practice of process control —along with Greg McMillan's Top 10 list of the benefits of reading Shinskey's books and the impact they had on him personally.

Saved by specifics

Useful details are the antidote to intertia

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"I'm especially grateful for these stories and their subjects because they and all the other interesting entities and events continue to light me up, especially in these difficult times."

WE'VE all been in mind-bendingly boring meetings, technical sessions or other gatherings that seemed to go on forever. I can recall three- and four-hour municipal and school board meetings stretching well past midnight, while rival elected officials argued endlessly about postage, zoning and other hot topics. I remember a few salaried support staffers and news gatherers despairing that they'd ever get home, and my vision actually seeming to distort and warp, perhaps due to the sheer inertia and possible gravity well caused by the absolute lack of progress.

Conditions haven't been that bad for awhile, but there are always a few numbing reminders, and the signs are unmistakable. It usually begins with a few vague, unfocused statements about looking into something or maybe doing something else. This is typically followed by other participants repeating what's already been stated, and continuing to go round and round with zero substantive action happening. In the later stages, as the lack of momentum reaches full force, some witnesses have told me they catch themselves starting to look around for sharp objects—only symbolizing their desire to escape, I hope.

Naturally, I've always tried to avoid conveying these pointless situations because I'm usually assigned to gather and relay "news you can use."

If you've talked to me before, you already know I'm slightly obsessed with specifics. Whether it's illuminating statistics or other little details for captions or graphics, or epic case studies by generous and brave system integrators and end users, I'm always on the hunt for more.

I know that I routinely rant about the need for particulars, but lately, my condition seems to have grown more intense. I'm scrambling after details on more fronts than ever, and straining more aggressively against real and perceived obstacles.

But why? Well, I normally accept fuzzy thinking, nebulous statements and drawn-out meetings as a journalistic occupational hazards and the chaff I'm obligated to sort through to find the few nutritious grains of information I can pass on to my readers. However, the recent passing of my friend and editor Paul Studebaker and my mom, Dorothy Montague, just a few weeks ago apparently unhinged me a little more than I realized. Similar to many reporters, I've covered numerous deaths and related tragedies in many communities, and even started out writing obituaries and weddings. I thought I was well-prepared to accept these new losses, just as other people I've covered have done. However, my brain and subconscious obviously had other ideas.

So why attack time-sucking meetings, vague language, generalized pronouncements, and inertia that stalls progress? Because they waste time, which I've been reminded is precious and increasingly scarce. That's why I've been extra impatient. I've also learned that inertia isn't just a lack of momentum, it's paralysis and poison. No wonder stiction is so hard to overcome; it's literally bringing components back to life.

Consequently, just as recent in-person gatherings have been surprisingly refreshing in the wake of COVID-19, I've also been pleased to sink my teeth and mind into some useful input, such as this issue's "Compressing gases, decompressing operators" feature about automating gas and refrigeration turbomachinery on the ethylene unit at HIP-PetroHemija in Serbia (p. 55).

Likewise, I also enjoyed covering system integrator BXG Systems and their use of common software blocks to simplify treatment and processing in Texas (www.controlglobal.com/articles/2021/raf-9). They detailed their efforts and successes during Rockwell Automation Fair 2021 a couple of weeks ago in Houston.

I'm especially grateful for these stories and their subjects because they and all interesting entities and events continue to light me up, especially in these difficult times. Of course, I know that movement and simple momentum aren't necessarily life, and that "passionate intensity" and "sound and fury, signifying nothing" are always present. However, I believe that seeking specifics and useful details are how we can tell the difference. ∞