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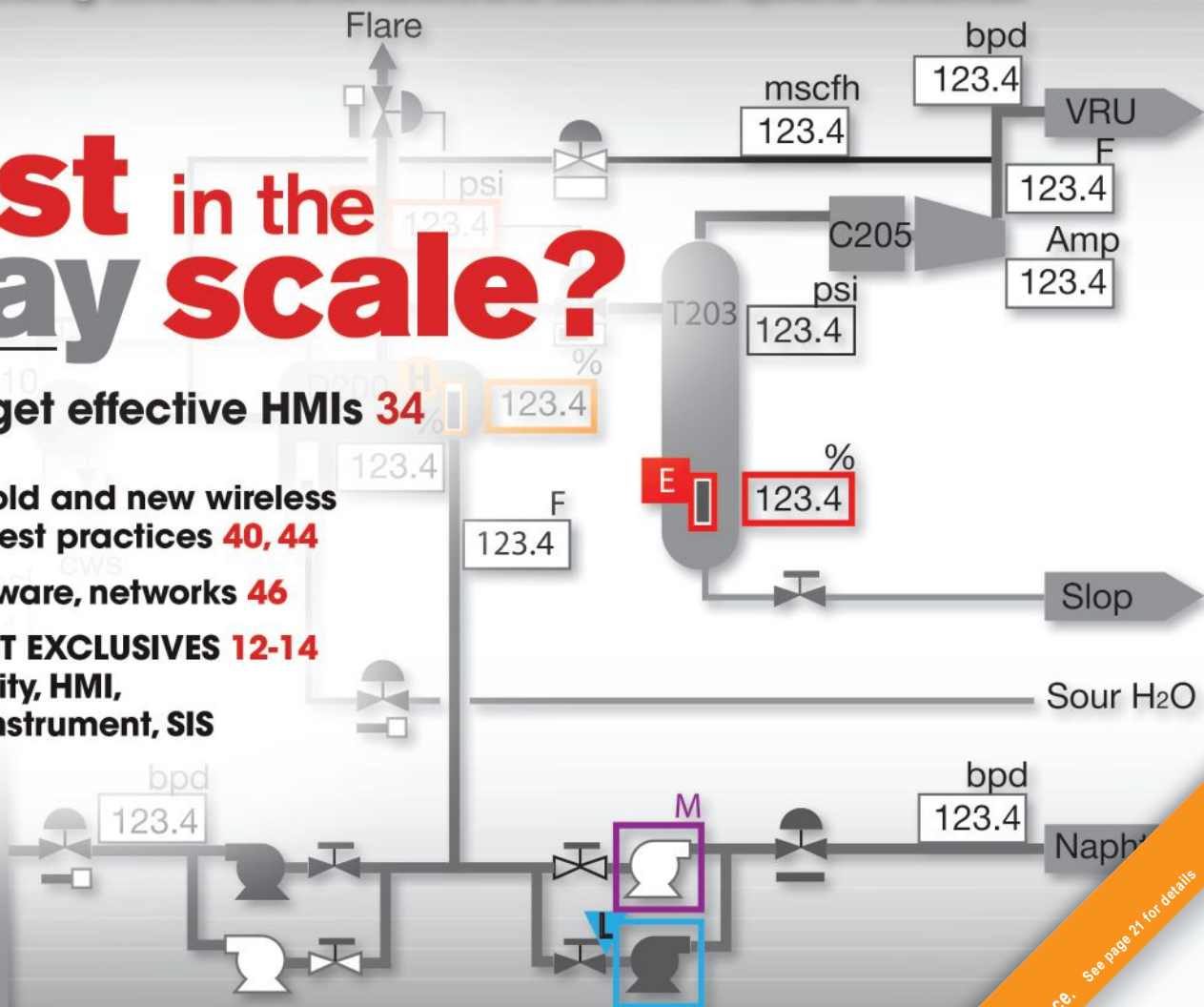
How to get effective HMIs 34

Integrate old and new wireless systems; best practices 40, 44

Smart software, networks 46

4 PRODUCT EXCLUSIVES 12-14

Connectivity, HMI, software instrument, SIS



New C-more® Touch Panels

Higher Performance, Lower Price



The popular **C-more** HMIs have ALWAYS been a great value, but now they are better than ever. We have included some of the latest technology into the new EA9 series C-more panels, and all at a lower cost to you. But don't let the lower price fool you - with a redesigned, more robust housing, thinner bezel, LED backlights and more communications and data storage options, the EA9 series offers even more value and performance.

ALL EA9 SERIES C-MORE PANELS INCLUDE:

- 800 MHz processor
- SD memory card slot for data logging
- One USB 2.0 A-type and one USB 2.0 B-type port
- Serial communications interface
- 26MB project memory space (82MB on the 12- and 15-inch units)

FULL-FEATURED MODELS ADD:

- 10/100Base-T Ethernet communications
- Additional SD card slot on 12- and 15-inch models
- Two additional for a total of three serial communications ports (RS-232, RS422/485)
- One HDMI Video Output (12- and 15-inch units only)

REMOTE ACCESS AND CONTROL BUILT-IN

- No Additional Hardware required. The C-more Remote Access feature resides in all EA9 panels with Ethernet support, and requires no option modules. Access real-time data or initiate an action on a control system from anywhere, any time.

CONNECT TO CONTROLLERS WITH DRIVERS FOR:

- All AutomationDirect programmable controllers
- Allen-Bradley - ControlLogix®, CompactLogix®, MicroLogix™ Ethernet, SLC Series, FlexLogix, SLC® 5/05 Ethernet™
- Modbus RTU and TCP/IP Ethernet
- GE SNPX
- Omron Host Link Adapter (C200/C500), FINS Serial and Ethernet
- Selected Mitsubishi FX Series, Q Series
- Siemens S7-200 PPI and S7-200/300 Ethernet (ISO over TCP/IP)

HDMI



The C-more EA9 series 12- and 15-inch panels now have an HDMI video output port. This allows you to connect HDMI devices like larger screen TVs to the C-more panels for longer-distance viewing of operator screens.

Research, price, buy at:

www.automationdirect.com/c-more

Order Today, Ships Today!



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the #1 value in automation

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AutomationDirect offers a complete lineup of cost-effective WERMA signal beacons, buzzers and stacklights for process indication or alarming to keep your operators well-informed. New styles include freestanding beacons and the attractive FlatSIGN signal lights.

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- Incandescent, LED, or Xenon light sources
- Permanent, blinking, flashing, and rotating signaling styles
- High protection rating IP65
- 29, 57/58, and 75 mm beacon diameters
- Audible modules with sight/sound combinations
- Five colors

Freestanding Beacons

Choose from a variety of mounting and signaling options with freestanding beacons.

- Base, bracket or tube mounting
- Incandescent, LED, or Xenon light sources
- Permanent, blinking, flashing, LED EVS and LED rotating signaling styles
- High protection rating IP65
- 57/58/75/98 mm beacon diameters
- Tall lens option available in some styles
- Five colors

FlatSIGNS

- Tri-color signal light for wall mount installation
- Audible alert option with 8 selectable tones or continuous tone
- Red/Yellow/Green LEDs
- 160-degree viewing angle
- Permanent or blinking (DIP switch selectable) models

Beacon Common Features:

- 360° visibility
- Red, green, yellow, clear or blue lens colors
- IP65 rated, -4°F to 122°F (-20°C to 50°C) operating temperature
- cULus file E164155, CE, RoHS
- 2-year warranty



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Research, price, and buy at:
[www.automationdirect.com/
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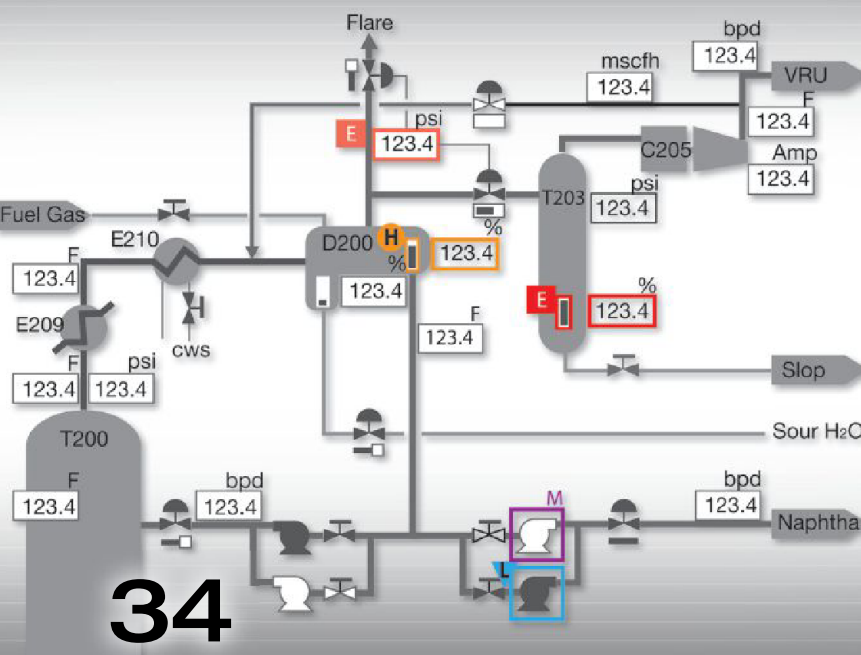


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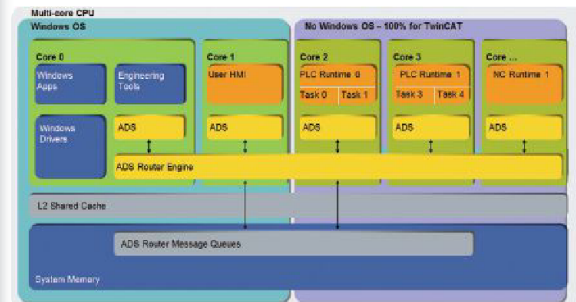
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Cover graphic courtesy: Human Centered Solutions

Online extra image, www.controleng.com/archives, June

46



48

Features

34 Creating an ASM-compliant HMI goes deeper than screen color selection

Simply adopting ASM guidelines for graphics does not create an ASM-compliant HMI. Achieving that level of effectiveness involves a range of factors that address how people interact with the control system.

40 How to integrate new with legacy wireless systems: 4 considerations

Blending the traditional with the new in an increasingly wireless world requires careful attention to capabilities of old and new wireless technologies, such as 4G LTE, upgraded Wi-Fi, and low-energy Bluetooth. See application example.

44 Best practices in wireless

Prior to choosing industrial wireless networking technologies, ask 4 basic questions to get the most out of a wireless network.

46 Smart software, networks trump smart hardware

Engineers should select a core control platform that minimizes complexity, with a unified software platform and network.

48 Certifications: A system integrator's journey

A system integrator explains how certifications matter for individuals and for the corporation, including for talent retention.

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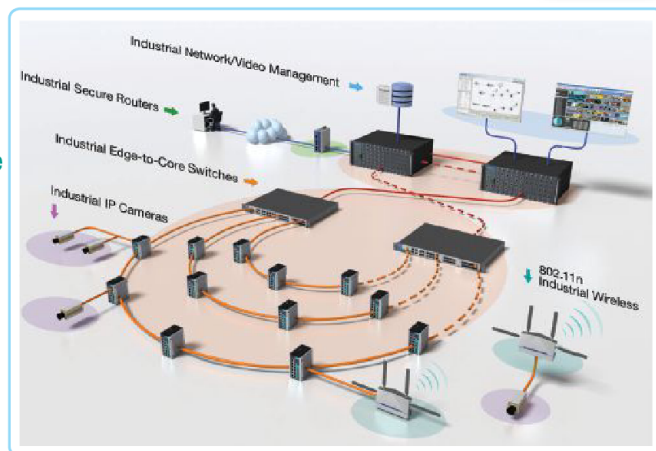
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Inside Machines

Starts after p. 52. If not, see www.controleng.com/archives for June.

M1 Vision-enabled robot replaces 4 conventional robots

Robot with machine vision replaces four conventional robots in this Fitz-Thors Engineering design for a Tier 1 automotive supplier. The robot operates continuously, eliminating robot idle time with conventional cells.

M6 Motion control for OEMs: 11 tips for improvement

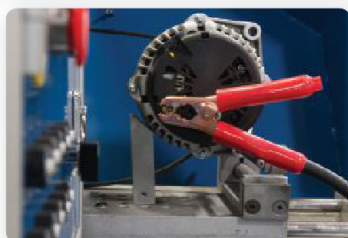
Tips explain how to apply recent technology advances to motion controls, benefitting end users and machine original equipment manufacturers (OEMs).

M10 Automation improves alternator test system

Motorcar Parts of America designs and builds a new testing system in house using a programmable automation controller and human machine interface. See lessons learned.

M14 Programming in motion

Automated Industrial Machinery moved to a digital motion control network to reduce wiring and ease programming with using IEC 61131-3 and PLC Open function blocks.



PRODUCT EXCLUSIVES



departments

8 Think Again

Control Engineering profile

8 Apps for Engineers

Mobile drawing applications

12-14 Product Exclusives

Secure, modular connectivity
Programmable HMI for mobility
Software based test instrument
Software manages SIS

16 60th anniversary

Training, supplier abroad,
women in engineering

17 Research

Information integration

18, 22 Technology Update

Capture baby boomer knowledge,
Reducing harmonics

26 International

Commercial-grade vs. industrial
wiring

28 Machine Safety

Verification is not validation

69 Digital Edition Exclusives

HMIs, help for MS Window XP

96 Back to Basics

Operator interface graphics 101

news

30 ERP helps plant-floor mobility

32 Google Glass observations

32 Borrow and invest now

products

94 Select and specify control circuit fuses

94 Capture and share real-time meter data anywhere

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- Ask *Control Engineering*: We still use MS Windows XP? What do we need to do? (See June Digital Edition Exclusive also.)

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- How old do you think is too old to be a Automation/Control Engineer?
- Need some advice for a slightly different loop control application
- Do you agree that there is a lack of young engineers in Automation and Control Engineering?
- Since Microsoft has discontinued support for Windows XP, it's best to upgrade to a newer OS to protect against attack. But what ...

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What video clips might help you do your job better? Recent posts include industry trade show developments and a short clip trying out Google Glass. (Have you tried Google Glass, yet? If so, click in and leave your comments and impressions, as well. See also, page 32.) www.controleng.com/videos
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Control Engineering professional profile

Understanding those interested in the control engineering profession is of great interest to people who interact with these professionals. Research and top articles focus on control engineers.

The annual *Control Engineering* Verified Audit Circulation report, just released for 2013, is an extensive piece of research about those interested in automation, controls, and instrumentation: what products are of greatest interest, what industries are most popular, and the continuing importance of system integration, among other topics. Intense interest in the control engineering profession continued last month with heavy online traffic to four May articles that together appeared six times in the “Top 5 *Control Engineering* articles” during three weeks in May include *Control Engineering* salary and career survey, 2014 and a related advice article; It is an engineer’s job market; and 7 things noncontrol people should know about control engineers.

The last article mentioned appeared first in three of the weekly Top 5 tallies after it was posted. Why the interest? I believe it’s because *Control Engineering* readers want to know about the control engineering profession and how to bring even more value to their organizations.

From the VAC report, a tally of 86,492 *Control Engineering* subscribers:

- 76% (65,724) have engineering job responsibilities at the primary job function. That breaks out into 28.5% process, production, or manufacturing engineering; 21.9% system or product design, control, or instrument engineering; 9.4% system integration or consulting, and 16.3% other engineering, including evaluation, quality control, standards, reliability, test, project, software, plant, electrical mechanical, or electric; 15% have general or corporate management as primary job function; and 9% have operations or maintenance as a primary job function, for a total of 100%.

- Of the 29 industry classifications cited, the leading five are: 1) Instrumentation, measurement, or control systems or devices, 2) Industrial machinery, 3) Industrial controls, test, or medical equipment, 4) Engineering or system integration services, 5) Electrical equipment.

- 37.4% said they design, build, or install machines for use within their own company.

- 21.9% said they design, build, or install machines for resale to other companies.

- About one-third, 33.9%, said they provide system integration or engineering services to manufacturing organizations.

- 21 categories of products or systems are purchased or specified. On average, each subscriber purchased or specified 10 products. Top 5 categories of products purchased or specified are: 1) programmable logic controllers or programmable automation controllers, 2) Human machine interface hardware or equipment, operator interface, control panels, alarms, annunciators, data acquisition equipment, or data recorders or plotters, 3) Computers, industrial PCs or PC-based control, 4) Power distribution systems or power protection systems, power supplies, or uninterruptible power supplies, 5) Distributed control systems or process control platforms.

- Beyond the print and digital edition reading *Control Engineering* reading habits extend to a total unduplicated audience of 146,365, with the print and digital edition (86,492) plus 11 topical newsletters as of Nov. 26, 2013. Among those, more than 40% receive four or more *Control Engineering* products. Total (duplicate) circulation for these equals 582,667.

Interest in *Control Engineering* extends globally to six editions published in five languages, with combined monthly magazine, newsletter, and website activity average of 986,857, for March-May 2013, said the *Control Engineering* Total Audience Profile, summer 2013 (excluding social media, webcasts, eGuides, or in-person events). Think again: the control engineering profession is a big deal with many interested participants seeking *Control Engineering* information in many ways, the world over. **ce**



Go Online

www.controleng.com/archives

This article in the June 2014 online archives has more bullet points and a “monthly reach” table.

Search “Top 5 Control Engineering articles” atop

www.controleng.com

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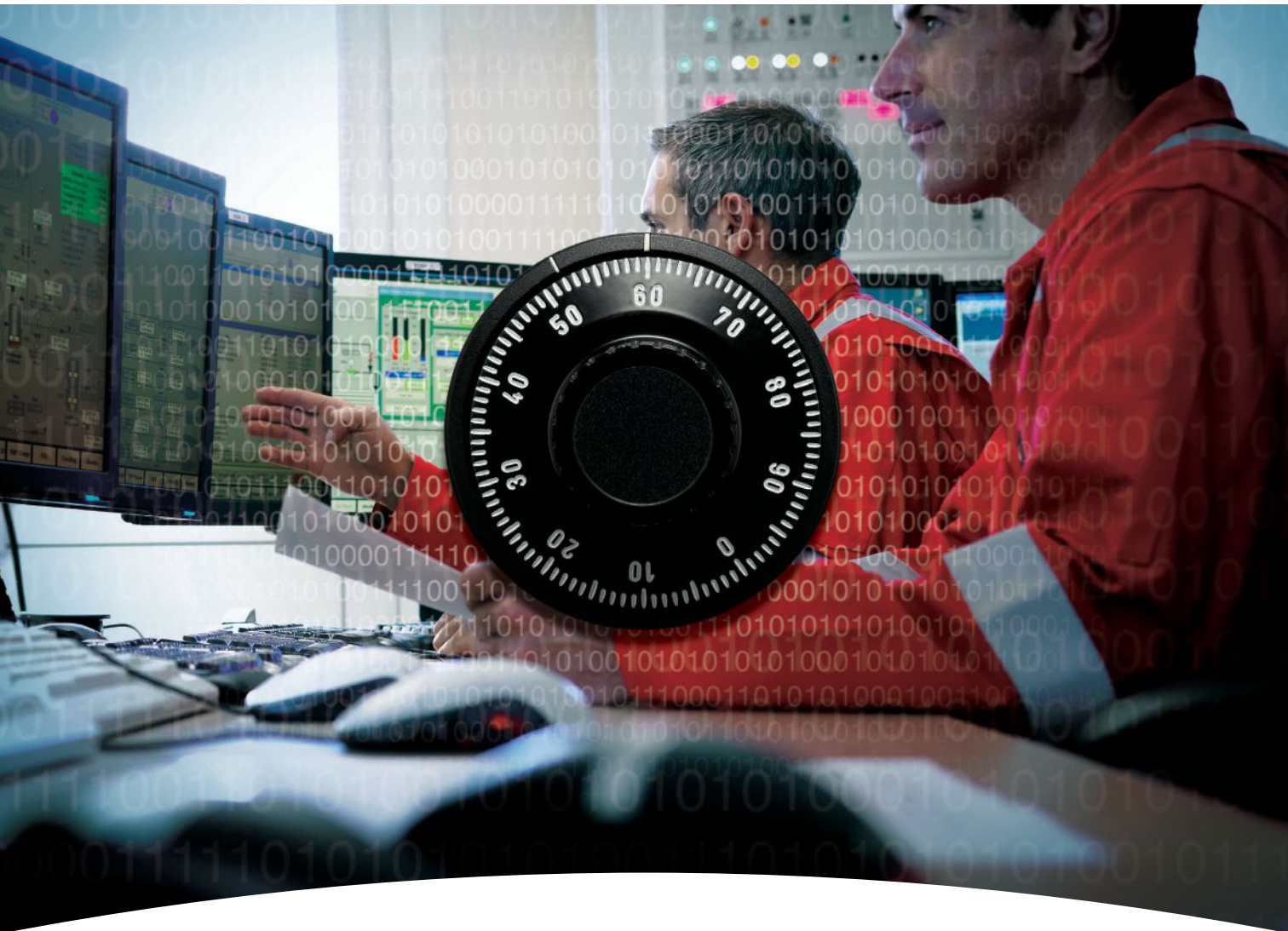
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Compact – Versatile – Powerful

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- Smaller space requirements
- Flexibility for many applications
- Information when failures occur

How SIMATIC Delivers

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- 8 push buttons, 8 standard I/O and 1 SIL3 safety inputs
- Completely configurable
- PROFINET device with full diagnostic support

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Drawing and graphing apps for iOS and Android

CFE Media's Apps for Engineers is an interactive directory of more than 240 engineering-related applications for Android and iOS, created by various companies. We've organized apps by category, company, and type. This month, gain access to drawing and graphing applications.



AutoCAD 360

Android 2.3+, iOS 6.0+

Cost: Free

Company: Autodesk Inc.

Website: www.autocad360.com

AutoCAD 360 is a free drawing and drafting mobile app that allows the user to view, edit, and share AutoCAD drawings. Simplify site visits and fieldwork with powerful design, review, and markup tools that are available online and offline. Share drawings across desktop, Web, and mobile devices.



TurboViewer X

Android 2.2+, iOS 5.1+

Cost: \$6.99

Company: IMSI/Design, LLC

Website: www.imsisoft.com

The TurboViewer product line is a native DWG viewer that supports 2-D and 3-D CAD DWG files for the Android platform. Users have access to a multi-touch navigation system as one pans, zooms, and 3-D orbits around one's DWG and DXF files. To view drawing files, send an e-mail with the DWG or DXF attachment to the mobile e-mail client. Drawing files can be viewed through Web downloads, FTP, Dropbox, WebDAV, and cloud-based storage systems.



MagicPlan

Android 4.0+, iOS 7.0+

Cost: Free

Company: Sensopia

Website: www.sensopia.com

MagicPlan measures a user's rooms and draws the floor plan through the use of a camera on the user's device. It's as easy as taking a picture. The floor-plan is then exported in PDF, JPG, and DXF format, or it can be published as an interactive Web design.



CAD Expert – for Floor Plans edition

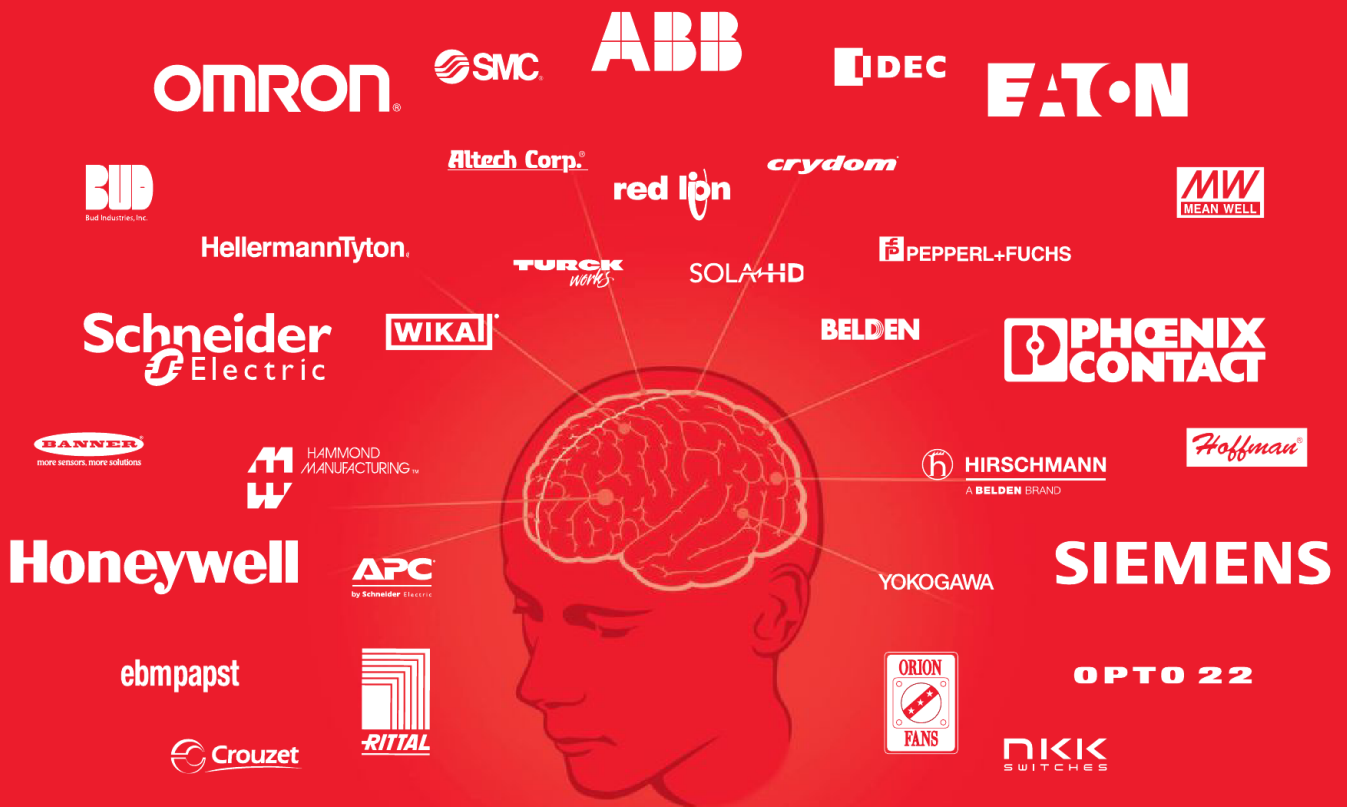
iOS 6.1+

Cost: \$9.99

Developer: pei yongyang

CAD Expert - for Floor Plans edition is a powerful and user-friendly floor plan creation tool for the iPad. Its intuitive, polished, and seamless interface makes creating floor plans on-the-go quick and easy. The user swipes one's finger across the screen to draw a room. In addition, the PDF compatibility and annotation features allow the user to import existing plans, add notes, and export files via e-mail.

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When secure data matters, use this modular industrial connectivity device

eWon introduces the Flexy, a modular and flexible industrial connectivity device featuring extension cards. Build the connectivity solution needed for each application and project; the base module allows four extension cards for connectivity: Ethernet/serial/MPI, WAN, Wi-Fi, Dialup, 3G and 4G.



A Belgian provider of remote access connectivity for industrial devices and sites, eWon is now introducing the Flexy, what it calls “the first modular and flexible industrial connectivity device featuring extension cards.” With the eWon Flexy, it is possible to build the connectivity solution needed for each application and project. The new eWon Flexy, the first modular industrial machine to machine (M2M) device available on the market, consists of a base module and a maximum of four extension cards allowing many connectivity options: Ethernet/serial/MPI, WAN, Wi-Fi, dialup, 3G and 4G.

“The modularity of the Flexy is designed to fulfill the need for flexibility that system integrators and OEMs [original equipment manufacturers] encounter daily on each project. Being able to easily adapt and take advantage of new, better, cheaper public infrastructure is an essential asset,” said Serge Bassem, eWon’s CEO.

The Flexy combine easy virtual private network remote access and data collection with one piece of hardware. It has

modularity to keep up with evolving communication technologies. Ethernet and serial ports with major programmable logic controller (PLC) protocols for connectivity with wide range of devices. Flexible apps, embedded alarms, data logging, remote access, and routing/web human machine interface (HMI) applications include easy Web-based configuration and programming tools for customization. The design is cost-effective: Buy only the needed modules. The eWon Flexy is compliant with Talk2M, the industrial cloud connectivity service hosted by eWon on multiple servers worldwide, and with eFive, a VPN server appliance, for real-time control applications. With full integration of IT security standards, the eWon Flexy and Talk2M VPN service enable a secure VPN connection to transfer data and perform troubleshooting operations with remote equipment without changes to IT network security settings at either end. **ce**

eWon

www.ewon.us

Programmable operator interface HMI has touchscreen, mobility updates

Fuji Electric Corp. of America introduces a series of next generation HMIs for the U.S. market; the Monitouch V9 Series Programmable Operator Interface HMI ranges from 8.4- to 10.4-in. and includes standard models to replace the V8 Series, and offers a step-up line known as V9 Advanced.

Fuji Electric Corp. of America introduces the next generation HMI model, a new series of human machine interface (HMI) products for the U.S. market. The Monitouch V9 Series Programmable Operator Interface HMI offers advanced features to reach new markets. The models range from 8.4- to 10.4-in. and include standard models to replace the V8 Series, while also offering a step-up line known as V9 Advanced. Fuji Electric committed to manufacturing the next generation HMI that would allow customers to select the appropriate model for their application, and the V9 Series offers them the option of choosing between a standard model and a more advanced unit. The Monitouch V9 also comes standard with a capacitive or analog resistive touchscreen, a remote monitor and updates for smartphones and tablets, a wireless LAN interface and access point. By including additional features such as a built-in VPN router, 6x processor

speed (800 MHz), and the ability to view PDF files and play video files, Fuji Electric aims to continue serving the evolving needs of its existing customer base while reaching new markets.

All models in the V9 Series are UL Certified. Select models will be Class 1 Division 2, NEMA 4X rated for outdoor environments, ideal for use in marine or oil and gas applications. A vibrant color display, dramatically increased processor speeds, and convenient search functions provide ease of operability. **ce**

Fuji Electric Corp. of America

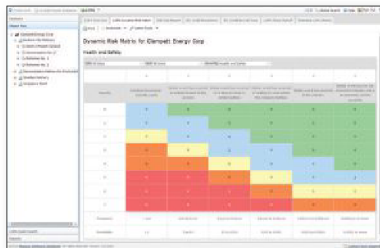
www.americas.fujielectric.com



Software reduces cost and resource strain of process safety and SIS management

Mangan Software Solutions (MSS) announces the launch of ProSys SLM, its newest generation of Safety Lifecycle Management software. The new product reduces cost and effort with automated and standardized workflows to execute compliance and engineering processes.

Looking for peace of mind surrounding your process safety program? ProSys SLM provides one source of truth for process safety information. It is designed to empower engineers and make their lives easier. Mangan Software Solutions (MSS) announces the launch of ProSys SLM, its newest generation of Safety Lifecycle Management software. The new product transcends traditional process safety database software with an integrated design to reduce cost and effort with automated and standard workflows to execute compliance and engineering processes. Real-time risk monitoring coupled with a unified ever-green database provides access to all process safety information in one platform; reporting tools and key performance indicators ensure accurate risk mitigation strategies; and modules for process safety management (PSM), safety



instrumented system (SIS), maintenance, and operations consolidate process safety information across the entire lifecycle.

Real-time risk monitoring and risk assessment functions that are integrated with built-in compliance and conformance functions facilitate informed decisions, aid in identifying gaps and allocating resources, and help reduce risk associated with a facility's safety lifecycle. MSS director of operations, Steve Whiteside, explained, "ProSys SLM was designed to take the complexity and expense out of safety lifecycle management while empowering engineers with the tools to identify risk gaps and influence organizational mitigation strategies." ProSys SLM provides instantaneous reports, monitors and measures performance continuously, and assists in optimizing the balance between risk and cost by providing tangible evidence of risk exposure. **ce**

Mangan Software Solutions (MSS)
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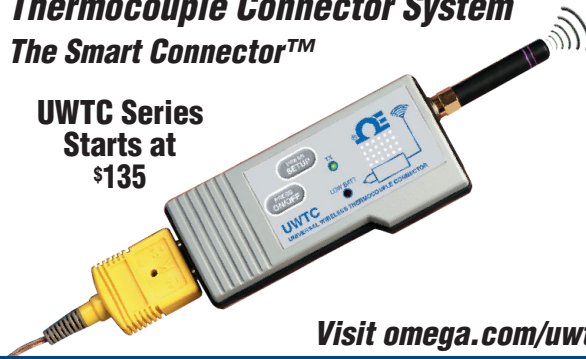


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Note: Because of transmission frequency regulations, these products may only be used in the United States, Canada, Europe, and China. (UWTC-1 and UWTC-1 may not be used in China.) Prices listed are those in effect at the time of publication and are subject to change without notice. Please contact OMEGA's sales department for current prices.

input #9 at www.controleng.com/information

Software-based, all-in-one instrument for benchtop testing

National Instruments VirtualBench has five instruments in one device with an innovative software experience. It integrates a mixed-signal oscilloscope, function generator, digital multimeter, programmable dc power supply, and digital I/O capabilities.

The NI VirtualBench is an all-in-one instrument that integrates a mixed-signal oscilloscope, function generator, digital multimeter, programmable dc power supply, and digital I/O capabilities. Users interact with VirtualBench through software applications that run on PCs or iPads. The device provides the most common functionality affordably and opens up new possibilities for how engineers can use benchtop instruments.

"Before, I didn't have the room or budget to buy a full setup for each bench," said Russell Stanphil, electronics advisor at Tech-Shop. "I can now park one laptop and a VirtualBench on each seat, replacing four to five boxes." Because VirtualBench uses today's consumer computing platforms, engineers and scientists can take advantage of the latest technologies like multitouch displays, multicore processors, wireless connectivity, and intuitive interfaces. The simplification and increased capability through

software leads to more efficient circuit debugging and validation.

Instruments included are a mixed signal oscilloscope (100 MHz bandwidth), function generator (20 MHz maximum output), digital multimeter (5½ digits), programmable dc power supply (3 outputs), and digital I/O capabilities.

Key benefits of this five-in-one device are that it takes up minimal space on a desktop or benchtop; simplifies instrument configuration through consistent, user-friendly interfaces; offers new capability and convenience with a consolidated view of multiple instruments, visualization on larger displays, and quick functionality to save data and screenshots; and integrates seamlessly with NI LabVIEW software.

The VirtualBench app for iPad is expected to be available in the App Store this summer. **ce**

National Instruments (NI)

www.ni.com/virtualbench



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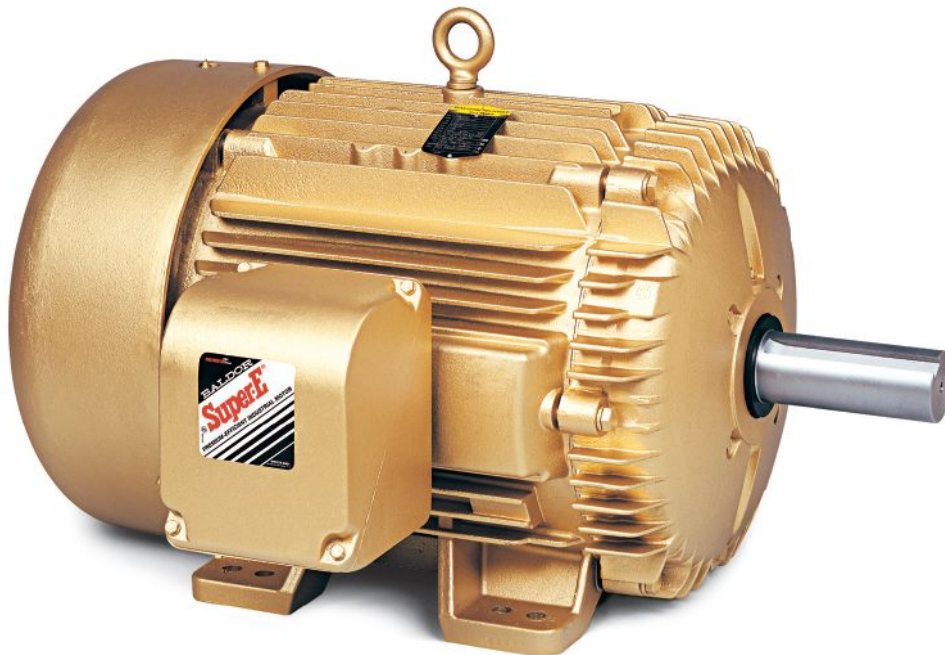
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60th Anniversary

Happy 60th, *Control Engineering*! Help us celebrate by looking at issues from 60, 30, and 15 years ago. *Control Engineering* magazine first published in September 1954. This monthly column in 2014 will review coverage in issues 60 (or 59), 30, and 15 years ago. Technologies have progressed since then, topics (technician training, global competitiveness, and women in engineering) remain relevant today.

JUNE 1955

Editorial—Needed: Technicians abroad

Domestic feedback to *Control Engineering* is clear cut. We are assured that the American frontiers of control are in development and application engineering. Letters from overseas, however, are troubled. In most of western Europe the advance of industrial activity and the problems incident to control are much like those in America. But in countries that are undergoing an industrial awakening, the situation is far different. In these countries control engineers constitute a small minority. Yet they are outspoken pioneers. Many have studied in the United States and in England. They say their problem is not in development and application but rather in the urgent need for technicians and maintenance men for their installations.

In the United States, basic training for technicians and mechanics is well established. The same could be true elsewhere. But who would set the necessary machinery in motion to accomplish this?



JUNE 1984

Trends in control—foreign control suppliers

A few years ago it seemed very likely that foreign control suppliers from Japan and Europe were getting into position to grab a substantial slice of the lucrative U.S. control market. Nobody was very surprised, what with the Japanese success in automotive and consumer electronics, and many of the domestic control companies were concerned at what they saw looming over the horizon.

Interestingly, with minor exceptions, this has not come about. Foreign control suppliers occupy visible positions in many product areas. There are quite a few joint ventures, and some domestic control suppliers have had products designed and sometimes manufactured for them overseas. But among the major control product categories, there is no obvious situation where a foreign supplier has gained a substantial share of market.

For the foreseeable future it appears the domestic industrial control business has successfully fended off foreign competition. The next obvious question is how well the domestic industry can do in the international marketplace.

JUNE 1999

Women in engineering gaining slowly, but steadily

Why aren't there more women in engineering? It might seem amazing now, but before Congress passed Title IX in 1972 requiring equal educational opportunities for men and women, many female high school students were not allowed to take auto mechanics, drafting, mechanical design, and other classes. Title IX was the first all-inclusive federal law banning discrimination based on sex in educational institutions, programs, and activities receiving federal funds.

Thanks at least partly to Title IX, "The number of women studying engineering increased dramatically after 1974. Undergraduate women, who made up less than 5% of the nation's engineering student population in 1974, increased to over 18% in 1993," says Jill Tietjen, PE, and director of the Women in Engineering Program at the University of Colorado, Boulder (UCB). She adds the number of female engineering students shot up to 15% in 1984, though gains have been smaller since then. In the workforce, 10% of engineers are women, she says.



See the *Control Engineering* history page:

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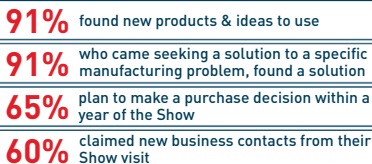
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INDUSTRIAL AUTOMATION & MDA NORTH AMERICA at IMTS 2014

From the renowned HANNOVER MESSE in Germany, Industrial Automation and Motion, Drive & Automation North America at IMTS provide attendees in the North American sector with a platform for innovations in process, production and industrial building automation, motion control, power transmission, and fluid technology.

Here are the reasons why you must attend:

- 1. Comprehensive event:** Industrial Automation North America will be co-located with IMTS and Motion, Drive and Automation North America to cover the entire product spectrum of the manufacturing industry.
- 2. Impressive numbers:** The 2012 event attracted a record-breaking 100,200 attendees and 91% of which found new products and solutions to implement in their business practices.



3. Latest technologies and solutions:

The event showcases industrial automation systems, microsystems technology, electrical systems, industrial IT & software, and other solutions to meet your manufacturing goals.

- 4. Network:** Attend to network with your fellow manufacturing and production engineers, sales and marketing professionals, corporate managers, designers and material buyers.

Meet buyers and decision-makers from the following user-industries:

- Machinery & Equipment
- Automotive/Transportation
- Government & Military
- Aircraft/Aerospace
- Construction & Mining
- Other Manufacturing Industries

- 5. Conference programs:** Will discuss optimization, plant improvement strategies, and best practices in increasing product efficiency and productivity.

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MDA Conference

MDA North America at IMTS

Tuesday, September 9, 2014 McCormick Place, Chicago

MDA
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Trends in Industrial Communications for the Factory of the Future

9:00 a.m. - 9:55 a.m.

As a real time Ethernet solution, the current generation of automation buses is making an important contribution towards "Smart Factory", the factory of the future. These automation buses allow machines, machine modules and peripheral devices such as control systems, servo drives, I/O modules and intelligent vision systems to be both flexibly and robustly connected to each other. Even safety related machine data can be transmitted over the same network infrastructure, so that additional wiring is not required any more. Hard real time capabilities play a key role as they guarantee that information is always available at the right time in the right place. Comprehensive, consistent and standardized profiles for different devices such as hydraulic, pneumatic or electric drives, encoders, control systems and I/Os enable facilities, production lines and individual machines to adjust to new demands in a short time and therefore increase machine performance by using 'Plug and Play'.

The presentation covers the following topics:

- Evolution of industrial communication
- Ethernet based communication systems – capabilities and realization examples
- Trends in industrial communication in the context of a smart factory

- Peter Lutz, Managing Director, Sercos International

Practical Application of 3D Machine Vision in Robotic Guidance, Motion and Inspection

10:00 a.m. - 10:55 a.m.

This conference session will present a thorough discussion of the application of 3D machine vision for industrial automation including robotic guidance, control of motion, and inline inspection of parts and assemblies. The session will educate attendees in the theory of 3D machine vision, and will examine the differences between various 3D imaging techniques as currently used in industrial applications. The speaker will detail several classes of 3D machine vision components available in the marketplace. The presentation will provide real-life examples of 3D imaging for machine vision, and how the technology is used in various applications. The speaker will also

present some advanced 3D concepts and components that have yet to be widely applied, but have potential for the future. The presentation will be targeted for engineering professionals and project/corporate managers with some experience in machine vision and a further interest in 3D technologies.

- David L. Dechow, Staff Engineer, Fanuc America Corp.

Best Practices for Specifying Linear Actuators

11:00 a.m. - 11:55 a.m.

Despite the performance improvement of control electronics and algorithms over the past decade or so to help mask deficiencies in linear actuator selection and application, it is still incumbent on the automation engineer to try to identify and provide the right set of parameters to better assure project success. To that end, the mnemonic A.C.T.U.A.T.O.R. has been created to aid and assist the system designer to remember to check for the minimum basic set of specifications to define a linear actuator. The mostly quantitative values that A.C.T.U.A.T.O.R. develops are independent of the primary motive force of the product and apply equally as well to conventional industrial hydraulic, pneumatic or electric linear actuators.

- Bob Ward, Product Manager, Rollon Corporation

Lunch Break

12:00 p.m. - 1:10 p.m.

Integrated Robotic Control into Machine Controllers

1:15 p.m. - 2:10 a.m.

Through the convergence well known controls principles, new machine designs are now possible that result in game changing advantages for machine builders and manufacturers. These benefits include reduced wiring, network and software platforms that are shared with the overall machine automation system and a significantly reduced machine footprint. This has led to the advent of higher performance mechatronic solutions for numerous applications including product packaging with variable product flow, complex material handling lines and many more.

- Matt Lecheler, Motion Specialist, Beckhoff Automation

“Function Integration” How It Saves Time While Increasing Productivity

2:15 p.m. – 3:10 p.m.

As modern production machinery becomes more complex it's natural to assume that the conversation between control systems and the devices that comprise these machines would also become more complex. In fact, innovative component manufacturers are simplifying these conversations by employing a philosophy called “function integration”. These “smart” devices often integrate the functions of several legacy devices, simplifying design, ordering, assembly, commissioning and maintenance. More importantly, they bring the data that these devices produce and consume together in a way that is intuitive for the users of the device. Additionally, the inherently integrated nature of these devices invites the application of more detailed, intuitive diagnostic systems. Detailed, plain text, real time descriptions of errors can be presented at the HMI level with very little additional programming work.

These features can result in increases in productivity for the end user. We will examine the various time savings that “function integration” can provide.

- Sean O'Grady, Product Manager, Festo Corporation

Inertially Optimized Motion Control System Drives New 3D Printer

3:15 p.m. – 4:10 p.m.

Learn about the development of a new 3D printing system based on an inertially matched variant of a parallel Delta mechanism. Robots based on the low inertia, high stiffness Delta mechanism have a proven track record in pick and place applications requiring high speeds, accelerations and positioning accuracies. The same basic design principles have now been applied to additive manufacturing, though not without novel mechanical modifications that optimize the inertial mass of the entire Delta mechanism.

- Mike Everman, Founder and CEO, Bell Everman

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Using the ANSI/ISA-62443 Standards to Secure Your Industrial Control System (IC32)

Course Hours: 8:00 a.m. – 4:00 p.m.

Length: 2 days (September 10-11)

Price: \$1,205 (ISA Member), \$1,510 (Non-member)

Description:

The move to using open standards such as Ethernet, TCP/IP, and web technologies in supervisory control and data acquisition (SCADA) and process control networks has begun to expose these systems to the same cyberattacks that have wreaked so much havoc on corporate information systems. This course provides a detailed look at how the ANSI/ISA99 standards can be used to protect your critical control systems. It also explores the procedural and technical differences between the security for traditional IT environments and those solutions appropriate for SCADA or plant floor environments. This course is required for the ISA99/IEC 62443 Cybersecurity Fundamentals Specialist Certificate Program. CEU/PDH Credits: 1.4/14.



For more information, please visit www.ia-na.com.

Global Automation & Manufacturing Summit (GAMS)

2014 Industrial Automation North America at IMTS
Wednesday, September 10, 2014 McCormick Place, Chicago

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KEYNOTE: Manufacturing Monitor Report

8:00 a.m. - 9:00 a.m.

Karen Kurek, principal at McGladrey, will discuss their exclusive Manufacturing Monitor Report for the first time since its August release and highlight the trends and challenges for manufacturing in the next two years.

Speaker: Karen Kurek, Principal, McGladrey

30 Years of Maintenance Excellence

9:15 a.m. - 10:15 a.m.

Process manufacturers must maintain equipment to maintain uptime, but that challenge is one they must meet daily. To achieve that kind of excellence for 30 years is a reflection on people, processes and evolving technology. We take a close look at how one global process manufacturer has met that challenge.

Speaker: Brandon Wheel, Alcoa/Allied Reliability

Plant Floor Connectivity

10:30 a.m. - 11:30 a.m.

Sometimes it's about making sure the data connects to workers. Sometimes it's about making sure the network itself is secure, connected and functioning. We'll go in-depth at one manufacturing facility that has found the way to achieve both.

Speaker: TBD, Molex

KEYNOTE: Legos Build Employee Engagement

12:00 p.m. - 1:30 p.m.

Expanding your manufacturing facility isn't usually something that becomes a team project with all of your

employees engaged. One Cincinnati manufacturer shows that employee engagement with such a project is like building a new facility: it happens one brick at a time.

Speaker: Mick Wilz, Sur-Seal Cincinnati

Using Mobility on the Plant Floor to Increase Productivity

2:00 p.m. - 3:00 p.m.

In an age when manufacturing is overrun with information, getting the right information to the right person at the right time is crucial. A new era of mobile devices has helped deliver the promise of greater productivity. With it comes the challenge of network security. Achieving both is possible, as we'll demonstrate.

Speaker: Matt Puskala, DMC

Integrating Logistics and MES

3:15 p.m. - 4:15 p.m.

In an automated material handling operation, tying system data back to your MES system becomes important. Its materials are in the right hands right when they need them, avoiding the need to carry stock or worse, be out of stock. It also allows you to deliver that stock to your manufacturing floor just in time.

Speaker: Rod Emery, RedViking

Networking Event

5:00 p.m. - 7:00 p.m.

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E-5040	ARGO - HYTOS Inc.	TBD	Meter Spa
TBD	Assofluid	E-5052	MFP Seals (A Division of Martin Fluid Power)
TBD	AS Aston Seals Spa	TBD	MGM Motori Elettrici Spa
E-4958	Belt Technologies Inc.	E-5085	NEUGART USA
TBD	Berarma Srl	E-4885	Nippon Pulse America
E-5030	Bimba Manufacturing Company	E-5059	Omativ North America
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TBD	Elettrotec Srl	E-5027	Thermal Transfer Products
E-5076	EZO SPB-USA, LLC	E-4924	THK America Inc.
E-4936	Festo Corporation	E-4535	TIMOTION
E-5079	FMC HYDRAULIC	E-5044	Tobul Accumulator, Inc.
E-5068	G H Binroth Co.	E-4401	Today's Energy Solutions
E-4401	Gear Technology	E-4401	Today's Medical Developments
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E-5096	GTEN Ball Screw Technology Co., Ltd.	E-5060	Tox Pressotechnik L.L.C.
E-4930	HAWE Hydraulics	E-4928	Wandfluh of America, Inc.
E-4836	HPB Motion Control Co., Ltd.	E-5088	Wepon Bearings, Inc.
TBD	ICE Agenzia per la Promozione all'Estero e 'Internazionalizzazione delle Imprese Italiane	E-4879	WITTENSTEIN
E-5026	IC Flow Controls, Inc. icotek GmbH	E-5050	Yarborough Precision Screws
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German Pavilion exhibitors will be confirmed by mid-June.

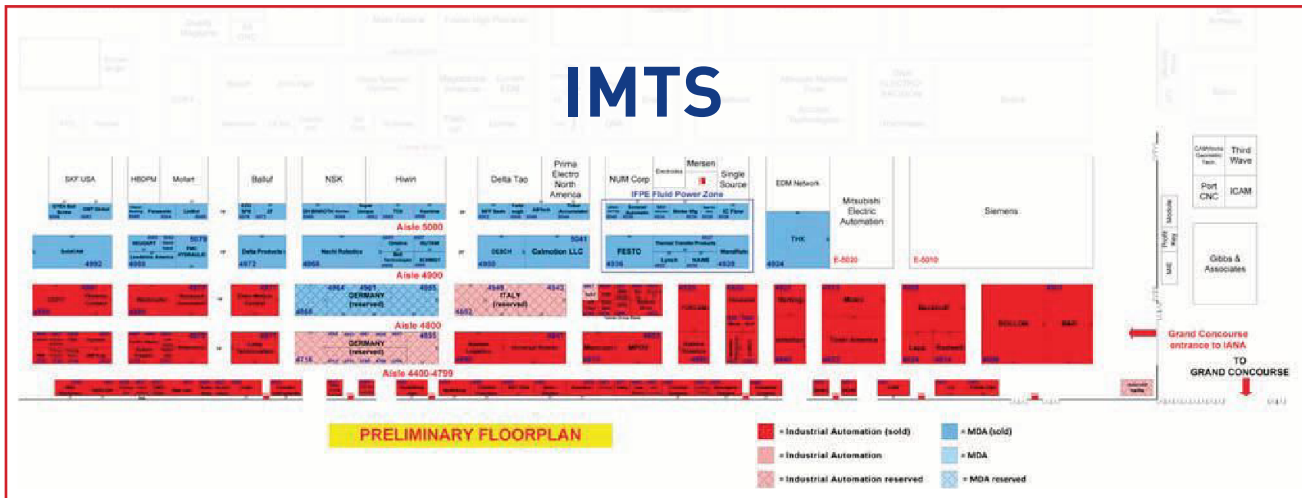
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Control Engineering Information Integration Study

According to the data in this report, engineers involved in information integration projects are seeing positive results despite a small project budget and personnel shortage.

Five key insights on information integration – benefits, challenges, resources, remote monitoring, and internal networks – are among findings in the *Control Engineering* September 2013 audience survey of those involved in information integration and those planning such projects soon. The study asked about information flow and why, how, and when information integration projects are done, project size and scope, and related trends. The five insights are:

1. Benefits: Some benefits from recent integration projects are better support for decision making (54%), more automated processes (48%), and an improved control of resources (43%). In fact, nearly half of all respondents who indicated high levels of integration between the manufacturing levels of their facilities said they were currently seeing the initial benefits and expected to see a continuous demand for integration.

2. Challenges: 46% of engineers agreed that a shrinking project budget is the greatest challenge they face when integrating operations, and another 41% find the shortage of personnel resources to be equally difficult.

3. Resources: The top five tools or resources used to establish and sustain integration are customized software (47%), system integrators (41%), browser-based interfaces (41%), off-the-shelf software (40%), and dashboards (32%).

4. Remote monitoring: According to the data, 25% of facilities allow management to routinely use mobile devices within the plant to upload manufacturing information, but 51% keep data isolated for security reasons and therefore cannot be accessed remotely.

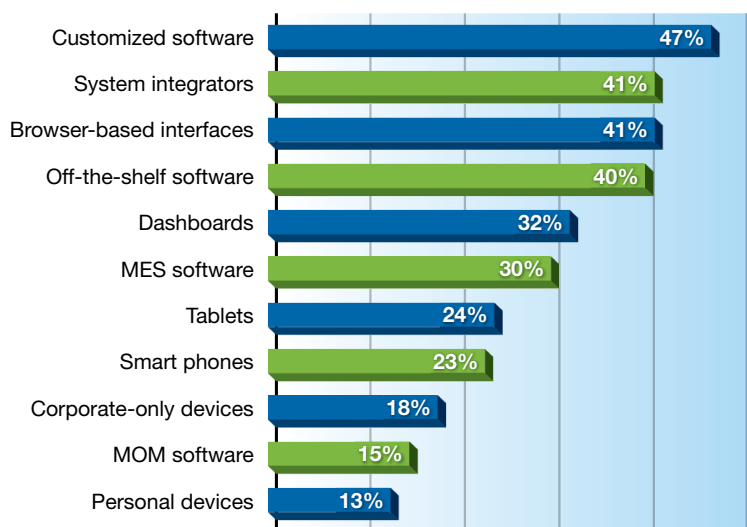
5. Internal networks: Half of internal wireless networks allow access to internal networks and the Internet from anywhere in their facilities, but 56% of respondents said that the concern for security has resulted limited avail-

ability of wireless communication. More than half of facilities' internal wireless networks are all in-house installations, and 74% have had no intrusions since defensive measures were placed. Internal networks were reported as the most common medium for exchanging information between corporate management and manufacturing (43%) and between manufacturing and the enterprise level (36%).

Access the full *Control Engineering* 2013 Information Integration report with additional findings and insights—including trends centered on levels of integration between the manufacturing areas of facilities—at www.controleng.com/ce-research. **ce**

- Amanda McLeman is director of research at CFE Media, Control Engineering.

What tools are you currently using to establish and sustain integration?



Nearly half of the study's respondents currently use customized software to establish and sustain integration while 40% use off-the-shelf software, 30% use MES software, and only 15% use MOM software.

Source: Control Engineering 2013 Information Integration Study

Boomers departing: A matter of integration

Baby boomers from manufacturing automation industries are taking knowledge gathered through years of experience into retirement. Scrambling to find qualified workers to fill that void has begun. System integration and related technologies are helping.

Key concepts



■ Skilled workers are leaving faster than new engineers are arriving.

■ System integrators can help fill the skills gap.

■ Automation tools can help capture knowledge in automation and control systems.

When Bruce Gibbens walks through one of his client's tomato processing plants, he knows things are running right just by listening to the hum of the machinery. The process tells all.

"By the noise you hear in the plant, you can tell if the plant is speeding up or slowing down," said Gibbens, president of the Temecula, Calif.-based Practical Controls LLC.

"As an integrator," Gibbens said, "I can feel the pulse of the plant just by being there. I don't have the knowledge of whether that is a good sound or a bad sound. The guys that work there all the time, they can say, 'We are going too fast; we have got to slow the process down.'"

What Gibbens knows—and the rest of the industry is trying to come to grips with—is that the knowledge gathered through years of experience by baby boomers is leaving the manufacturing automation industries; people are scrambling to find qualified workers to fill that void.

The unknown part is with a scarcity of engineers to fill the openings, and with manufacturing

driving the U.S. and global economic recovery, just who and what will fill that expertise walking out the door? That gap is where systems integrators will provide human and technical knowledge to a manufacturing enterprise.

"A lot of [boomers] are going to be leaving," Gibbens said. "It can go two ways. The people that are going to take over are going to be less knowledgeable and have less experience—and they may have to lean on external resources more than relying on the people that are leaving. They may have to reach out to systems integrators and seek advice for their control system and outdated control systems for upgrades and the knowledge for helping them in what they need in their plan. Or, a lot of these plants are trying to be lean and mean, and they may try to do some of that stuff in-house."

Documenting tacit knowledge

"A lot of what we do is talk to senior management people and document everything they know: documenting the processes, documenting the information they use, going out and finding the trends for things that they have done, and understanding why they made the decisions they made," said Emmett Moore, product manager at the systems integrator Cimation in Houston.

"With that type of knowledge—and us in the field working with these guys—we have learned the experience, but we are trying to use more of an analytical and engineering approach to really find out why these guys have done the things they have done. Why does an operator at a control station push this button at a certain time? Let's build that into the product itself."

That all means systems and tools will need to be more intelligent. It also means technology will take a higher share of the workload so the new generation coming in dealing with the new manufacturing paradigm will feel more at ease with proper training. Having software-driven systems in place that already have the intelligence to measure and assess the situation and take corrective actions automatically will ease the generational



Manufacturers require a more intense and robust form of automation. Tony Paine, president and CEO at communications software developer Kepware Technologies, explained: "If vendors and systems integrators are doing their jobs right, then we are building solutions that can let people know when something is running normally; or, if there is an abnormal condition, what is the reason for the abnormal condition?" Courtesy: Kepware Technologies

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“If I have components that have physical connectors that look like they should match and they can hook together, then they better darn well work behind the scenes with little or no configuration.”

shift. But this change doesn't happen automatically. Companies need to recognize it and understand it is an opportunity to allow for change.

“If vendors and systems integrators are doing their jobs right, then we are building solutions that can let people know when something is running normally; or, if there is an abnormal condition, what is the reason for the abnormal condition?” said Tony Paine, president and CEO at communications software developer Kepware Technologies.

“The younger generation coming into the workforce doesn't know everything that someone with 30 to 40 years of experience knows. What we can do is make their life easier through diagnostic tools, asset management tools, and condition-based monitoring tools. If we can create our magic such that we can team up with other companies or team up with systems integrators to put their touch on it, that problem goes away,” Paine said.

Plant evolution

From pneumatics and boards to PLCs, tablets, and smart devices, technology has changed the concept of how plants and people work. Take a midstream gas plant that came on line 40 years ago. That plant developed over 40 years of data and the people working with those assets are leaving, Moore said.

“We are not losing everything,” Moore explained. “We are losing the people that have worked on it from the beginning. So, instead of working with pneumatic controls [from 40 years ago], you have electronic controls and you have RTU modules and you have all the instrumentation that is collecting information. When you start analyzing it, we get more information out of these facilities than they ever knew existed. We view advanced process control as something an operator could never do by himself when he could turn valves by push button.... Yes, knowledge is leaving, but we have already collected it and built it into the process.”

That is only part of it. As manufacturers rely more on automation and try to get along with fewer engineers, they will need more robust tools to communicate with the disparate systems and protocols in the manufacturing enterprise.

“In the past 10 to 15 years, it was really hard to get an [Rockwell Automation] Allen-Bradley control system to talk to a Siemens control system and vice versa,” Gibbens said. “Because you have the different manufacturers out there, you will need the systems to be able to communicate to one another.”

That means to be able to automate to a

higher level, get the most out of the system, and create more products, it will become more important to have software that allows systems to communicate to a higher degree.

“You have associations like the OPC Foundation pushing for information to share between devices or between devices and software applications,” Paine said. “We have the *de facto* standard that everybody should implement and buy into so everybody can play with no configuration and automatically discover what is available from another data source. That will give more context to that data.”

Gibbens said, “Allowing ways to go ahead and be able to talk from different software and hardware platforms—and be able to connect them—is going to become bigger and bigger. OPC is the layer that will bring a lot of these systems together. As systems go along and you need to communicate between various things, there will be more use of that interoperable software in the future.”

Automation means security

Connecting systems does create potential for a cyber security incident, however.

“Security has come to the forefront of everybody's mind because businesses are demanding access to data at any time from anywhere,” Paine said. “Anything that can have an influence on the control system, they want to monitor. So when you start thinking about mobile, big data, and the Internet of Things, you are starting to get the market to realize there has to be a shift in how we expose our control systems.”

When the boomers first came on the job 30 to 40 years ago, no one had to worry about cyber security. The manufacturing floor was its own island. Now, “we are doing vulnerability research on products that are already out there,” Moore said. “We are testing these products and working with vendors to patch the vulnerabilities as soon as possible. Once we find a vulnerability, we are working with clients to create mitigation techniques that allow us to protect them until a patch comes out.” In a sense, it could be an easier and more secure transition with the new generation coming on board.

“The younger generation is basically used to the consumer technology that is available today. It is plug and play. It just works,” Paine said. “There is going to be an expectation: if I have components that have physical connectors that look like they should match and they can hook together, then they better darn well work behind the scenes with little to no configuration.” **ce**

- Gregory Hale is editor and founder of *Industrial Safety and Security Source* (ISSSource.com). Edited by Mark T. Hoske, content manager, Control Engineering, mhoske@cfemedia.com.



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This article is posted in June archives has more demographics, and integration details.

Control Engineering Information Integration Study and the Salary and Career Survey at

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Information Integration newsletter at

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Answers for industry.

Reducing harmonics with IEEE 519 practices, procedures

Industrial facilities should include a system evaluation, including a harmonic distortion analysis, while planning facility construction or expansion. Vendors of nonlinear loads, such as variable frequency drives, can provide services and recommend equipment that will reduce harmonics to comply with IEEE 519.

Key concepts



- With increased use of nonlinear loads, the issues of power supply harmonics are more noticeable than ever.
- Industrial facilities should include a system evaluation, including a harmonic distortion analysis, while planning facility construction or expansion.
- Vendors of nonlinear loads devices, such as variable frequency drives, can provide help to comply with IEEE 519.

With increased use of nonlinear loads, power supply harmonics are more noticeable than ever. Controlling and monitoring industrial system designs and their effects on utility distribution systems are potential problems for the industrial consumer, who is responsible for complying with the IEEE 519 recommended practices and procedures.

Industrial facilities should include a system evaluation, including a harmonic distortion analysis, while planning facility construction or expansion. Vendors of nonlinear loads, such as variable frequency drives, can provide services and recommend equipment that will reduce harmonics to comply with IEEE 519 guidelines.

Generally, at any point of common coupling (PCC), the measured value of total harmonic voltage distortion should not exceed 5% and that of any individual harmonic voltage distortion should not exceed 3% of the fundamental value of the line voltage. Normally, in typical applications, the harmonics are measured up to 25th order, but in critical applications, those are measured up to 50th or 100th order.

There are many harmonic mitigation methods available for individual applications (for example, per drive) and for “global mitigation” (such as a common harmonic mitigation solution for a group of nonlinear equipment). A particular type of harmonic mitigation solution can be used depending upon the application and desired level of attenuation to meet the limits given in IEEE 519.

Control of harmonics, IEEE 519-1992 Guidelines

IEEE 519 was initially introduced in 1981 as an “IEEE Guide for Harmonic Control and Reactive Compensation of Static Power Converters.” It originally established levels of voltage distortion acceptable to the distribution system for individual nonlinear loads. With the rising usage of industrial nonlinear loads, such

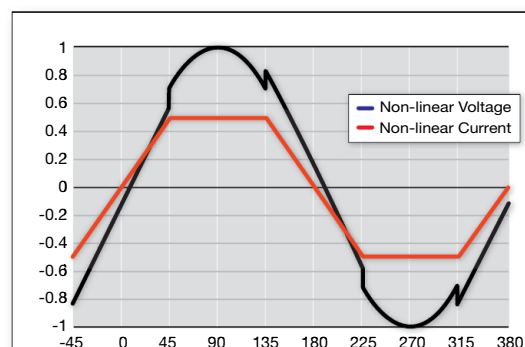


Figure 1: Voltage and current waveforms of a nonlinear load: A load is considered “nonlinear” if its impedance changes with the applied voltage. Due to this changing impedance, the current drawn by the non-linear load is also non-linear (non-sinusoidal in nature, even when it is connected to a sinusoidal voltage source (for example computers, variable frequency drives, discharge lighting, etc). Non-sinusoidal currents contain harmonic currents that interact with the impedance of the power distribution system to create voltage distortion that can affect both the distribution system equipment and the loads connected to it. IEEE 519-1992 defines harmonic as a sinusoidal component of a periodic wave or quantity (for example voltage or current) having a frequency that is an integral multiple of the fundamental frequency. All graphics courtesy: Siemens Industry Inc.

as variable frequency drives, it became necessary to revise the standard.

The IEEE working groups of the Power Engineering Society and the Industrial Applications Society prepared recommended guidelines for power quality that the utility must supply and the industrial user can inject back onto the power distribution system. The revised standard was issued on April 12, 1993, updating the 1992 version of IEEE 519 that established recom-

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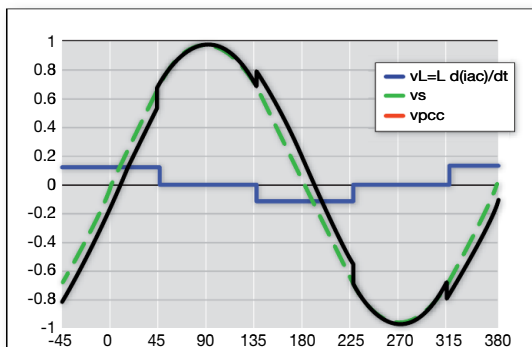


Figure 2: Graph shows distorted voltage waveform at the point of common coupling (PCC). The distortion in the waveform for voltage at the PCC (V_{pcc}) is due to the flow of nonlinear current through the finite system impedance. The notches in the voltage wave are caused by the commutating action of the rectifier. Ideally, when the rectifier is fed from an infinite source, the current wave shape is rectangular and voltage notching does not occur.

Bus voltage at PCC	Individual voltage distortion (%)	Total voltage distortion THD (%)
69 kV and below	3.0	5.0
69.001 kV through 161 kV	1.5	2.5
161.001 kV and above	1.0	1.5

Note: High-voltage systems can have up to 2.0% THD where the cause is an HVDC terminal that will attenuate by the time it is tapped for a user.

Figure 3: Voltage distortion limits is Table 11.1 within IEEE 519-1992; it defines the voltage distortion limits that can be reflected back onto the utility distribution system. Usually if the industrial user controls the overall combined current distortion according to Table 10.3 (online), this will help meet the limitations set forth in the guidelines.

mended guidelines for harmonic voltages on the utility distribution system as well as harmonic currents within the industrial distribution system. According to the standard, the industrial system is responsible for

Evaluation of system harmonics

To prevent or correct harmonic problems that could occur within an industrial facility, an evaluation of system harmonics should be performed if:

- A plant is expanded and significant nonlinear loads are added
- Power factor correction capacitor banks or line harmonic filters are added at the service entrance or in the vicinity
- A generator is added in the plant as an alternate stand-by power source
- The utility company imposes more restrictive harmonic injection limits to the plant.

Often, the vendor or supplier of nonlinear load equipment, such as variable frequency drives, evaluates the effects that the equipment may have on the distribution system. This usually involves details related to the distribution system design and impedances, similar to performing a short circuit study evaluation. **ce**

- Nikunj Shah is with design engineering, low-voltage drives, Siemens Industry Inc. Edited by Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.

A IEEE 519 revision includes changes based on the significant experience gained in the last 20 years about power system harmonics.

controlling the harmonic currents created in the industrial workplace. Since harmonic currents reflected through distribution system impedances generate harmonic voltages on the utility distribution systems, the standard proposes guidelines based on industrial distribution system design.

In 2004, an IEEE working group named "519 Revision Task Force (PES/T&D Harmonics WG)" was created to revise the 1992 version of IEEE 519 (Recommended Practices and Requirements for Harmonic Control in Electric Power Systems) and develop an application guide IEEE 519.1 (Guide for Applying Harmonic Limits on Power Systems).

A revision to IEEE 519 includes the changes based on the significant experience gained in the last 20 years with regard to power system harmonics, their effects on power equipment, and how they should be limited. In addition, this document contains certain material dedicated to the harmonization of IEEE and other international standards where possible.

The application guide IEEE 519.1 contains significant rationale for and numerous example scenarios of the limits recommended in IEEE 519 and provides procedures for controlling harmonics on the power system along with recommended limits for customer harmonic injection and overall power system harmonic levels.

Both documents, revised IEEE 519 and the application guide IEEE 519.1, are considered complementary.

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...in the June online archives, this article explains various harmonic mitigation methods, provides references, and adds 7 more online figures for connections of passive harmonic filter, 12 pulse converter front end, 18 pulse converter front end, active filter, and active front end, along with a values table of harmonics corrections for different types of front ends.

Consider this...

How are you controlling and monitoring industrial system designs and their effects on utility distribution systems? Are you paying fines to your utility or controlling harmonics?



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Ensure network availability in an industrial environment

Industrial grade cables can improve the long-term performance and reliability of industrial networks, explained Loredana Coscotin, product marketing manager for Industrial Cable EMEA at Belden, in a *Control Engineering Europe* article.

Industrial plants rely heavily on their automation, instrumentation, and control data communications to relay signals between devices, machinery, and the control system to activate events on an exacting and predetermined schedule, with little or no margin for error. Belden conducted a series of tests to compare the physical and electrical performance of commercial off-the-shelf (COTS) cables with industrial cables. The results clearly indicate why a commercial grade cable is never suitable for the variety of extreme conditions that can apply in an industrial environment. The tests included:

■ **Abrasion:** Using a fixed drum

covered with sandpaper, cables were stretched across a portion of their circumference and then moved back and forth cyclically for 25 cycle counts. The conductors of the commercial grade cables could be seen through breaks in the jacket, which would cause it to lose mechanical and electrical integrity. The conductor pairs of the armored industrial cable were not compromised.

■ **Cold bend:** Conducted according to UL 444, samples of cables were left in a controlled temperature and humidity chamber. They remained there for one hour prior to testing. They were then tested (at -80, -60, and -40 C) by being

partially wound around a 3-in.-diameter horizontal mandrel with one end of the cable under tension from an aluminum weight. The commercial grade cables became brittle and showed visible cracks. The industrial grade high/low temperature cable showed no visible damage.

■ **Cold impact:** Conducted according to UL 444, an aluminum weight was dropped down a hollow guide-tube to smash against a segment of the cable under test. The impact force delivered 24 in.-lb or 2.7 joules of impact energy. Each length of cable had been previously cooled. A total of 10 samples were inspected at a series of increasingly lower temperatures to determine if the cable jackets' integrity was damaged, which could allow ingress of chemicals and moisture and could potentially lead to a conductor-to-conductor short or catastrophic failure. The standard commercial grade jacketed cable failed at -20 C. The industrial grade cables, protected by high-low temperature jackets, did not crack until impacted at -70 C.

Other comparison tests preformed were crushing, cut-through, high temperature, oil resistance, UV exposure, and water immersion.

(See the results from these tests, along with additional information about rugged versus COTS cables, in this article posted online. Information is below about how.)

Use cables specifically designed for manufacturing environments, with in-design, tested performance. **ce**

- Edited by Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com, from Control Engineering Europe, Suzanne Gill, editor.



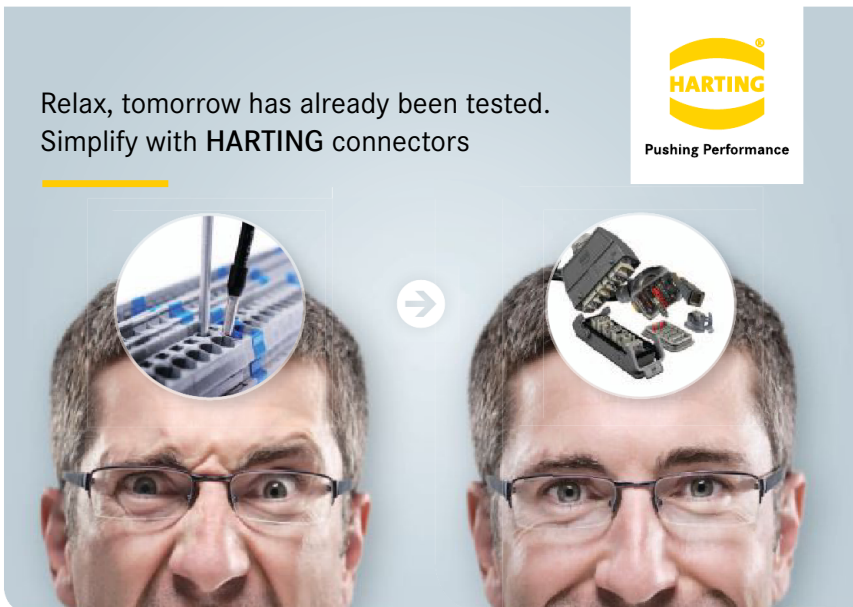
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Verification is not validation

Know the 5 steps of the functional safety lifecycle. To perform functional safety and comply with safety standards like ISO 13849-1 and ISO 13849-2, design engineers need to know how to perform verification and validation measures; they are not the same step.

To perform functional safety and comply with safety standards like ISO 13849-1 and -2, design engineers need to know how to perform verification and validation measures. But aren't they the same step? NO!

Best-in-class companies are generally adopting the "lifecycle" design model when approaching functional safety design requirements. The graphic shows the functional safety lifecycle:

1. Perform risk assessment
2. Examine functional requirements
3. Design and verify mitigation
4. Install and validate
5. Manage, change, and improve.

ISO 13849-1 requires that during the design stage a verification step is performed (Lifecycle step #3). For example, see clause 4.7 on page 26 of the standard [talking about Safety Related Parts of The Control System (SRP/CS)]:

4.7 Verification that achieved PL meets PLr

"For each individual safety function the PL of the related SRP/CS shall match the required performance level (PLr).... The PL of the different SRP/CS which are part of a safety function shall be greater than or equal to the required performance level (PLr) of this safety function."

Validation is a different step. While verification is often performed by someone other than the original designer during the design phase, validation is performed during the build and/or installation stage (Lifecycle step #4). The goal of validation is to acknowledge that the required safety function is achieved for any one hazard in all modes of operation. See clause 8, page 41:

"The design of the SRP/CS shall be validated (see Figure 3). The validation

Functional Safety Life Cycle



In the functional safety lifecycle, has much to teach us about machine safety process. Courtesy: Control Engineering Machine Safety Blog, JB Titus & Associates

shall demonstrate that the combination of SRP/CS providing each safety function meets all relevant requirements of this part of ISO 13849. For details of validation, see ISO 13849-2."

Requirements above are for the safety related parts of the control system (SRP/CS) for a machine's overall control system. ISO 13849-1 and -2 also cover the software of a control system, which includes requirements for verification and validation of application software for all safety functions. I think this information can help clear up possible confusion over the terms "verification" versus "validation" for functional safety applications. **ce**

- J.B. Titus, Certified Functional Safety Expert (CFSE), writes the Control Engineering Machine Safety Blog.



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See this post, link to more about machine safety, and add your thoughts about verification, validation, and the functional safety lifecycle; leave your comments online.



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ERP can improve project controls and bottom line

While those dealing with automation, controls, and instrumentation may have considered enterprise resource planning (ERP) as a faraway system that may exchange some data points with the plant floor, ERP also can be an enabling platform for plant-floor mobility applications. At the 2014 CSIA Executive Conference, Erik Johnson, vice president technical strategy, Epicor Software Corp., suggested that plant floor automation and connected systems can be more efficient by using mobile, social, and cloud technologies as part of an enabling ERP architecture.

In his April 25 session, "Innovating with ERP: Improving Your Project Controls and Bottom Line," Johnson suggested that company CEOs are focused on innovation to drive business growth and see technology as a critical factor toward capturing that innovation. Tech-

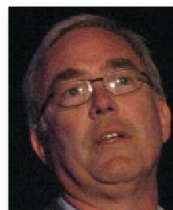
nologies supporting mobile, social, and cloud-based applications can transform business and processes and drive innovation. Johnson said:

■ **Information technology (IT)** spending on technology can separate winners from losers, according to a Harvard Business Review article.

■ **New technologies** in the right hands are creating huge advances and saving costs. Using a 3D printer, the medical profession can print a model of bones in a week, from x-rays, for about \$150, versus weeks for thousands of dollars, previously.

■ **Future factories** will be assembled, owned, and operated by individuals in multiple companies, with production orders arriving via smartphone applications, like people order pizzas via text messages now.

■ **ERP** is more relevant for the plant



At the 2014 CSIA Executive Conference, Erik Johnson, vice president technical strategy, Epicor Software Corp., suggested that plant floor automation and connected

systems can be more efficient by using mobile, social, and cloud technologies as part of a connecting architecture.

Courtesy: Control Engineering

floor as devices are overriding the PC client as the primary user interface.

■ **Twitter showed people** how pull messaging works, as opposed to push messaging. Personalized feeds of what people see can easily be changed daily, and this model can be used for plant floor applications, where those involved subscribe to information related to a project for a designated time period.

■ **An example from Flickr** shows how social media can be used inside an organization's supply chain for a project. Searching in Flickr on Dubai shows about 195,000 photos from 400 contributors, and about 80% were from 30 people. Depending on project goals, one could use this to hire the most productive (80/20 rule) or select the best few by quality, from the long tail of other photographic contributors.

■ **Following the adage**, "you cannot manage what cannot measure," new tools can quickly assemble resources to resolve issues or take advantage of opportunities that traditional systems didn't anticipate ahead of time. Analytics can be available to be more of a self-serve model, as needed. A globally diverse group of individuals in an organization may assemble using social-media-like tools supported by an ERP architecture, quickly solve a problem, and then disappear into the history books after those involved are done, he suggested.

- Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.



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Developments to watch:

Google Glass



Mark T. Hoske tries Google Glass. Functions include voice recognition, touch pad on the wide side to navigate, camera, video, Internet access, search, e-mail, and other apps. Courtesy: Control Engineering

Thinking this might be a possible future for human-machine interfaces, I tried Google Glass at our local Gail Borden Public Library, which bought them for \$1,500. During heavy use by many patrons during a three-hour session, Google Glass needed to be charged twice. When it was my turn, I asked Google Glass to go to the *Control Engineering* website. It searched for troll engineering. I obviously started speaking too soon. I found images in the viewer to be small. I didn't have time to try more functions, such as pairing with an Android or iOS device. Wider use of mobile, Internet-connected computers integrated into eyewear is a development to watch. It's likely to improve productivity some manufacturing applications. Learn more with this article online and at <https://support.google.com/glass>.

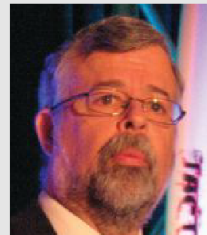
- Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.

Borrow, invest, expand, grow: Advice for system integrators

Control system integration firms should be full of optimism and action; 2014 can work to the advantage of firms proactive to larger economic expansion anticipated for 2015 and beyond, according to Alan Beaulieu, president, Institute for Trend Research, at the CSIA Executive Conference in April in San Diego.

Beaulieu said the U.S. is accelerating in its economic growth, with record levels of gross domestic product (GDP) and consumer spending. The U.S. is in a strong position. The worst that will happen is that the rate of growth will slow later this year and early in 2015, to perhaps 1.4% growth rate. The growth in 2013 will be hard to duplicate through the next couple of years. But the economy is healthy and vibrant, and there are opportunities. In general, leading indicators are pointing up, and the world is in relative calm. Our industries cannot find enough people with the right skills and right attitude. Wage inflation competing for the best talent will lead to real inflation eventually.

See other trends and advice with this article online, under June, at www.controleng.com/archives.



Alan Beaulieu, president, Institute for Trend Research, spoke at the 2014 CSIA Executive Conference. Courtesy: Control Engineering



The Next Generation HMI

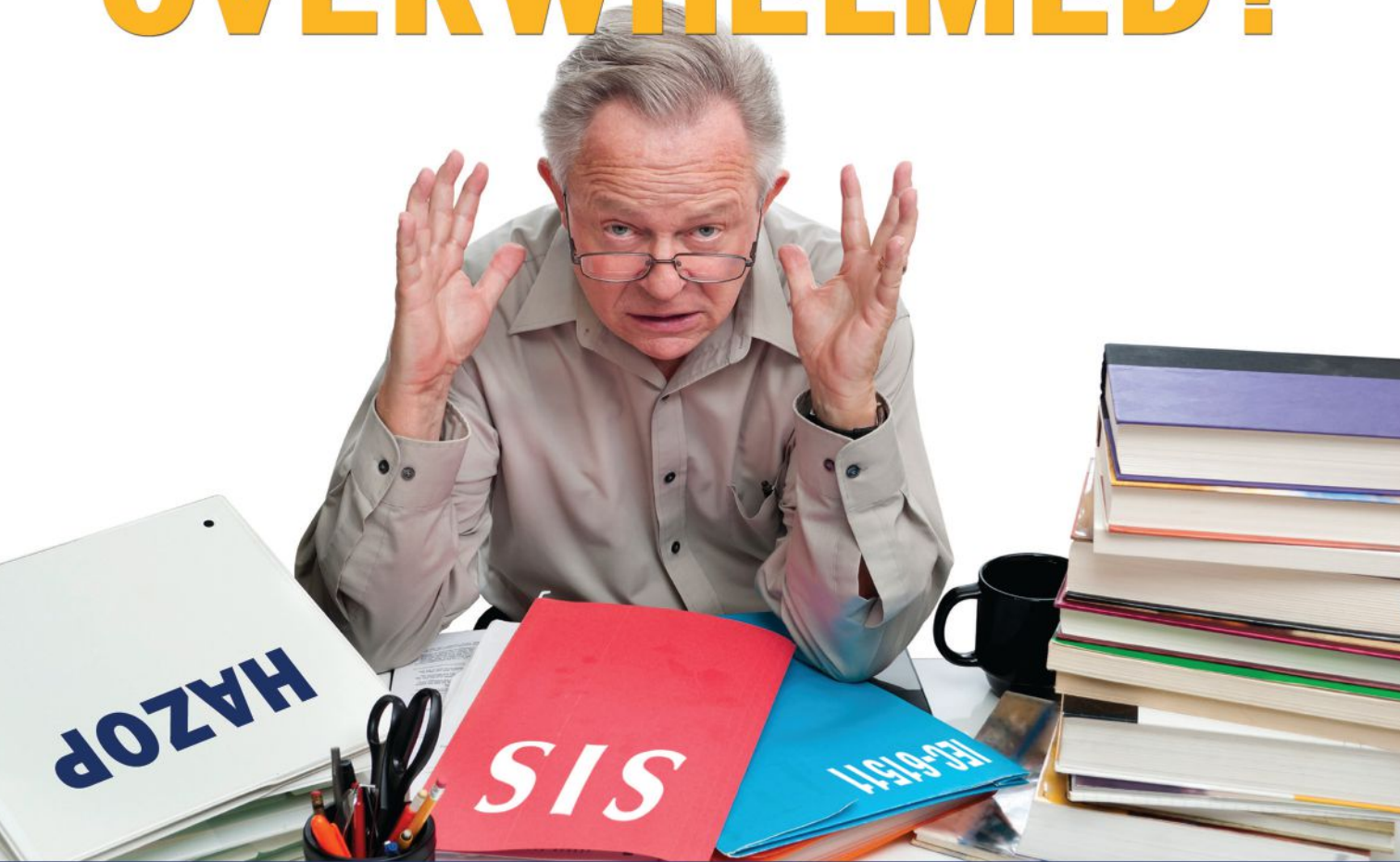
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Creating an ASM-compliant HMI goes deeper than screen color selection

Simply adopting ASM guidelines for graphics does not create an ASM-compliant HMI. Achieving that level of effectiveness involves a wider range of factors that address how people interact with the control system.

Key concepts



- HMI designers often believe, incorrectly, that ASM HMI guidelines only deal with color selection.
- Effective HMI design has to begin with understanding the factors that affect how humans interact with control systems.
- ASM guidelines, when implemented effectively, can facilitate major improvements in operator response time and decision-making accuracy.

One of the most common misunderstandings and misapplications of the ASM Guidelines on effective console operator HMI (human-machine interface) design has been an over-emphasis on simply applying a new color palette to all the existing displays for a console position. This is often called a like-for-like HMI migration project. In such projects, there may or may not be improved display style and display layout practices, which would be consistent with the ASM Guidelines as well. One might expect such a like-for-like color palette change project to convert the display in Figure 1a to the one in Figure 1b. Typically, when the distributed control system (DCS) HMI is not based on an effectively designed display hierarchy for the console operator position's span-of-control, the result is a flat, wide DCS display system where most, if not all, displays are most accurately characterized as P&ID (piping and instrumentation diagram) detail displays. When given such a DCS display system, console operators will typically use their DCS screens as shown in Figure 2, where each individual console operator picks his or her favorite Level 3 equipment displays, along with the alarm summary display. At best, if the developer has correctly applied the guidelines on use of color and followed good display layout principles, the migrated DCS display system might have ASM-compliant individual Level 3 displays, but the DCS HMI would not be ASM compliant.

What does compliance involve?

Applying the ASM guidelines for HMI design is more than converting color palettes

to a grayscale design and eliminating color for everything but alarms. In fact, the guidelines advocate effective use of color, which includes properly specified display backgrounds that are much lighter in hue than is typically in vendor-supplied HMI libraries that claim ASM compliance. However, to have an ASM-compliant HMI, the other guideline categories, in particular display types, display content, and navigation and interaction, need to be implemented as well. This would require, among other implementation details:

- Designing the display hierarchy based on major steps of operation to support operator mental models
- Designing effective Level 2 control and monitoring displays consistent with the display hierarchy so that these Level 2 displays support day-to-day operations
- Identifying the Level 1, 2, 3, and 4 display content based on requirements analyses with subject matter experts so the HMI supports proactive operator situation awareness, day-to-day monitoring and control operations, troubleshooting activities, as well as abnormal situation management
- Designing the previous navigation strategy to a method based on the redesigned hierarchy, using simple, on-screen navigation targets to support operator mental models and quick, error-free use
- Eliminating pop-up displays that cover up operating display content and instead using windows management techniques that assign different display types to specific locations and predefined sizes, and

- Providing simultaneous view of Level 1 overview displays, such as a KPI overview and trending overviews, Level 2 monitoring and control displays, faceplate(s), scratch-pad trending, and alarm summary details (Figure 3), rather than approaching the HMI design as a single screen, single display system (Figure 2).

The guidelines are about more than simply using gray backgrounds and restricting the use of color. Color was only one of 16 categories of guidelines in the original edition. The intent of the ASM HMI guidelines has always been to design an operator HMI framework that supports both proactive operator situation awareness and effective interaction. The second edition (Bullemer & Reising, 2013) shifts the emphasis strongly to the display hierarchy, its role in operator situation awareness, and its role as the basis for operator interaction and navigation. This emphasis led to the removal of the term “display” from the second edition’s title to stress the holistic, Effective Console Operator HMI Design. While the ASM guidelines do address the design of individual displays, the overall HMI design framework promoted by the ASM guidelines requires multiple displays at different levels of detail on a console workstation with multiple screens and interaction devices to support the scope of the operator’s job.

The recent migration to wide-aspect ratio (WAR) screens is creating opportunities to migrate more directly to an ASM-compliant HMI. In particular, if the migration project abandons the typical single-screen, single-display approach, then the extra pixels in WAR screens provides a place for the HMI to house defined locations for faceplates, trending windows, and Level 4 displays that would otherwise be a pop-up display over the full-screen operating display (Figure 4).

Operator situation awareness

The vision of the ASM Consortium is: operating teams who are empowered and enabled to proactively manage their plants, maximizing safety and minimizing environmental impact while allowing the processes to be pushed to their optimal limits. The overriding objective for effective operator HMI design practices is to enable the operator to manage manufacturing processes proactively, optimizing the plant performance while simultaneously preventing the occurrence of abnormal situations. Moreover, when abnormal situations do occur, the objec-

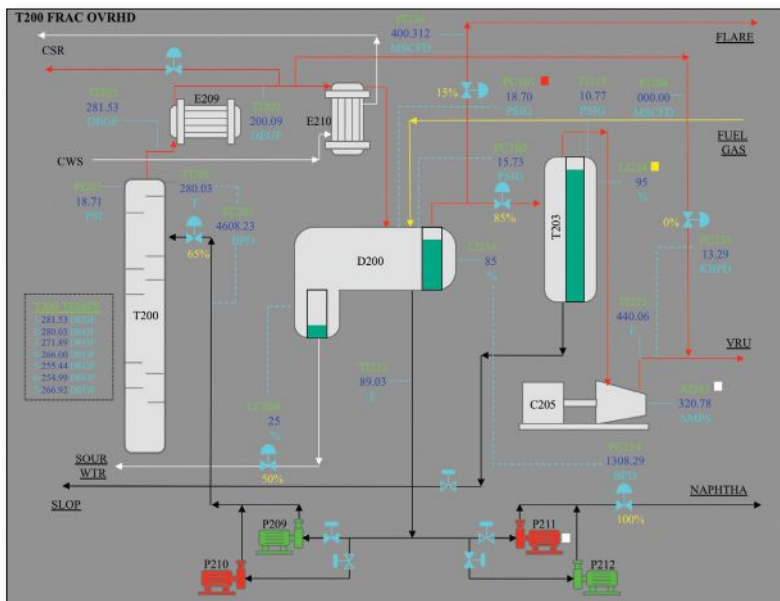


Figure 1a: Existing display, prior to like-for-like color palette migration project. All graphics courtesy: Human Centered Solutions

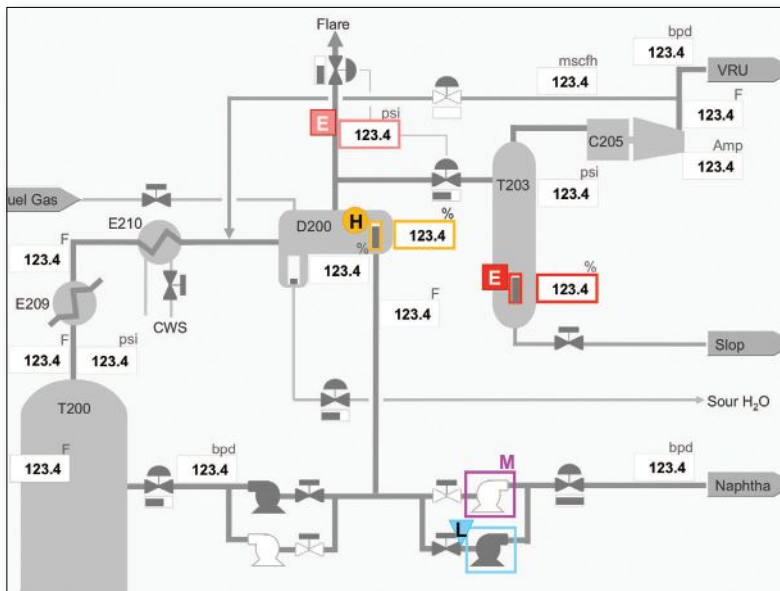


Figure 1b: Migrated display, with some basic layout principles applied.

tive is to enable the operator to recognize the current situation, quickly bring the plant to a safe state, and then return the plant to normal operations.

The link between proactive operations and the console operator HMI is the operator’s situation awareness. Continually updating operator situation awareness, understanding the state of the process and equipment, and, as a result, taking appropriate control actions—before alarm limits are reached—is the essence of being pro-



Figure 2: Typical console screen use with a like-for-like HMI migration project.

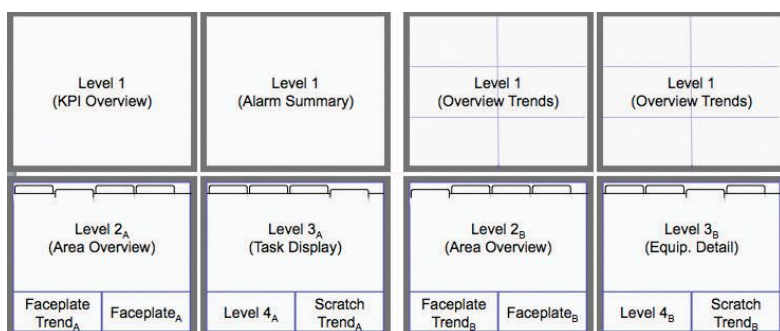


Figure 3: A conceptual illustration of an ASM-compliant console operator HMI, simultaneously supporting big-picture situation awareness while providing access to operating displays, faceplates, equipment detail, and scratch-pad trends, in this case, with a linked-navigation approach.

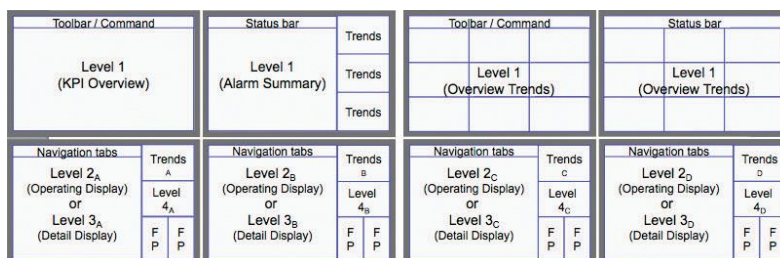


Figure 4: A conceptual illustration of an ASM-compliant console operator HMI for wide-aspect ratio displays, in this case, with a drill-down navigation approach.

active. Providing effective operator HMI design practices that establish a high level of operator situation awareness is a necessary step for operating companies to enable a proactive operating posture.

Endsley characterized three stages of situation awareness:

- Perceiving information and changes to that information
- Understanding the status of the process and implications for any deviations, and
- Predicting where the process is moving and how much time is available to respond.

A key psychological construct in Endsley's model of situation awareness is the *mental model*. Rasmussen and colleagues have demonstrated that human experts working in complex

systems possess a mental model that includes varying levels of abstraction and detail. They demonstrated that human experts move back and forth between varying levels of abstraction and detail, described as hierarchy of knowledge about how the complex system functions and what equipment is composed of, when performing their required work activities.

An ASM-compliant HMI intentionally defines display types at different levels of the *mental model hierarchy*, creating a display hierarchy that matches this mental model. Moreover, as shown in Figure 4, these display types all have a home in the overall HMI design so an operator can simultaneously move between the information in each type of display, consistent with human factors research on mental models. Providing ample access to trended information also supports the operator's ability to be proactive, predicting where the system is going, and how quickly, consistent with both human factors theories on situation awareness and mental models.

The benefits of providing an ASM-compliant HMI have been demonstrated in a controlled comparison using professional petrochemical plant operators using their own high-fidelity simulator of their actual plants, where the overall ASM systems approach to the DCS HMI led to 41% faster completion times, 36% more accurate diagnoses, and 380% greater detection of a process disturbance before the first alarm.

More recently, ASM Consortium research has demonstrated the benefits of span-of-control overview displays built using qualitative, at-a-glance gages and the benefits of qualitative trend indication for improving better operator situation awareness.

HMIs and effective operator interaction

Fast, error-free navigation through the display hierarchy and interaction with the DCS itself are critical to operator performance, not to mention critical to effective proactive operations. An ASM-compliant HMI provides on-screen navigation that reflects overall display hierarchy, as well as clear indications for where the operator is in the overall hierarchy and for critical alarm conditions, whether the ASM best practice linked navigation is implemented or an industry-typical drill-down navigation (Figures 5 and 6).

An ASM-compliant HMI also supports fast operator input. In the case of control adjustments on a single tag, the HMI provides dedicated locations where the faceplate will open (Figure 3). At the same time, the HMI also provides a home for Level 4 displays, where an operator could inter-

What's new in the second edition of the ASM Guidelines on Effective Operator HMI Design

The Abnormal Situation Management (ASM) Consortium has recently released a second edition of its ASM Guidelines document on effective display design. It has a new title, *Effective Console Operator HMI Design*, intended to communicate the refocus on console operators and their HMIs. The motivations for the new edition were to incorporate recent ASM Consortium research and to address misunderstandings and challenges to applying the guidelines that have surfaced in recent years.

Released at the end of 2013, and available at CreateSpace.com and Amazon.com, the second edition includes:

- A new preface that outline several common misunderstandings with the first ASM guidelines document
- A new section on HMI design philosophy, covering the overarching philosophical principles that the individual guidelines were originally intended to support
- A new appendix on an ASM-conducted case study on value proposition for adopting the ASM guidelines as a systems approach for the console operator DCS HMI
- A revamped appendix on compliance that emphasizes how to design the console operator's HMI, before concerning oneself with how to design individual displays that would have previously been considered compliant
- A reduction in guideline categories from 16 to 7 with many of the original categories being combined into a new category on lifecycle management. The seven categories are: display types; display content; navigation and interaction; display style and layout; use of color; use of symbols, lines, text, and numbers; and development lifecycle
- A reduction in total number of guidelines from 81 to 64, with 5 guidelines being removed and 12 other guidelines being combined with 9 exiting guidelines
- More than 50% of the guidelines were revised or updated
- 28 new figures, and
- 43 revised figures.

act with predetermined sets of controllers, selectors, and indicators (Figure 8). These sets might be based on cascaded control loops, for example, or pulled together from different Level 3 displays to support specific activity (e.g., fired heater pilot gas, fuel gas, and pass flow controllers to support heater start-up).

Operator interaction also involves windows management, such that operators are not required to move pop-up displays and faceplates around, resize windows, close windows, and so on. Systems that use sufficient tools or minimal scripting without such tools eliminate the need for operators to divert their mental energy and attention away from the plant processes to do this windows management on their own.

Fundamental design principles

Two fundamental design principles that characterize an effective role of the operator HMI in improving the operators' ability to adopt a proactive operating posture include:

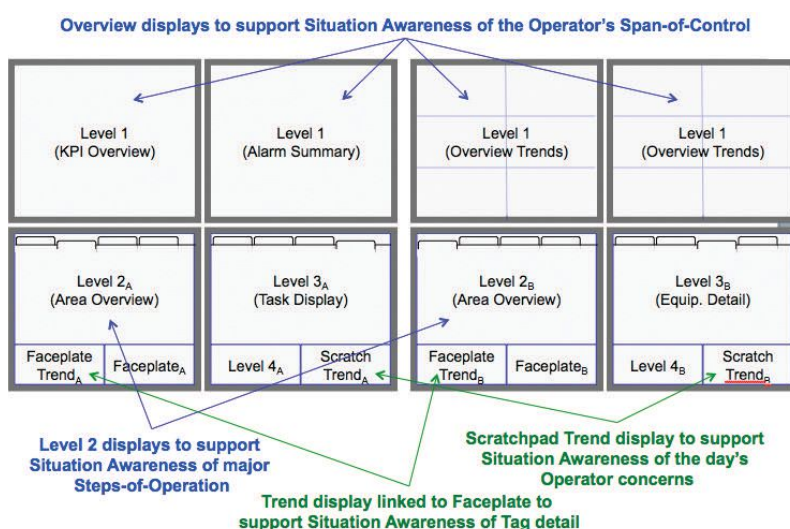


Figure 5: A conceptual illustration of an ASM-compliant operator HMI, and simultaneous support for proactive operator situation awareness from big picture to tag detail.

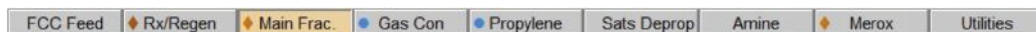


Figure 6: Prototypical on-screen navigation buttons at the top of all Level 2 displays for a console position's set of Level 2 displays where a linked navigation strategy is implemented.

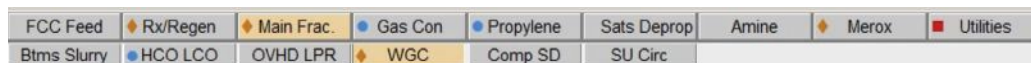


Figure 7: Prototypical on-screen navigation buttons, where the top row is the same for all Level 2 and 3 displays and the second row is specific to Level 3 displays for a given Level 2 display where a "drill-down" navigation strategy is implemented.

- The operator interface allows operators to develop and maintain a high level of real-time awareness of the state of the process under their control, while also allowing them to work at a very detailed level in performing specific operations on individual process units and equipment.
- The operator interface allows operators to focus their mental resources on controlling the process, not on interacting with the underlying system platform. That means the HMI is consistent and easy to use in terms of making minimal demands on the console operators' mental and physical resources to understand and interact with the process control system.

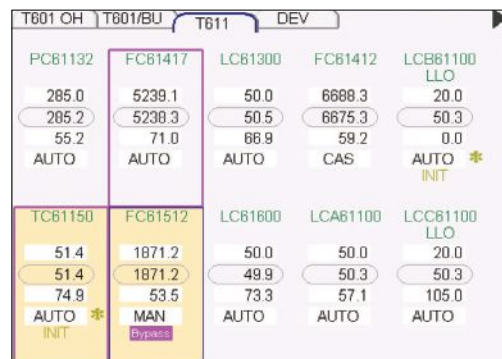


Figure 8: Example of a multi-faceplate Level 4 display.

hierarchy, effective navigation, and interaction support is also necessary in achieving ASM compliance, and not just a gray-scale display that only uses color for alarm indication. **ce**

- Dal Vernon Reising, PhD, and Peter Bullemer are consultants for Human Centered Solutions, an Abnormal Situation Management Consortium associate member company.

Go Online

To read more about ASM HMI guidelines at www.controleng.com, search on Dal Vernon Reising:

Gray backgrounds for DCS operating displays?

Webcast: Graphic design for HMIs

For more information, visit: www.asmcnorsortium.com
www.applyhcs.com

While color use is critical to supporting the latter design principle, other ASM guidelines need to be implemented to deliver an ASM-compliant HMI. An HMI design based on an effectively defined display hierarchy, a multi-screen / multi-window approach—and not a single display / single window approach, simultaneous access to display levels in the display

Additional reading:

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How to integrate new with legacy wireless systems: 4 considerations

Blending the traditional with the new in an increasingly wireless world requires careful attention to capabilities of old wireless technologies and new wireless technologies, such as 4G LTE, upgraded Wi-Fi, and low-energy Bluetooth. While wireless upgrades add capabilities, a well monitoring site application shows that no wireless technology is yet the best, or the most cost effective, for every purpose.

Key concepts



- Rip-and-replace strategy isn't needed when integrating new with legacy wireless systems.

- Heed 4 considerations and 3 new wireless technologies when upgrading wireless technologies and related capabilities and applications.

- Application notes: See the lessons learned from wireless upgrades, past and future, at a well monitoring site.

New wireless technologies, such as 4G LTE, upgraded Wi-Fi, and low energy Bluetooth, will add new device category layers and cloud-based analytics that will coexist with and add value to traditional machine to machine (M2M) monitoring systems for the foreseeable future. New wireless technologies won't eliminate existing M2M data networks and con-

nected devices, as a well monitoring case study shows. Included among new wireless networking options are:

- 4G LTE. As network engineers build out the 4G LTE networks, providing excellent bandwidth and low latency, 4G LTE presents a high-bandwidth alternative to cabled connections.

- Upgraded Wi-Fi. Improvements in Wi-Fi are making remote devices like sensors smaller and smarter, and it is becoming easier and easier to position wireless intelligence out beyond the network edge.

- Low energy Bluetooth (Bluetooth LE, marketed as Bluetooth Smart). Bluetooth LE will let devices operate for months or years on one battery, while simultaneously giving technicians the ability to communicate with those devices using handheld equipment like tablets and smartphones.

These new wireless technologies will work in tandem with the traditional technologies, providing them with dramatic new capabilities and increasing their value.

To do this, network engineers will need to accommodate traditional M2M technologies, some of which are decades old. They will have to be prepared to aggregate, convert, and wirelessly transmit multiple data networking protocols, from Modbus to TCP/IP. While adding millions of smaller, smarter, more capable nodes to networks, wireless technologies also will have to help keep the existing equipment connected and communicating.

Onsite HMI Touch Panel



Pressure indicator



Pump monitor



Level indicator



Zlinx I/O radios

Zlinx modem



Figure 1: Sensors report to a human machine interface. All images courtesy: B&B Electronics

Remote water well monitoring system

I've established a water well monitoring test site in the Arizona desert. It's a tank monitoring system for the Pinal County, Ariz., well owners' co-op, whose purpose is to predict system failures by measuring and aggregating pump current. By building intelligence, or analytics, into the system, I have given it the ability to make decisions based on changes detected over time. Currently, the system can SMS [short message service—send a text message to] a technician to schedule preemptive maintenance before a catastrophic failure.

I've added new networking technologies whenever it made sense to do so. But I've often kept existing equipment in place as long as it continued to do the job efficiently, and at a reasonable cost. To draw an analogy, think about the tire pressure gauges that we all keep in our toolboxes. The newer, digital versions are easier to read. But they cost more, they require batteries, and they tend to be more fragile. Are they always the better choice?

Below examine four considerations that went into present and future upgrades for this wireless monitoring application, integrating new wireless technologies with existing, legacy wireless capabilities.

1. Centrally gather and analyze sensor data.

In an earlier incarnation of my Pinal County site, I used I/O [input/output] radios to transmit data from pressure sensors, current sensors, and level sensors to a radio modem. The radio modem then connected to an on-site human machine interface (HMI). It was a convenient way to gather all of the data in one location, as Figure 1 shows. But I had to be physically present at the site if I wanted to review it.

2. Add wireless Internet access via the cellular network.

Later, I added a 3G cellular router to the mix. It provided Internet backhaul via the cellular telephone network, making it unnecessary to visit the site in person. I could now monitor the site anywhere I could establish an Internet connection. The router had built-in firewalls and powerful security protocols, and when combined with virtual private networking (VPN), I used the cellular system as securely as if it were proprietary infrastructure. (See Figure 2.) Note, however, that I didn't have to discard my Modbus sensors, my I/O radios, or my radio modem. By adding cellular networking to the site, I merely expanded its capabilities. I wasn't starting over

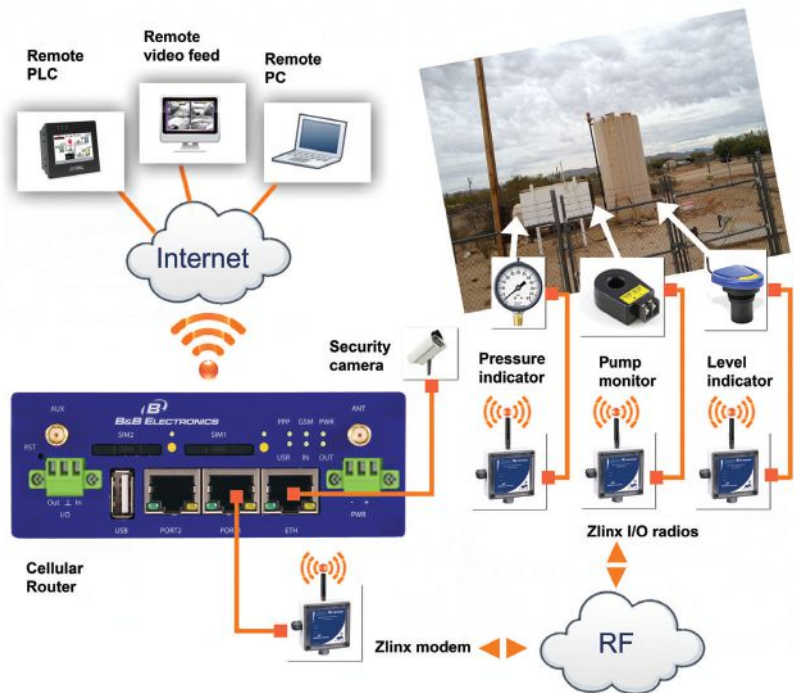


Figure 2: Sensor system integrates cellular backhaul capabilities.

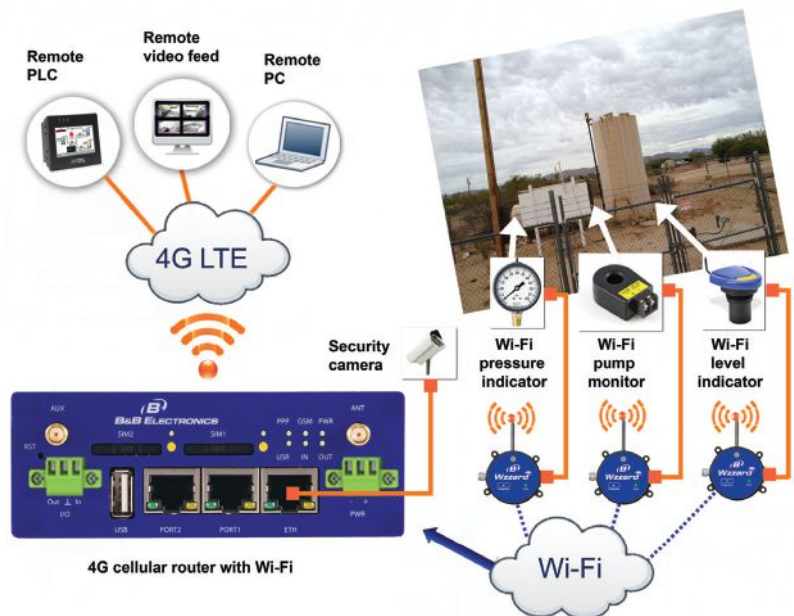


Figure 3: 4G LTE router has Wi-Fi.

from the ground up, and I didn't need to replace all of my existing equipment.

At this point, you could say that I was simply using the cellular router as a protocol converter with cellular backhaul. But as I've added additional devices and additional protocols to the system, I'm taking better advantage of the router's ability to function as a data aggregator with multiple backhaul options. Now that I've attached an IP security camera to the router's Ethernet port, for example, I'm not just able to remotely moni-



“Like most networked systems, my well monitoring site will continue to evolve, and it will continue to be a mix of the traditional with the new.”

Consider this...

Wireless infrastructure upgrades can enable functionalities and applications that add efficiency, security, and reliability, without ripping out existing wireless nodes.

for the data from my sensors, I can actually view the site in real time.

3. Exploit data aggregation and backhaul capabilities.

There are numerous upgrades that I could add to the site right now, if I felt the need. If I wanted full motion video, I could upgrade to a 4G LTE router and take advantage of 4G's bandwidth. I could streamline the installation by replacing my older sensors and I/O radios with Wi-Fi sensors that reported directly to the cellular router, as Figure 3 shows.

4. Deploy future wireless technologies and sensing applications.

I'll make changes as the need arises. At some point in the future, I'm sure that I'll want to add new networking technology to the site and additional sensing capabilities. Corrosion sensors, which measure the remaining thickness of a pipe or vessel, would tell me how my water tanks are holding up, and whether I should be thinking about replacing one. If a new industry appeared in the neighborhood I might need to keep a close eye on the quality of the water in the well and

watch for contaminants. Entirely new sensing capabilities will come along as well, and it's likely that I will find some of them useful.

The site will continue to be an integrated mix of wireless monitoring and sensing technologies. So, like most networked systems, my well monitoring site will continue to evolve, and it will continue to be a mix of the traditional with the new. No single technology is yet the best—or the most cost effective—for every purpose. **ce**

- Bill Conley is the M2M systems development engineering manager at B&B Electronics. Edited by Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.



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www.controleng.com/enewsletters has the System Integration newsletter, which includes wireless networking topics.

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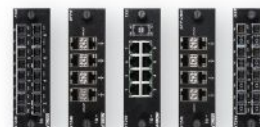


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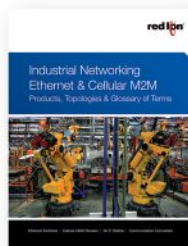
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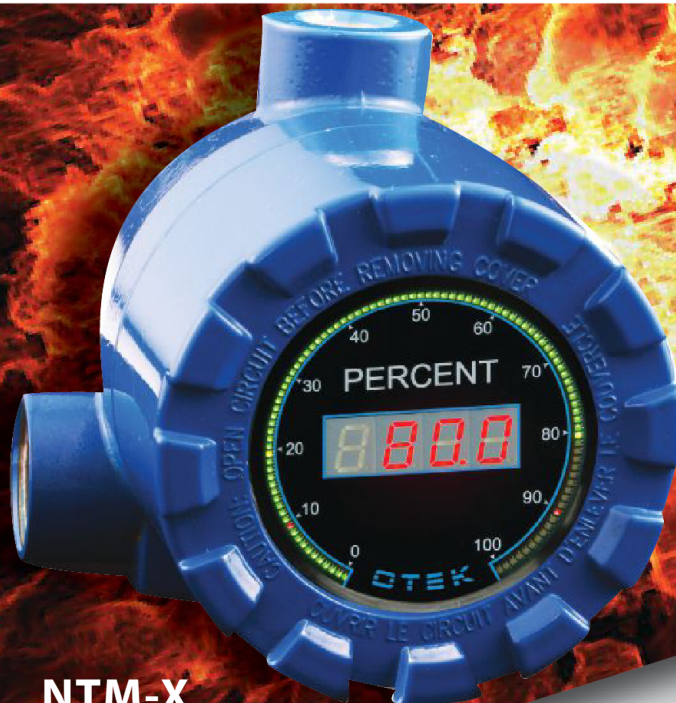
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Best practices in wireless

Prior to choosing industrial wireless networking technologies, ask 4 basic questions to help get the most out of a wireless network.

Key concepts



- Best practices for selection of industrial wireless involve asking a few basic questions.
- Know what you're trying to accomplish and what you're connecting.
- Also know required certifications, and how you want to manage the wireless network.

The advancement of wireless technology over the past five years has contributed to a growing acceptance of wireless technology within the industrial realm. Wireless networking has proliferated in industrial applications that were once considered too remote, too expensive, or too risky to hardwire with typical hard bus or fiber networks. Still, as a relatively new technology within industrial applications, choosing and designing your wireless network solution can be difficult.

Prior to choosing a wireless networking solution, it is important to ask four basic questions to help ensure that you get the most out of a wireless network.

1. What am I trying to accomplish?

This question can be rephrased in a couple of ways, such as, "How large is my required

bandwidth? Or "How many end-devices am I connecting to?" Asking yourself these questions will elicit the correct advice and solution offering from a wireless solutions provider. For many wireless industrial networks, bandwidth is a secondary requirement to availability and redundancy. Understanding exactly what traffic will be running over the wireless local area network (WLAN) will ensure that your wireless network is reliable and built to size.

2. What am I connecting to?

"Industrial wireless" is a broad term. Wireless technology has become so prolific due to its ease of deployment in locations once too remote or expensive to hardwire. However, with this added benefit, it is important to take temperature, electromagnetic impedance, vibration, inter-unit barriers, and moisture abrasion into consideration. Additionally, be mindful of the location of each unit and the distance between each module. On an oil platform, for example, wireless signals often must pass through a jungle of pipes and tanks while competing with high levels of noise. Manufacturing facilities, as diverse as they may be, can be subjected to high volumes of cellular interference and vibration in parts of the manufacturing operation. Deploying a comprehensive wireless network requires a physical audit of the field operation as well as a logical one.

3. What certifications are necessary?

The issue of certifications takes the previous question of network placement to the next level of validation. Leading industrial networking manufacturers have gone to great lengths to test and certify their products along the stringent international regulatory demands dominant within the various industrial verticals that they service. For example, in the oil and gas vertical, ATEX or UL Class 1, Division 2 cer-

What am I trying to accomplish?

What am I connecting to?

What certifications are necessary?

How do I want to manage my network?



Functional Accomplishment



Network Location & Connection



Industrial Certifications



Management & Integration

Choosing industrial network technologies is easier when considering

1) functional needs, 2) network location and connections, 3) industrial certifications, and 4) management and integration. Courtesy: Moxa

tified products are generally required for any field-level application. Additionally, depending on the network exposure to chemical or water intrusion, marine-grade certifications, such as those from DNV GL and American Bureau of Shipping (ABS), are often a requirement. With this said, other industrial segments have less stringent regulations that vary between government and region.

4. How do I want to manage my network?

After reaching this point in the conversation with a wireless solution provider, both parties should know what the bandwidth requirements are, as well as the redundancies and certifications that the wireless network demands. This will allow the customer to intelligently select a host of wireless solutions and products with specificity to their design preference, price, and sensitivity to cyber security and operational risk. Now the customer must ask itself how it wants to manage its network via HMI. There are many network management software solutions available in the market. It is important to make

sure that if the customer already has a solution to manage its network, that it is compatible with its wireless solution. **ce**

- Thomas Nuth is global vertical manager, oil and gas; and Ariana Drivdahl is product marketing manager, industrial wireless; both with Moxa. Edited by Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.

Understand what traffic will be running over the wireless local area network (WLAN) to ensure the wireless network is reliable and built to size.



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In June, this article links to additional wireless info.

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Smart software, networks trump smart hardware

Machine architectures require many field devices. For easier system design, engineers should select a core control platform that minimizes complexity. A unified software platform and network is easier to implement, support, and maintain.

Key concepts

- PC-based control, using a unified programming software, simplifies system design of machine architecture.
- Use one system-wide network that doesn't require managed switches and routers.
- Reusing device parameters helps with enhancements, maintenance, and upgrades.

Machine design is easier with integrated PLC, safety, motion, robotics/kinematics, and communications functionality in software, with fewer auxiliary points of control (hardware), and software-based devices replacing hardware functions.

When determining the controls architecture of a machine, there are many important factors to consider and many types of devices that will be included in the system. Some devices have built-in intelligence ("smart devices") while others are more basic, using a central controller to process and react to data. When taking system reliability and maintainability into account, simplicity and flexibility are the most significant keys to success.

Naturally, machine builders (original equipment manufacturers, OEMs) prefer that the automation and controls architecture help decrease the time and effort required to build and commission

a system. Therefore, it is important for engineers to reuse as much preexisting engineering work as possible. This helps reduce configuration time for individual devices and systems. At the same time, the equipment end user needs the machine architecture to promote good overall equipment effectiveness (OEE) and minimize the impact on production when an unexpected failure or maintenance requirement occurs. The most efficient and reliable way to accomplish these goals is by increasing the use of smart software in the areas previously occupied by dedicated, special-purpose hardware.

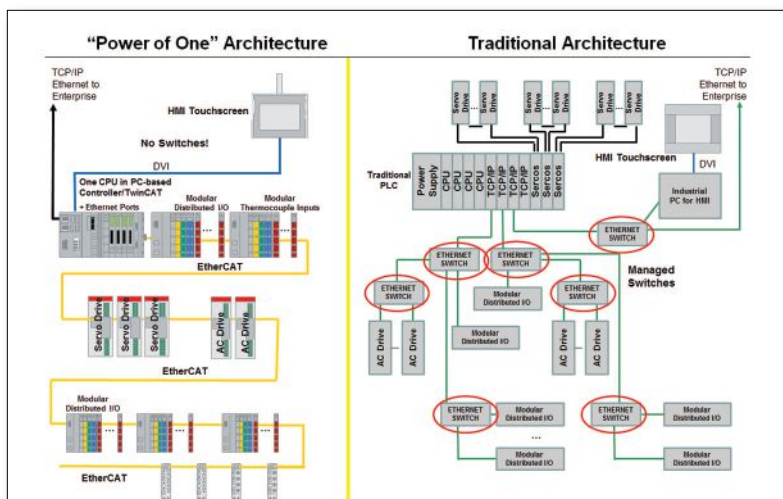
Simplified controller architecture means that the core of the machine (or machines) is built around one controller and one network, which is all configured and programmed using one software platform that in itself has one primary development environment. Within one platform it is possible to integrate programmable logic controller (PLC), safety, motion, robotics/kinematics, and communications functions largely in software, while reducing the amount of auxiliary points of control (hardware), and replacing "smart" hardware devices in favor of "software" devices. Data from the field is gathered by standard I/O equipment for the centralized controller running smart software to process. This reduces the amount of "black box" hardware on machinery and the configuration that goes along with that hardware. This can lead to significant cost savings and fewer potential points of failure for simpler system commissioning and maintenance. **ce**

- Daymon Thompson is TwinCAT 3 product specialist, Beckhoff Automation. Edited by Mark T. Hoske, Control Engineering, mhoske@cfemedia.com.

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See this article in the online June archives for more graphics, links and information on the speed of PC-based control, efficient engineering, flexible networks, software, unified programming, faster setup, condition monitoring, outsmarting dedicated smart devices, and streamlined architecture.



Removing network switches from the fieldbus system enables EtherCAT to deliver deterministic data from remote devices to the central controller. This brings with it the possibility to process the control algorithms in a central CPU, eliminating the need for a wide range of "smart devices." Courtesy: Beckhoff Automation



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Certifications:

A system integrator's journey

When choosing a system integrator, how much importance should you place on certifications? Both individuals and the corporation can earn them, but how much do they matter?

Key concepts



- System integrators develop specialties connected with the skills and certifications of individual employees.
- Integrator companies can be certified based on business practices.
- Customers and prospects can evaluate possible integration firms based on certifications.

While the Declaration of Independence says that “all men are created equal,” such is not the case with automation system integrators. At our core, each of us, as individuals and companies, has our own unique combination of culture, values, and ethics. Layer on top of this our technology and industry expertise, mix it all together with our standards, work products, and practices, and you have the unique blend that represents each of us as individual organizations.

A big part of the corporate DNA at our company and many others is certifications, both individual and companywide. Certifications have the power to make people and companies better, often in ways you do not expect. Our journey can serve as an illustration which might show you how a certification process could be of benefit to your organization.

The power of credentials

Above all else, the most important attribute your clients seek from an integrator is competence in performing their work at hand. This usually requires expertise with some combination of technology platforms, manufacturing processes, business intelligence, information technology, project processes, and business practices. Even great system integration firms are not necessarily competent in all disciplines relevant to a particular project.

Clients that already know you and your company will understand your strengths and weaknesses. Those that don't will need a little help. Certifications can help shine a light on the attributes you possess that your clients are searching for. System integrators often cite the value of a certification as a differentiating point between

them and their competitors. It can indicate to your clients that your firm has put in the upfront time, effort, and resources necessary to implement their projects successfully.

While any certification relevant to a specific project can provide the power of a credential, the total value often runs much deeper. As you will see, the preparation process itself for a specific certification can be of immense value to your firm. Let's take a look at a few types of certifications we have been through, and the benefits we received from each experience.

Supply-side economics

Historically, supplier programs have been a bit of a cottage industry in the system integrator community, particularly with technology providers. For many, the entry level into a supplier program required little more than an annual fee, a few references, and some nominal demonstration of familiarity with that company's product. In return it would provide development and test platforms for its products, as well as the occasional project lead.

Today most of these supplier partner programs have evolved into genuine certification programs on various aspects of specific technology platforms, even though the entry-level component usually still exists. As the size and complexity of our systems increased over time, so did the complexity of these technology platforms. Our company pursued multiple supplier certifications as part of a risk abatement strategy. While our initial motives were simply to acquire more technical expertise in proper application of these products, our measured benefits over time became much more than that.

The deeper we delved into these supplier technical certifications, the closer we became to



System integrators often cite the value of a certification as a differentiating point between them and their competitors. It can indicate to your clients that a firm has put in the upfront time, effort, and resources necessary to implement projects successfully.

Courtesy: TriCore Inc.

the suppliers themselves. For us, this strategy made a lot of sense. The more effort we put into earning certifications, the more trust each supplier had in us, resulting in more opportunities from that supplier, project and otherwise.

Knowing how to navigate a key supplier's organization in times of trouble allowed us to marshal resources much more quickly to address issues. In large supplier organizations this can be a huge advantage, and it really enhanced the level of customer service we could provide to our clients. Close relations provided opportunities for us to be part of supplier beta-testing efforts, and to provide our input into enhancements and features we would like to see in future releases. Some suppliers have even shared views on the evolution of our collective technology, geographic, and industrial markets. This has aided us in our own internal strategic planning. What started with a simple goal of risk abatement blossomed into many additional benefits for our organization, none of them foreseen at the onset, and all of them of value.

More than the sum of its parts

Supplier certification programs typically require that individual associates of your organization pass exams. Depending on the complexity of a given program, certain levels may require successfully completing prerequisites. Acquiring enough individual certifications (and often company references and more) in a particular area could certify the entire organization in that area. Partner programs at Rockwell Automation and Microsoft work this way, as do many others.

There are other types of certifications we pursue strictly on a professional development level for our associates. Examples range from American Society of Quality (ASQ) certifications for calibration technicians to Project Management Professional (PMP) certifications, and more. Vesting in the professional development of our associates has yielded many tangential benefits.

Certifications for individuals in your company from various governing bodies may not impute any specific status on your company, but

they still provide significant value to the firm at large. Your organization receives an indirect credential, simply by having these certified individuals on staff. Those who complete such certifications often bring best practices and new ways of thinking in these areas of excellence. For us this has been a big driver in a variety of

Professional development has contributed to a low turnover rate; audit-related introspection created new ways of thinking and new ways to measure, and made us a better organization.

continuous improvement initiatives. Encouraging these individual certifications for our associates is a big part of the overall professional development focus at our firm, and has contributed to a low turnover rate, helping to provide organizational stability in a very competitive labor market.

Saving the best (practices) for last

There is another type of certification our organization has gone through, the best practices type. For us it was certification from the Control Systems Integrators Association (CSIA). CSIA is a not-for-profit trade association with more than 400 member firms in 27 countries, representing our professional peer group. This certification required an outside audit of 79 process and practice areas. They were broadly grouped in nine categories including general management, human resources, sales and marketing, financial management, project execution processes, quality processes, and more. Minimum scores per category and a minimum aggregate score were required to pass.

For us the preparation process itself was transformative. With more than 20 years in business, we felt we were a mature organization when we embarked on this process. We had well-established practices in all of these areas, which in our view were also of reasonably high quality. But the fact that an outsider, an auditor, was coming, gave us pause. This person has measured others in our peer group, and will now measure us. Based on our size, we were held to the most stringent version of the audit, which also gave us some things to think about.

Being true to another part of our corporate DNA, we overprepared for the audit and the

results turned out more than fine. In the end the audit results themselves were not what was of prime importance. It was the preparation process that caused us to give a hard look at each of those 79 measuring points. We looked closely to see if what we were doing in each of these areas was really as good as it could be. More often than not, even if our process or practice was good, we found ways to improve upon it. This introspection created new ways of thinking and new ways to measure, and made us a better organization for it. When we reached out to those in our peer group who had been through this process, it became clear that our experience was the norm.

The journey continues

Starting out, we felt certifications were as much about credentials as anything else. Most young firms need to establish their credibility in a variety of ways, and certifications are a good way to do that. As we walked further down this path, our offerings became larger and more complex, as did the complexity of the technology platforms we were deploying. Risk abatement became another part of the mix.

As we worked to develop supplier certifications, relations with those critical companies deepened, providing a host of unforeseen benefits to both our organization and our mutual clients. Individual certifications earned by our associates not only made all of us collectively technically better, it opened us up to new ideas and ways of operating. It also contributed to a low turnover rate.

Finally, the best practice certification was the best of all. It provided the motivation and framework to look at our organization as a whole. Every firm will benefit from taking the time to look at all of its practices, with an eye toward self-improvement. For us and many of our peers, the dividends from such activities were enormous.

At our company this process continues and is now part of the fabric of who we are. If you have not done so already, I encourage you to start your own journey. You will be glad you did. **ce**

- David McCarthy is president and chief executive officer for TriCore Inc. Edited by Peter Welander, content manager, CFE Media, Control Engineering, pwelander@cfemedia.com.

Consider this...

Does your organization encourage or fund continued learning and certifications? Do you value the expertise of organizations that do?



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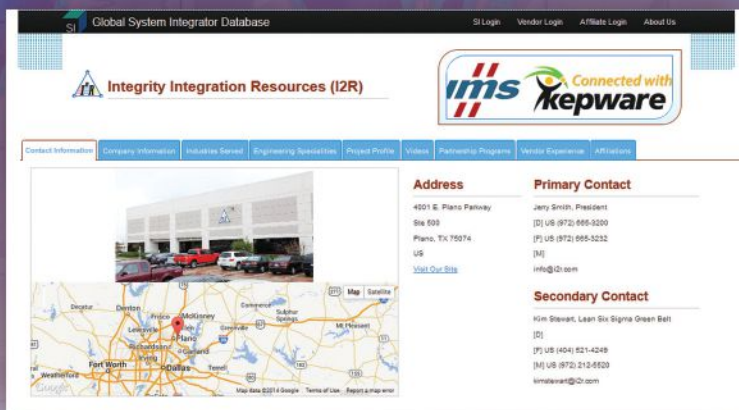
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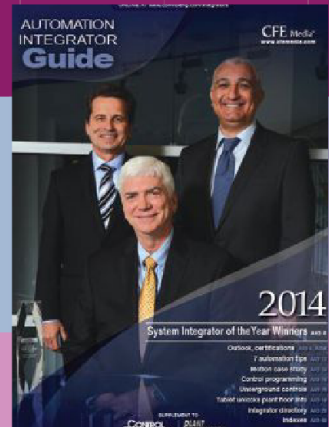
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Vision-enabled robot replaces 4 conventional flame-treating robots

Robot with machine vision replaces four conventional robots in this Fitz-Thors Engineering Inc. design for a Tier 1 automotive supplier. The robot operates continuously, eliminating robot idle time with conventional cells. The new robot approach also eliminates proximity sensors, making it possible to handle a wider range of parts.

Enabling a robot with machine vision and careful workcell layout improves asset utilization and frees three robots for use elsewhere. Volatile organic compound (VOC) free coating systems used for automotive interior components require flame treatment to increase the surface tension and improve coating adhesion. Traditional cells used for flame treating have four stations, with a robot in each station applying or flame treating parts mounted on a turntable fixture with proximity sensors. Fitz-Thors Engineering Inc. has improved on this approach by producing a cell that provides the same throughput with one robot serving all four stations.

The vision system views the part prior to flame treating to ensure it is present and properly positioned in the fixture. The robot operates continuously, eliminating the considerable amount of robot idle time seen with conventional cells. The new robot approach also eliminates the need for proximity sensors, making it possible to handle a much wider range of parts and eliminating the time required for wiring the sensors. When running at full production, the new cells require four operators, the same as traditional cells. However, when running at less than full production, the new cells can be serviced by two operators loading two cells each.

Traditional flame-treating methods

Most plastic parts used in automotive interiors are coated to improve their feel and acoustic performance. Recent regulations have mandated the use of VOC-free coating systems based on polyurethane or ultraviolet coatings that require the substrate to have a high level of surface tension.

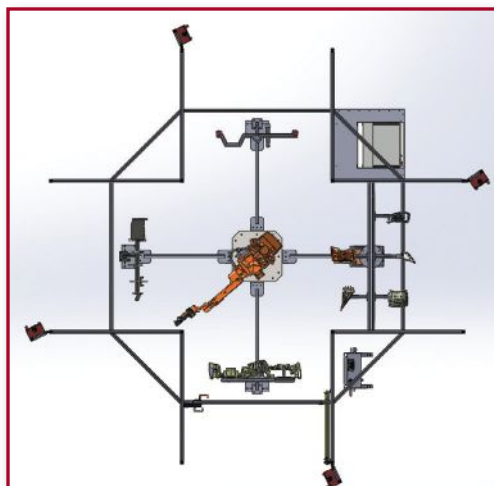


Figure 1: Plan view of the four-station flame-treating cell features a vision-enabled robot in the center for a Tier 1 automotive application. The ABB IRB 2600ID robot has an Enercon Dyne-A-Flame surface treater to flame treat the parts. The robot integrates process cables and hoses inside the robot arm for less maintenance and maximum acceleration. It has a swing base radius of 337 mm and a base width of 511 mm. All images in this article courtesy: Cognex

Key concepts



- Consider workcell and workflow design to maximize robotic utilization.
- Machine vision allows one robot to work more efficiently and on more parts than four using proximity sensors.
- Four operators work the cell at full speed or two operators can for less throughput.

Flame treatment is an inexpensive and efficient way to provide the surface tension levels that can help promote coating adhesion and eliminate the need for primers.

Flame treatment in the automotive industry is normally applied with a robot to ensure high quality levels. A typical vehicle interior might have



Figure 2: Fitz-Thors engineers designed this machine-vision enabled station in a workcell with a turntable used to treat smaller parts for a Tier 1 automotive application.



Figure 3: One of three stations in the Fitz-Thors designed robotic workcell doesn't have a turntable and is made to heat-treat larger parts. ABB SafeMove robot safety option enables operators to safely load parts on the three stations without turntables.

several components that require treatment, such as steering wheels, dashboards, consoles, glove boxes, etc. A traditional cell used to flame treat these components has individual stations with each station served by an individual robot. Each different part has a custom fixture with proximity sensors to ensure that the part is properly positioned in the fixture. Each fixture is mounted on a turntable to isolate operators from the robot. Operators load each part, and then rotate the turntable to put the part and fixture into position for flame treatment by the robot.

Workflow process efficiency

Fitz-Thors engineers decided to take a fresh look at flame-treatment systems. They questioned why a robot was needed for each station when the robots spent much of the time sitting idle. They also asked whether machine vision might be a better approach than proximity sensors to ensure the proper positioning of the part. Fitz-Thors' engi-

“Vision systems cost about as much as the proximity sensors, but their flexibility to handle future changes is much greater so they reduce the total cost of ownership.”

neers concluded that a robot enabled with a vision system could move quickly around the cell to each fixture that was ready for flame treatment, verify that the right part was present and properly positioned in the fixture, flame treat the part in the fixture, and then move on to the next.

Fitz-Thors engineers selected an entry-level vision system developed for inspection tasks where vision sensors are too limited and standard vision systems may not be cost effective. They configured the vision system with a software user interface by selecting the pattern find vision tool with an angle orientation limit that provides a percentage match to ensure that the right part is positioned correctly in the fixture. The pattern-find function can locate the part anywhere in the field of view so the program can consistently detect the presence or absence even when the fixture might be in a different position.

The self-contained vision system includes autofocus optics and integrated lighting in an IP67 rated industrial housing. With autofocus, users can set and save the focus values associated with the inspection of each part. Users also can fine-tune focus levels manually with the interactive software, enabling seamless part change over without any manual adjustment of the lens. Integrated white lighting is suitable for most vision applications. If a specific color light is required to highlight particular parts or features, four optional colored lights are available.

A robot fitted with a surface treater flame treats the parts. All process cables and hoses are routed inside the robot arm to decrease downtime caused by interference and wear. Integrated dressing also ensures that the maximum achievable acceleration is available at all times without restriction. The robot has a swing base radius of only 337 mm and a base width of only 511 mm. The surface treatment ignites flammable gas to form an intense blue flame and a plasma field. The flame changes the distribution and density of the electrons on the surface of the part and polarizes surface molecules through oxidation. Flame treatment also deposits other functional chemical groups that promote wetting and adhesion.

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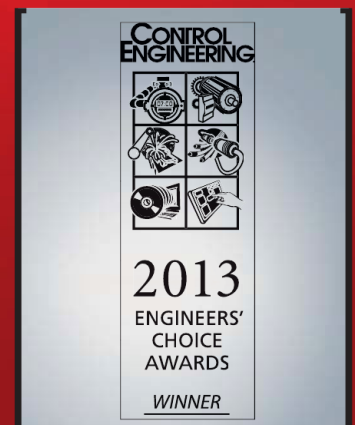
CX2030 | 2nd Generation Intel® Core™ i7 @1.5 GHz, dual-core (fanless)

CX2040 | 2nd Generation Intel® Core™ i7 @2.1 GHz, quad-core

The basic CX2000 CPU module contains:

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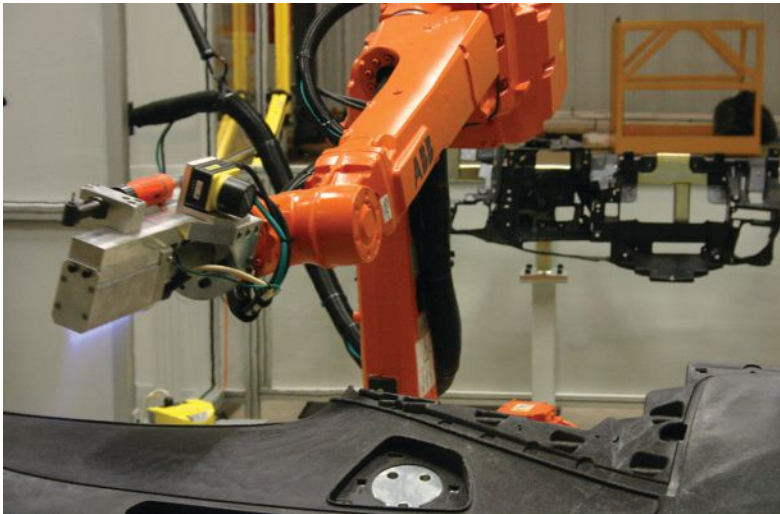


Figure 4: A vision-enabled ABB IRB 2600ID robot has an Enercon Dyne-A-Flame surface treater to flame treat interior components for a Tier 1 automotive supplier. Fitz-Thors engineers used the Cognex In-Sight 7010, an entry-level, self-contained vision system developed for inspection tasks where vision sensors are too limited and standard vision systems may not be cost-effective. It has autofocus optics and integrated white lighting suitable for more applications (optional colored lights are available) in an IP67 rated industrial housing. The ABB IRB 2600ID robot has an Enercon Dyne-A-Flame surface treater to flame treat the parts.



Figure 5: Configuration for this vision-enabled ABB robot is achieved via Cognex EasyBuilder user interface, by selecting the pattern find vision tool with an angle orientation limit that provides a percentage match to ensure that the right part is positioned correctly in the fixture. The ABB IRB 2600ID robot uses an Enercon Dyne-A-Flame surface treater to flame treat the parts for a Tier 1 automotive supplier.

Cell for Tier 1 supplier

Fitz-Thors Engineering recently built a flame-treatment cell for a major Tier 1 automotive supplier. The four-station system uses a turntable to handle smaller parts while the other three stations are open to handle larger parts such as dashboards. A robot safety option enables operators to safely load parts on the three stations without turntables. Sensors monitor the location of the operators, and the robotic safety option enforces geometrical and speed restrictions to maintain automatic operations while restricting robot motion to maintain a safe distance from operators. A safe tool zone is continuously calculated based on operator position, and the robot motion is restricted to stay inside the defined zone. The operator loads the turntable or loads a part into one of the open fixtures and pushes a green button. The robot control controls the robot based on the availability of parts in fixtures and the position of the operators. Operators can walk in and place parts in cells while robots are working in a different station.

Using vision instead of proximity sensors makes it possible for each fixture to handle

a wider range of parts. Design changes can frequently be accommodated without having to make any changes to the fixture. In addition, the elimination of proximity sensors eliminates the need for a substantial amount of wiring when installing the system and also for rewiring when changes are made to the design. The vision systems cost about as much as the proximity sensors, but their flexibility to handle future changes is much greater so they reduce the total cost of ownership.

One robot used in the cell continuously treats parts without downtime. The floor space occupied by the cell is considerably smaller than a traditional cell with four robots and four turntables. When the system runs at full capacity, it uses four operators to continuously load parts for maximum throughput. Another option is to run at a reduced production rate with two operators each loading parts for two stations.

Machine vision for test stand

Fitz-Thors Engineering uses machine vision in many other applications. For example, the company recently completed an automated custom vision application for another Tier 1 automotive supplier. These test stands use vision systems and displays to verify the location and color of the screws and plastic clips on the inside of door panels. Machined fixtures ensure the door panel is positioned correctly by the operator. Once the panel is in position, the operator initiates the test by pressing two buttons. The display alerts the operator of a failed part by displaying a red box around the quadrant that failed as well as placing a red circle around the incorrect or missing fasteners. This visual indication allows the operator to quickly identify why the part has failed. The results are stored in a database, providing traceability in case future defects are found.

The first flame-treat cell shown here has been in successful operation for more than one year. Fitz-Thors Engineering recently built a second system for the auto supplier. This new cell is capable of functioning as a backup to the current cell and also will make it possible to treat new components and increase throughput. **ce**

- Ron Pulicari is Cognex Corp. marketing manager for the Americas. Edited by Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.



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Motion control for OEMs:

10 tips for improvement; 1 for good measure

Eleven tips follow about how to apply recent technology advances to packaging machines and line motion controls, benefitting end users and machine original equipment manufacturers (OEMs).

Recent technology developments in packaging machine and line motion control provide significant benefits for machine end users and expand capabilities for the machine original equipment manufacturer (OEM). Ten machine design tips follow, along with an 11th that you might not have considered.

1. Decentralized drives

Decentralized drive technology consists of a drive mounted directly over the motor. This technology significantly reduces the amount of cabling required, and it conserves control cabinet space, cooling costs, and related energy efficiencies. Quick connects and a common dc bus further enhance the effectiveness and field performance of this decentralized drive concept. With just one cable per motor, it also eliminates the need for a separate communication cable. This is an integral part of hybrid cable technology.

2. Ethernet communications

Incorporation of an Ethernet communications interface into the drive permits online communications with other brands of equipment. This development has significant advantages in a brownfield line expansion or upgrade with legacy controls or when new equipment that uses various brands of motion control components is being incorporated by an end user or system integrator. Through a regular Ethernet cable connection, other communication languages can be routed to the drive system components and motion controller, thereby providing huge capital savings and time savings. In short, it

gives the end user and OEM the flexibility to choose the best control components. From the software perspective, the heterogeneous automation environment of the past was a significant engineering challenge and financial roadblock. This roadblock is gone.

3. Enhanced safety, integrated

Advancements in the "safety wall" for packaging machine builders, including a safety programmable logic controller (PLC), hardware and software, plus features such as safety integrated into the drives, provide an effective double safety scenario. The days of mandatory key-switch lockouts and intense engineering of the line safety have given way to the fail-safe controller, with safety functions integrated on the drive, while closed-loop position control of the drive remains fully active. This means faster restart of the line, as setup functions can be performed with the protective covers and guards open, for shorter downtimes, less wasted product, and higher productivity, in a safe environment that protects operators and machinery.

4. Single motion platform

New motion controller technology, ranging from 1-128 axis capacity, with just two form factors (motion control and

Key concepts



■ Machine designs can be improved with 11 tips related to advanced automation technologies.

■ Packaging machines benefit from IP67K equipment that can withstand high-pressure washdown.

■ Automation provides faster product changeover, faster recipe adjustments, homing of new line components after an install, and enhanced troubleshooting capabilities.

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PLC functionality in one hardware package) is becoming widely accepted in the industry. Having one software platform and the same programmability to configure from 1 axis to 128 axes adds an extra advantage on cost-saving and engineering time. This development is emerging in tandem with enhanced communication protocols from machine-to-machine or up to a full manufacturing execution system (MES) network. The result is faster construction, commissioning, and line integration. Also, having an integrated web server inside the controller helps troubleshooting, from basic to advanced. Operator control, maintenance, and diagnostics data are standardized, while the data links to the master mainframe or IT system are simplified.

5. Higher-performance motors

Motor advancements, including field replaceable encoders plus plug-and-play technology and quick-connect technology, have changed the landscape in machine building and line maintenance. As an example, high-performance, energy-efficient ac servo motors, coupled with a drive component, are being offered as a package, and manufacturers are making more software tools available for motor size selection, drives pairing, and communications hardware options. Likewise, servo, torque, and linear motors are available with a quick identification device to make line integration a one-click operation.

6. Efficient electromechanical packages

Gearmotor packages are generally used for specific heavier duty conveyor applications. Advanced helical bevel technology allows lower horsepower motor usage, smoother starts, high torque control, operating efficiency, and less energy consumption. These are just some of the features that should be considered when specifying gearmotors. As a side note, most manufacturers provide downloadable CAD files for easier design

integration by the builder and end-user communities, to facilitate in-plant and engineering system documentation. In addition, all mechanical data are usually available online for the mounting of gearmotors, a real plus for the installer.

7. Environmental protection

New washdown motor technology is emerging for the food and beverage production and food packaging sectors that features a complete stainless steel enclosure. Hygienic design gets special consideration in certain sectors of the packaging and processing industries, whenever machine components are in direct contact with food, beverage, cosmetics, etc. Having a washdown motor with totally hygienic design adds value to the overall machine for the builders and keeps the downtime to a minimum for the end users. Currently, IP69K is getting considerable attention in this huge mar-

“Having an integrated web server inside the controller helps troubleshooting, operator control, maintenance, and diagnostics.”

ket segment. IP69K is the standard used for all applications where high-pressure and high-temperature washdown are used to sanitize equipment. IP69K will become the norm for food processing in the near future, as it represents a decided improvement over the older IP ratings.

8. Modular capabilities

Modular machine design can allow one large machine with multiple sections of motion control or a full production packaging line to run without the need for multiple CPUs. With modularity comes flexibility, and one can then engineer the solution to provide a seamless transition from a machine with all options to a machine with fewer but job-specific options. The economic advantages here are self-evident, and the key driver to this development is the enhanced open architecture of the motion controller and drive systems.

9. Remote connections

Remote connectivity is more practical through an integrated web serv-

er, with a maintenance person having a password that will allow complete condition monitoring and on-site troubleshooting on a packaging line. The end user can also access a full library of “fixes” online. This web server can be customized to suit user needs. In a more complex arrangement, the machine builder and end user can also extract performance data to track machine uptime, component wear, maintenance strategies, and other considerations in an overall equipment effectiveness (OEE) paradigm. Functionally on the floor, of course, the key advantage is the maintenance engineer’s ability to quickly and accurately isolate an issue in the line, do the diagnostic analysis, get a part ordered, or obtain on-site service in the most efficient and cost-effective means possible. The price of one hour of downtime on a major packaging line provides incentive for such remote connectivity plant wide.

10. Global standards, built-in

With more domestic (North American) machinery and equipment builders selling overseas, global standards compliance is important. Supplier presence worldwide is essential to make it easier for the machine builders to get parts and competent service quickly. The remote connectivity mentioned above is also a factor here, but the need for standards-compliant machine components that can be integrated into an existing design for foreign sale is critical. To be competitive in the world market, builders must be cognizant of their vendors’ international capabilities. For the multinational end user, as well, this norm is consequential in achieving efficient compliance approval from the local standards organizations.

11. Regeneration adds efficiency

Finally, while it may not be entirely obvious, regenerative drives technologies provide a new measure of sustainability and the flexibility of

Automation means faster product changeover, faster recipe adjustments, and enhanced troubleshooting.

energy conservation to machine builders and end users. Smarter machine designs incorporating regeneration means that kinetic energy wasted in braking can be used to drive other machine components or returned to the grid in a measurable manner. This “active front end” technology

on the drive, coupled with more energy efficiency on the motors used, yields a definable best practice accomplishment in energy cost savings for the builder and end user alike.

In the overall evaluation, automation is the watchword for a modern packaging line and the equipment or machinery builder who supplies it. Automation combined with trained personnel will provide faster, more efficient, and cost-effective production. With automation products and software becoming so much more reliable and affordable, the days of the purely mechanical system are numbered, if not already spent. Having a high degree of automation in a line or on a machine means faster product changeover, faster recipe adjustments, homing of new line components after an install, enhanced troubleshooting capabilities, and more. **ce**

- Ajay S. Rana is industry business development manager, packaging, for Siemens Industry Inc. Edited by Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.



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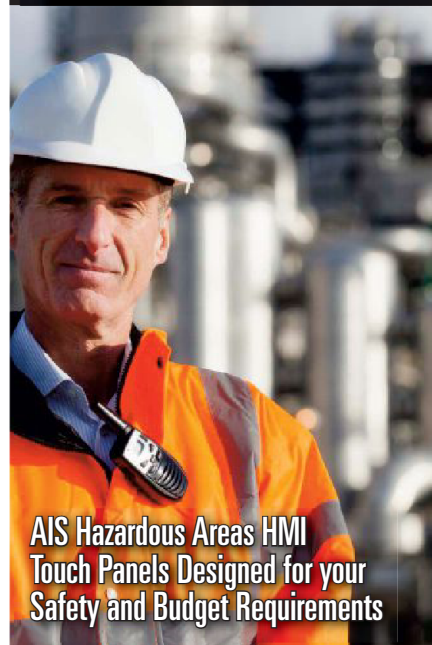
This article, in the June online archives, contains additional information and links to other machine design information.

www.controleng.com/enewsletters provides the machine control newsletter.

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Automation improves alternator test system

Motorcar Parts of America, an autoparts rebuilder, decides to design and build a new testing system in house using a programmable automation controller (PAC) and human machine interface (HMI). Off-the-shelf automation components work quickly and efficiently.

Key concepts



- MPA testing technicians can completely test a unit in less than 90 seconds, performing about 1000 tests per day.
- Ability to design, build, and program production and test systems in-house using primarily off-the-shelf industrial automation products provides a lower cost threshold.
- Lower cost automation enables projects considered uneconomical before.

When Motorcar Parts of America decided it needed a new testing system for its alternators, the company knew it would need a custom application. Therefore, the engineering team decided to design and build the system in house using a programmable automation controller (PAC) with a human machine interface (HMI).

To transform the raw data collected into a form the PAC would understand, we added numerous signal conditioners, solid-state relays, and other interfaces. This enabled us to thoroughly test all our alternators. When an alternator goes bad, most mechanics will replace it with a used unit that has been remanufactured, and it might have come from our company, Motorcar Parts of America (MPA) in Torrance, Calif. Given the number of units that have come through our shop and the expertise we've gained, many of our remanufactured alternators are better than the original as we have found ways to eliminate many design weaknesses.

The practice of rebuilding engines and subassemblies has been going on for decades, and MPA is a major supplier of replacement starters, alternators, wheel hub assemblies, and bearings. As engines have become more sophisticated, so has the remanufacturing and testing process.

Rebuilding an alternator from a current or recent model car is a complex process, one that virtually demands thorough testing to ensure that performance demands are met. Given the cost pressures always present in anything related to the automotive industry, companies that want to compete as rebuilders must be able to carry

out the remanufacturing and test processes quickly and predictably. Mechanics and auto part store chains will quickly drop a supplier that causes customer dissatisfaction by supplying substandard components, so quality is a must.

Thousands of alternator types are in use given the variety and age of cars on the road. Even so, MPA promises 100% end-of-line testing of all remanufactured alternators. Handling a huge range of sizes, capacities, and case design form factors requires an automated testing procedure that can step through and record a series of tests faster and more positively than with manual operations, which is why we employ automated test systems.

Custom built test system

Since an automated alternator test system isn't an off-the-shelf item, MPA has had to design and build much of its own test equipment. At present, MPA has rebuilding and testing recipes for more than 3,000 alternator models. This includes parts catalogs, performance parameters, test protocols, and other information. To implement these test recipes in an automated fashion, MPA recently installed a new alternator test bench, built in-house with the help of automation distributor and system integrator Quantum Automation.

Any company with a complex project needs to choose the right vendors to supply the required hardware and software components. To assist in the selection process, we chose Quantum Automation because of a sales support staff that we knew would point us in the right direction.

In a world driven by evolving technology and constant changes with new applications and solutions, it is necessary to consult with highly trained and trusted partners before beginning any automation project. Skirting this step could result in sourcing the wrong hardware or software.

Testing a given alternator requires mounting it in the test stand, generally using the same mounts that are used with the engine. This requires drop-in retainer inserts that mate with each specific alternator case design. Electrical

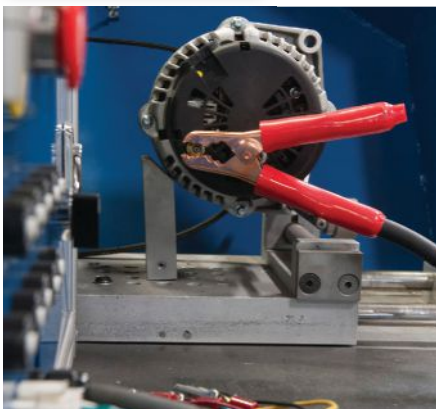


Figure 1: Electrical and data connections are made between the test system and the alternator after mounting in the test stand. An AutomationDirect GS drive controls the speed; making the connection to the Ethernet-based PAC required conversion to RS485 serial communication for the GS drive. All graphics courtesy: Motorcar Parts of America

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2014 Global Automation & Manufacturing Summit Agenda:

8:00 a.m.-9 a.m.	Breakfast Keynote: Karen Kurek, McGladrey: Manufacturing Monitor Report
9:15 a.m.-10:15 a.m.	Brandon Wheel, Alcoa/Allied Reliability: 30 years of excellence in process manufacturing maintenance
10:30 a.m.-11:30 a.m.	Panel Discussion: Building connectivity on your plant floor
12 p.m.-1:30 p.m.	Luncheon Keynote: Mick Wilz, Sur-Seal Cincinnati: Legos build employee engagement
2:00 p.m.-3:00 p.m.	Matt Puskala, DMC: Using mobility to increase productivity
3:15 p.m.-4:15 p.m.	Rod Emery, RedViking: Integrating logistics and MES
5:00 p.m.-7:00 p.m.	Networking event

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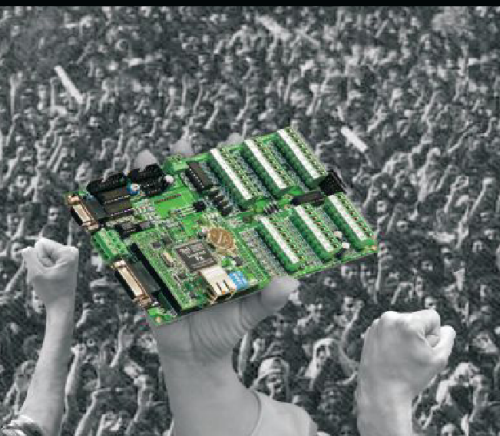


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connections have to be made to simulate a load (Figure 1), along with data connections that communicate with the ECU (engine control unit).

The testing protocol includes spinning the alternator at specified RPM values and checking its output in volts and amps, ac and dc. Running an alternator at full load requires the safe dissipation of high currents. A unit for a luxury SUV has to be able to power a huge number of accessories, so total output can easily be 200 A or more. The testing machine has to talk to the unit, giving it digital instructions and receiving information using CAN bus, just as the ECU would in a vehicle.

A programmable automation controller (PAC, Figure 2) is the heart of the test system. Operators control and monitor the test system via a touchscreen PC running web-based human machine interface (HMI) software, and the PC is connected to the PAC via Ethernet (Figure 3).

All of the testing parameters have to be programmed into the PAC, with some of the more commonly used programming routines standardized as function blocks for reuse from one program to another. An in-house designed printed circuit board communicates CAN-based data to the alternator that simulates what the engine would send in normal use.



Figure 2: A programmable automation controller automates the test system, monitors its operation and gathers test data. High processing speeds, sophisticated data handling, and high-level programming options were a must to meet system requirements. A sophisticated controller is the heart of the test system, in this case an AutomationDirect Pro-ductivity3000 Programmable Automation Controller (PAC).



Figure 3: The test system includes a touchscreen PC running HMI software, which allows operators to select recipes and perform other interactions with the system. Opera-

tors control and monitor the test system via a touchscreen PC running Web Studio Human Machine Interface (HMI) software from InduSoft, and the PC is connected to the PAC via Ethernet.

The test system also has a main drive motor that spins the rotor. Given the variety of units that must be tested, the motor has to operate over a wide speed range to match what the alternator would see in normal use. An ac drive controls the speed, although making the right connection to the Ethernet-based PAC required conversion to the RS485 serial communication required by the drive.

Designed for easy operation

In day-to-day use, an operator has a production lot of specific alternators to test. After inserting the correct mount to affix the alternator to the test stand, the operator calls up the parameters for the specific alternator from more than 3000 alternators in the database using the touchscreen HMI. The HMI provides the appropriate test screens for the specific alternator, and the operator interacts with the HMI as required during the test procedure (Figure 4). The test system first performs its own self-diagnostic before beginning the actual testing process. If a specific alternator fails, the test system can diagnose which component failed or if there is another defect, by determining which step the process was on when the failure was spotted. Quality technicians can then trace the root cause. Appropriate corrective actions can be performed according to MPA's test procedures. Once set up, testing technicians can test a unit in less than 90 seconds, about 1000 tests per day. The 1000 tests generate upwards of 250,000 total data points; all information is uploaded to the larger corporate server database.



Figure 4: The touchscreen HMI is programmed to lead the operator through the test procedure by following a series of logical steps. After using the AutomationDirect Productivity3000 PAC and the Indusoft Web Studio software, other parts of MPA manufacturing and test processes are being examined for opportunities to increase production or improve quality through a higher level of automation.

Handling large amounts of data

The test system has about 100 I/O points. With the amount of data that has to be gathered in a short time, the PAC and the HMI have to process data quickly. The kind of data collected when testing an alternator differs from most industrial automation systems. We added signal conditioners, solid-state relays, and other interfaces to convert the alternator test data into formats for the PAC. PAC and HMI communications have to be quick and are with 100 MB Ethernet.

Designing, building, and programming a unit of this complexity was not easy, but using standard industrial hardware and software made for a relatively inexpensive project. In years past, the only practical approach was using proprietary hardware and software that was more costly, more difficult to program, and harder to maintain. Earlier versions of a test system with this level of complexity would have cost two or three times what this did, without the same capabilities. That's the value of using off-the-shelf components to build a custom system.

Based on experience using the PAC and the web-based HMI software, we are looking at other parts of our manufacturing and test processes where we can increase production or improve quality through a higher level of automation. The ability to design, build, and program production and test systems like this in-house using primarily off-the-shelf industrial automation products has given us a lower cost threshold, allowing us to consider applications previously considered uneconomical. **ce**

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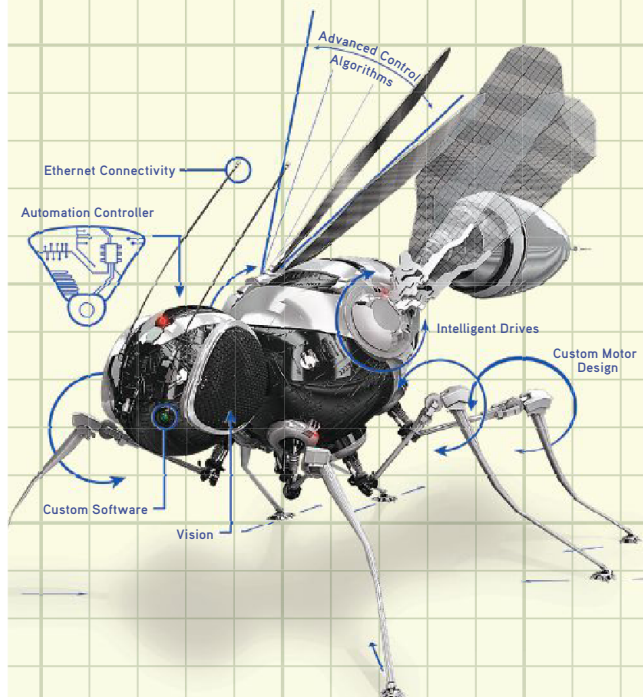
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Programming *in motion*

Automated Industrial Machinery (AIM Inc.) moved from an analog interface to servo amplifiers to a digital motion control network to reduce wiring and simplify programming. It used IEC 61131-3 compliant software and industry-standard PLCOpen function blocks.

Key concepts

■ Machine builders can reduce complexity by using digital networking.

■ Programming is easier, more modular and reusable by using standards such as IEC 61131-3 and PLCOpen function blocks.

■ Sequential Function Chart (SFC) language (part of IEC 61131-3) incorporates other languages as needed.

Machines now use less wiring and easier motion control programming with code that can be reused. What's not to like? Automated Industrial Machinery (AIM Inc.), is a leading producer of automated CNC wire-bending machinery. AIM motion control solutions have relied on traditional motion controllers with an analog interface to the servo amplifiers. To drive down costs, AIM decided to investigate using a motion control network to reduce wiring.

AIM's machine uses servos to pull wire through a straightening mechanism and into a bending head, which is also servo-powered. The bending head can also be rotated about the wire to provide bends in three dimensions. Other optional functionality is also servo-driven. The motion control requirements were handled by a standalone non-networked controller programmed in a text-based language. The user would create a part program using AIM's SmartEditor software, which then generates the text program required by the controller. The controller controlled the servo with an analog torque signal, relying on encoder feedback for speed and position data.

IEC 61131-3 programming, function blocks

AIM has used the same servo motors and

amplifiers for many years and is very satisfied with the performance and dependability of the products. AIM wanted a networked control system, and the servo motor supplier developed a solution using a multi-axis controller that is programmed with IEC 61131-3 compliant software from the servo motor supplier. Industry-standard PLCOpen function blocks are used for motion control functions, along with programming toolboxes to add functionality.

The first challenge was figuring out how to get data from the AIM SmartEditor to the servo controller, which isn't programmed in the same way as in the previous controller. The part program, with instructions to make the part, had to be transferred. The AIM SmartEditor also needs to be able to command the controller directly. This is used to do things like jog an axis, turn on an output, or start the part program. Servo motor supplier engineers created a special set of IEC function blocks for these tasks and bundled them into a custom software library toolbox.

Programming steps

To make the part program (the list of instructions needed to make a part), a custom program language was created for AIM's needs. After the user enters the data to define the part, SmartEditor generates a program similar to before, but in the new customer language. It is based on two-letter commands, such as MV to make a move, CT to cut the wire, or SV to set a variable to a particular value. A series of operands specific to the command follows the command code, each separated by a comma as a delimiter to make the command parsing simple. These commands were streamed over an Ethernet socket from SmartEditor to the controller, which parsed each line and stored the command and operands in an array. This custom language allows for great flexibility as complex sequences in the controller can be launched with one command.

When the user commands the controller to make a part, the array of commands is executed line by line to make the part. To do this, the Sequential Function Chart (SFC) language of the IEC 61131-3 standard is used. To call SFC a lan-

Figure 1: AIM's programmable CNC steel wire bending machines increase productivity and are simple to operate. Advanced servo technology enables machines to operate at very high speeds without sacrificing accuracy and repeatability.

AIM uses Yaskawa servo motors and amplifiers and, in a machine redesign, asked for a networked control system; Yaskawa supplied its MP2310iec controller, a multi-axis controller programmed with IEC 61131-3 compliant Yaskawa MotionWorks IEC software. Industry-standard PLCOpen function blocks are used for motion control functions; programming toolboxes add functionality. All figures courtesy: Yaskawa America Inc.



guage is a bit of a misnomer; it's a sequence of actions and transitions that looks and acts much like a flowchart. Each action and each transition can be programmed in a different "standard" language like LD (ladder diagram), FBD (function block diagram), or ST (structured text), mixing and matching as the circumstance dictates.

To execute the part program, an idle action waits for the start signal and then reads the first command in the program. Simple commands such as toggling an output can be done immediately within the idle action, but complex tasks like moves require more in-depth programming. In these cases, an internal variable is set that executes the particular branch of the SFC that performs the function. After the command is executed, the step number is incremented and the next line is executed. This repeats until the end of the program.

Direct commands work in much the same way, but are sent over a different Ethernet socket. Using two sockets makes it easy for the controller to determine which commands are for the program and which should be executed immediately. Monitoring information is sent back over these same two sockets: One provides continuous monitoring of machine status and performance, while the other provides on-demand monitoring of variable values.

Reusable toolbox of code

Since the creation of the custom software library toolbox, other customers have expressed needs for similar control requirements. This application-specific reusable code can address these needs by interfacing with a previously existing PC program to provide the controller with data to operate the machine more effectively. The result has been positive: "The increased product reliability and simplified wiring that the... controller offers translates to cost reduction," said Constantine Graspas, president of AIM. "Product quality, performance, and dependability, along with the quality engineering support for product development, have helped AIM to be ranked for the third year in the INC 5000 list of the highest growth companies in the USA," said Graspas. **ce**

- Mark Wilder is regional motion engineer, Yaskawa America Inc., drives and motion division. Edited by Mark T. Hoske, content manager, Control Engineering, mhoske@cfemedia.com.



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www.controleng.com/archives in the June archives, this article has links to other relevant information.

Consider this...

How could standard programming and easier networking help your machine design or use?

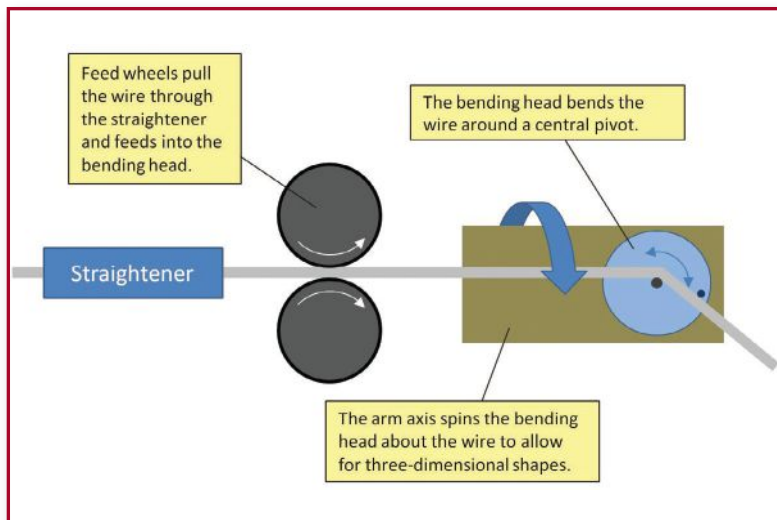


Figure 2: AIM's machine uses servos to pull wire through a straightening mechanism and into a bending head, which is also servo-powered. The bending head can also be rotated about the wire to provide bends in three dimensions. Yaskawa engineers created a special set of MotionWorks IEC function blocks to accomplish the motion control tasks in the machine and bundled them into a custom library called the Communications Toolbox.

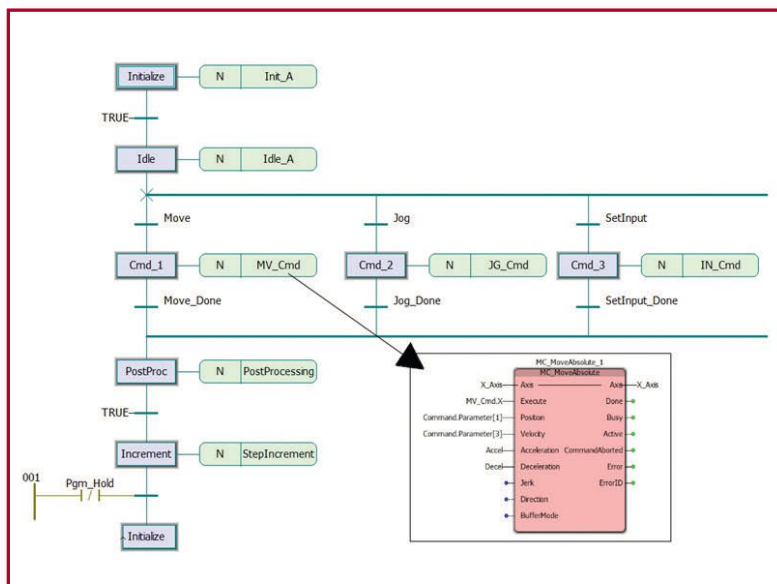


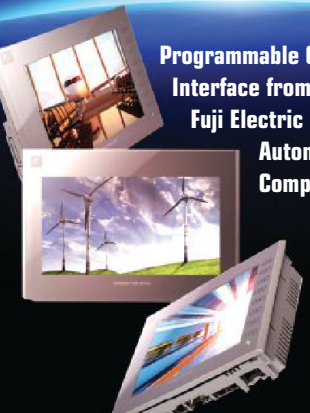
Figure 3: When the user commands the controller to make a part, the array of commands is executed line by line to make the part. To do this, the Sequential Function Chart (SFC) language of the IEC 61131-3 standard is used. SFC is a sequence of actions and transitions that looks and acts much like a flowchart. Each action and each transition can be programmed in a different "standard" language like LD (ladder diagram), FBD (function block diagram), or ST (structured text), mixing and matching as the circumstance dictates. Commands stream over an Ethernet socket from SmartEditor to the Yaskawa controller, which parsed each line and stored the command and operands in an array. Using two sockets makes it easy for the Yaskawa MP2310iec controller to determine which commands are for the program and which should be executed immediately. "The increased product reliability and simplified wiring that the MP2300Siec controller offers translates to cost reduction," said Constantine Graspas, president of AIM.

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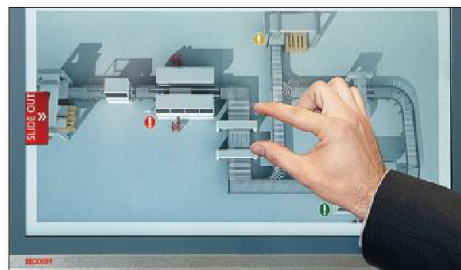


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DE-1 HMI best practices in technology

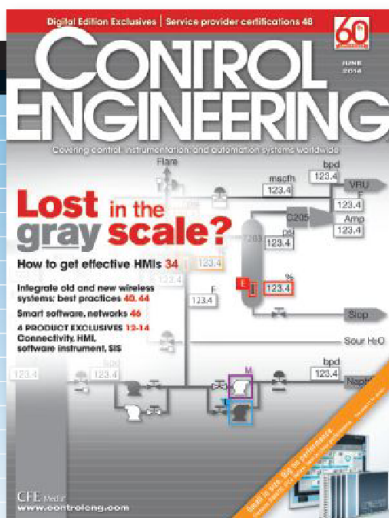
Advances in connectivity, PC-based control, and multi-touch functionality boost value of human machine interfaces (HMIs).



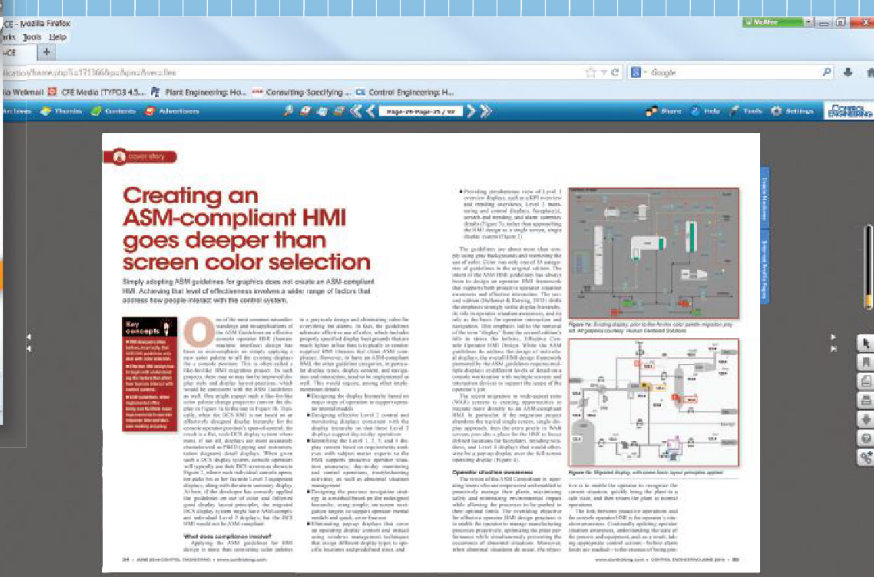
DE-3 Microsoft Windows XP EOS: What manufacturers need to know

Ask *Control Engineering*: What do I need to know about end of service (EOS) for Microsoft Windows XP, and what should I consider going forward? See 5 areas impacting cyber security, production reliability, and quality. Alert organizations have been migrating away from Windows XP; Microsoft may still provide limited support for companies that pay for extended support, costing at least \$100,000 per year.

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HMI best practices in technology

Advances in connectivity, PC-based control, and multi-touch functionality boost value of human machine interfaces (HMIs).

Key concepts



- Human machine interface hardware and software involves look, function, and connectivity.
- Open, “vendor-neutral” connectivity solutions such as the OPC UA (Unified Architecture) communications model help.
- The modern HMI and OPC UA can help serve as a conduit that connects the user to the machine, the plant floor, the MES layer, and other higher level enterprise systems and back again.

The best human-machine interfaces (HMIs) are designed for easy use by all operators on the plant floor. This optimization leverages modern technology advances and can affect every aspect of the HMI—from the way it looks, to the way it behaves, to the way it can connect the user to live data from the plant and to live support from the machine builder or equipment vendor. Open, “vendor-neutral” connectivity solutions such as the OPC UA (Unified Architecture) communications model are increasingly important to establish this connectivity.

Better connectivity, data access

The modern HMI and OPC UA can help serve as a conduit that connects the user to the machine, the plant floor, the MES layer, and other higher level enterprise systems and back again. This enables the implementation of more

intelligent and connected systems. OPC UA client and server functionality can be available in a PC-based controller without a hardware add-on. The PC-based hardware can even be in the form of a panel PC, which can serve as the all-in-one HMI and controls hardware. Pushing data to the cloud via OPC UA can be easily accomplished with two or three simple function blocks used within the controller, which can facilitate a completely secured connection from the controller to the cloud.

Look first to the HMI for troubleshooting and support

HMI can also be the key enabling technology in the area of troubleshooting and support. Hands-on troubleshooting requirements can be decreased to a minimum by integrating rich diagnostic capabilities into the HMI. Today, there is no need for problems to be resolved the old-fashioned way by opening up the electrical cabinet, logging into a hardware PLC, and struggling through ladder logic to get production up and running again.

With a PC-based automation system that uses programming software that works for controllers, networking, motion, and HMIs, the HMI can visually show a wealth of diagnostics information such as production data and measurements relating to the health of equipment such as temperature, vibration, energy use, etc.

Built-in diagnostics capabilities of EtherCAT can also quickly localize the source of problems for faster corrective measures. Possible troubleshooting techniques can be displayed as on-screen options on the HMI along with multimedia materials for tutorials and documentation. The machine builder can decide how much direct operating system (OS) access to give the end users on the PC-based controller. It is possible for machine builders to easily embed media players within the HMI software to play tutorial/troubleshooting multimedia.

A range of standard tools can also facilitate remote connectivity to off-site support from the machine builder or equipment vendor, which is

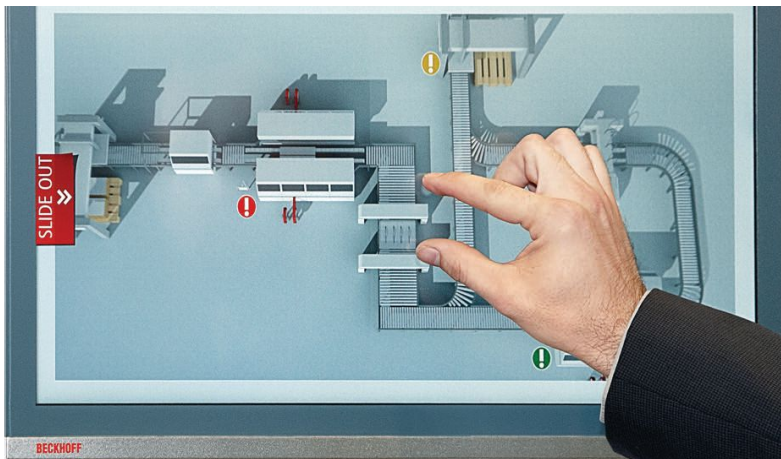


Figure 1: The modern multi-touch HMI and OPC UA can help serve as a conduit that connects the user to the machine, the plant floor, the MES layer, and other higher level enterprise systems and back again. Beckhoff Automation offers built-in OPC UA client and server functionality in any PC-based controller without a hardware add-on. With a PC-based automation system that uses TwinCAT software and EtherCAT networking from Beckhoff, the HMI can visually show a wealth of diagnostics information such as production data and measurements relating to the health of equipment such as temperature, vibration, energy use, etc. All graphics courtesy: Beckhoff Automation

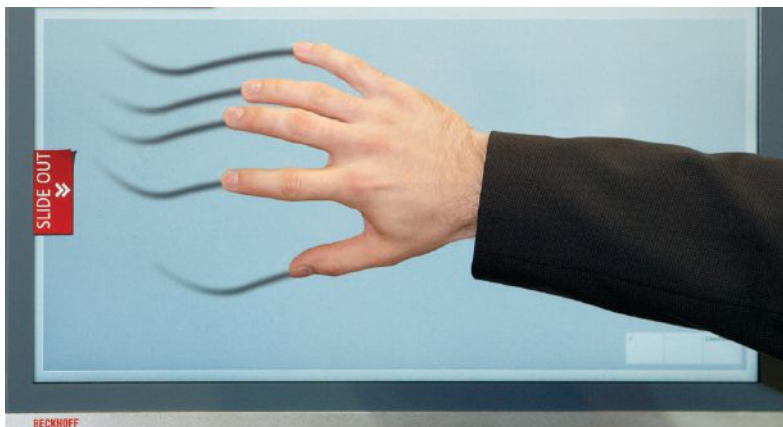


Figure 2: Well beyond a simple “cool factor,” multi-touch can enable easier and more intuitive access to more detailed plant information, such as scrolling through detailed machine views with pop-ups that can indicate important updates or problem areas.

more often the case today. This takes the burden off the end users so they can put more of their time and efforts behind production-related concerns. This is especially important for operations that simply don’t have the budget to employ as many controls or software specialists on-site.

Multi-touch changes the game

A major new development that enables enhanced user-friendliness to HMI hardware is the advent of multi-touch technology in industrial applications. Well beyond a simple “cool factor,” multi-touch can enable easier and more intuitive access to more detailed plant information, such as scrolling through detailed machine views with pop-ups that can indicate important updates or problem areas. Users can pinch and zoom into specific machine modules for more information on a targeted area. This can be a much more user-friendly experience than a traditional single-touch interface, which may require far more time spent clicking through different machine views and menu options.

Multi-touch-enabled control panels and panel PCs have up to five simultaneous points of touch on the screen at any time.

These are designed for industrial use so they feature robust, stable construction and protection ratings up to IP65. The multi-touch panels with projective capacitive touchscreen (PCT) technology feature a high touch-point density, which enables accurate, safe, and jerk-free operation even in minute steps. These are available in multiple formats such as 16:9, 5:4, and 4:3, as well as versions in landscape or portrait orientation. In addition, screen sizes and resolu-

tions from 7-in., 800 x 400 pixel resolution up to 24-in., 1920 x 1080 pixels are available with numerous variants in between for maximum flexibility for the application. While multi-touch functionality isn’t yet a “must have” for most industrial applications, HMI users are increasingly influenced by consumer electronics technology with multi-touch so the demand for industrial equivalents will continue to grow.

HMI leverage

Machine builders that are able to leverage the connectivity, troubleshooting, and multi-touch technologies now will establish better practices for end users and will have at least a temporary competitive advantage over much of the competition in the areas discussed previously. Over time, the benefits and savings will become better known by end users, and ultimately, the preferences of today will become the requirements of tomorrow. **ce**

- Reid Beilke is industrial PC product specialist, Beckhoff Automation. Edited by Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.



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In June see this article in the online archives for more information and links to related articles.

Consider this...

See HMI screen design tips in this issue. Are older HMIs costing you missed opportunities?



Figure 3: Beckhoff Automation offers a wide range of multi-touch-enabled control panels and panel PCs with up to five simultaneous points of touch on the screen at any time.

Microsoft Windows XP EOS: What manufacturers need to know

Ask Control Engineering: What do I need to know about end of service (EOS) for Microsoft Windows XP, and what should I consider going forward? See 5 areas impacting cyber security, production reliability, and quality. Alert organizations have been migrating away from Windows XP; Microsoft may still provide limited support for companies that pay for extended support, costing at least \$100,000 per year.

Key concepts

- Microsoft Windows XP support ended on April 8, 2014.
- Risk of cyber security issues increase over time.
- Resources are available to protect existing assets and migrate to other options.

There has been much talk lately about the end of lifecycle issue related to the Microsoft Windows XP operating system (OS). In fact, for the past year, Microsoft has been reminding folks that on April 8, 2014, it would officially end extended support for the Windows XP operating system (OS). For more than 12 long years Windows XP has been a stable and significant workhorse of an operating system. Not only for enterprise-wide desktop PCs, you may be surprised to find out Windows XP is heavily used in industrial applications including ruggedized PCs (such as human machine interface HMI computers, pro-

gramming stations, and engineering laptops) as well as embedded computers used in thousands of devices that control and monitor many factory automation and process control operations; and power, water and transportation infrastructure.

Cumulating effects over time

What does this mean? For starters, end to extended support for Windows XP refers to the date when Microsoft no longer provides automatic fixes, updates, or online technical assistance. It doesn't mean Windows XP will stop working; it means Microsoft will no longer release security updates and "hot fixes" routinely available for the Windows XP OS before April 8, 2014.

Leaving Windows XP unsupported will expose users to a growing risk as the number and severity of security exploits grow, and continued support, if any, from Microsoft will be costly. Time will make even clearer that the quantity of serious security exploits for Windows XP is likely to increase rapidly as soon as Microsoft stops delivering security updates.

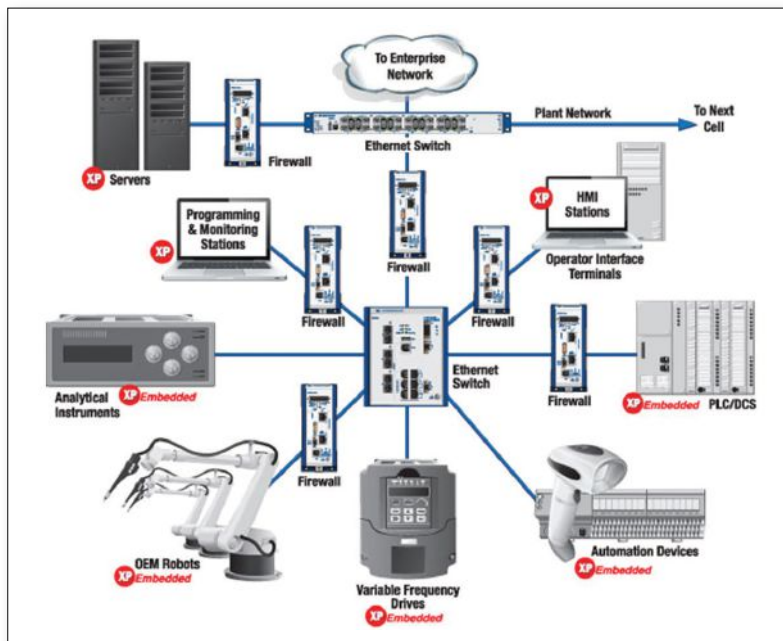
Consider this fact: 70% of Microsoft's security bulletins in 2013 affected XP, and there is no reason to assume that this will change (unless it increases) in the near future.

And while Microsoft may still provide limited support for companies that pay for extended support—an option that costs at least \$100,000 per year—alert organizations should develop a plan to migrate away from Windows XP.

Reduce risk: Fix before it breaks

How does this impact industrial users? For industrial users, migration from Windows XP is more complicated than at the enterprise level.

Critical infrastructure and industrial plants use complex networks of computers, PLC con-



This simplified drawing of an industrial network shows some points of vulnerability and protection. Courtesy: Belden

trollers, remote terminal units, and other specialized equipment. These mission-critical networks are designed, deployed, and managed with a razor-sharp focus on safety, reliability, and “up” time; outages of even just a few minutes are unacceptable. Any type of plant outage has an immediate and significant financial impact on its owner. For many plants, the cost of an outage can easily be hundreds of thousands of dollars per hour. Many of these industrial facilities include safety-critical processes which could put the lives of their employees or the surrounding communities at risk, or cause significant environmental impact, if not managed properly.

This creates a set of operating conditions and priorities that is very different from that in a typical IT or enterprise network. The prevailing mind-set in the plant is “if it ain’t broke, don’t fix it.” Once a plant control system has been tested and commissioned, the engineers are very reluctant to make any changes to a working facility, and for good reason. Windows XP is everywhere in today’s industrial plants and factories. Numerous industrial control and supervisory control and data acquisition (SCADA) systems use Windows XP in operator displays, human machine interfaces (HMIs), engineering laptops, and programming stations. Many plants use specialized application software which in many cases can’t natively run, or hasn’t been thoroughly tested on any operating system but Windows XP.

Windows XP also shows up in another form called “Windows XP Embedded.” This is a lighter-weight version of Windows XP that was developed by Microsoft for use in branded OEM devices and systems such as machine tools, instrumentation, and operator interface terminals. Since these devices are not “computers” in the traditional sense of the word, their owners may not even be aware that Windows XP is running inside them, and that they therefore present the same security risk as an XP desktop or laptop computer. Even with awareness that such devices use Windows XP or Windows XP Embedded, there is typically no practical way to upgrade or patch them without completely replacing them. [Support on Windows XP Embedded is scheduled to end Jan. 12, 2016.]

The Windows XP EOL places industrial users in a very uncomfortable position. The risk of security issues and resultant downtime will steadily increase over time after the EOS, and yet the cost of upgrading or replacing XP-based systems (particularly the cost of the associated

plant shutdown) is often prohibitive.

What should you consider going forward?

Secure your devices, the network, and its operation. While you may not immediately have vulnerabilities, the longer you wait after April 8, 2014, the more susceptible your operation will become because of the EOS of Windows XP.

Most industrial firms that choose to migrate to a new operating system know it takes planning and time (usually 12-24 months for a complete change out) to ensure everything works as it should once it’s put back together. How can you improve your migration success factors?

5 key challenges at end of service

Create an inventory of XP and non-XP assets in your plant network, and identify five areas that often present the biggest challenges:

1. Application compatibility problems
2. Time available to perform migration and conflicts with other operational/IT initiatives
3. User training and support required after migration
4. Lost productivity during migration
5. Issues with repackaging, remediating, and deploying applications.

Create a plan, provide the right budget, and assign folks who can focus on the task of getting it right. Remember, it won’t get done overnight.

For those devices that cannot be migrated from XP to a supported platform, or to provide immediate mitigation while you deploy your longer-term plan of migrating from Windows XP, you may want to apply “compensating devices,” such as industrial firewalls. These devices can be easily configured to block network traffic that can exploit vulnerabilities in your XP systems, while still allowing them to perform their primary functions without interruption.

Many times an outside firm can help. Find and work with a “trusted advisor,” someone you know who understands the technology and subject matter, and brings industrial solutions, certified in locking down industrial networks. **ce**

- Frank Williams is senior manager, Belden Cyber Security Initiative. Edited by Mark T. Hoske, content manager, CFE Media, Control Engineering, mhoske@cfemedia.com.

Consider this...

If you're still using Microsoft Windows XP without a clear plan for protection and migration, how will you explain to customers, employees, and others when a cyber security breach and outage results?



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Ask Control Engineering has more information and links to related Microsoft Windows XP advice.



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INNOVATIONS FROM THE INDUSTRY

System 800xA enhances security and drives Windows XP upgrades



System 800xA Extended Automation

System 800xA is known for delivering productivity through consolidating process, electrical, safety, and telecoms in one system and providing the ultimate high performance operator control room environment featuring the Extended Operator Workplace. This sixth generation release, commonly called 800xA v6, is not only for new projects but has been specially developed to support upgrades of older DCS systems running on unsupported operating systems such as Microsoft XP. 800xA v6 provides customers with a more secure automation environment that lowers the total cost of ownership, while providing countless opportunities to improve productivity.

"System 800xA's collaboration platform and its built in functionality allow you to tackle money saving initiatives and implement productivity enhancing solutions for a fraction of the cost of adding third party software and hardware. In addition to alarm management, advanced control, video systems, safety and electrical integration System 800xA v6 adds:"

- Wireless routers for mobile operator clients, maintenance workplaces and even controllers
- New information management platform with secure access for data mining and analysis
- Operator effectiveness improvements such as trend and alarm list enhancements and an embedded public address system
- Collaboration table providing a 3D view of plant KPIs



System 800xA Version 6 – Collaboration Table



Tobias Becker

Reaching New Heights of Collaboration

"The most exciting part about upgrading is seeing what you can do with System 800xA v6" says Tobias Becker, Business Unit Manager for Control Technologies.

Time to Celebrate!

The launch of System 800xA Version 6 marks the next level of ABB's innovative quest to create a collaborative process automation environment that allows for the sharing of data without boundaries to generate productivity, efficiency and safety improvements. With approximately 10,000 800xA systems installed, ABB will celebrate 10 years of innovation and the release of Version 6 with the World Control Tour during the Spring / Summer of 2014.

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INNOVATIONS FROM THE INDUSTRY

Allied Goes Interactive

It's an interactive world, and in the spirit of innovation, Allied has introduced new interactive elements to their website. Designed to make the customer experience easier, more immersive, and more enjoyable, Allied recently debuted several new product information features that take full advantage of the Internet's interactive capabilities.

Allied's innovative Product Finders make locating the parts needed for a particular project simple. Take the Control Cabinet Product Finder, for instance. Mouse over any component in the 3D-rendered control cabinet drawing for a list of all the manufacturers of that product and a link that instantly takes you to the catalog page for the part you're interested in.

Need a transformer for a control cabinet? Just click on the accurately-rendered drawing to find transformer products from Acme Electric, Hammond Power

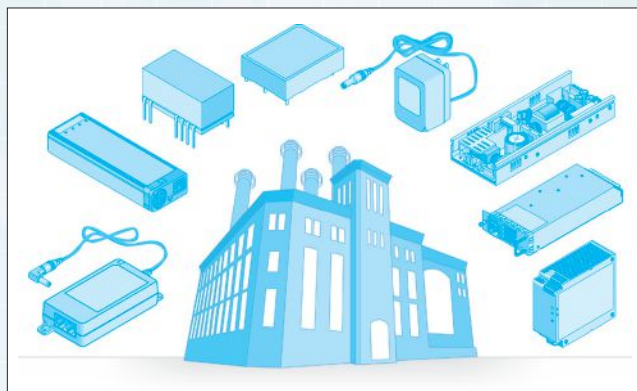
Solutions, Sola/HD, and more. Click on the "View All" button to see a sortable list of all the transformers available in the Allied catalog (more than 950!).

The Power House Product Finder features AC/DC and DC/DC power supplies from a host of leading suppliers, including Cosel USA, Phoenix

Contact, Power-One, SL Power, SolaHD, and TDK-Lambda. Power Over Ethernet, Modular power supplies, LED drivers, PCB mounts, and more are just a click away with this easy-to-use search tool.

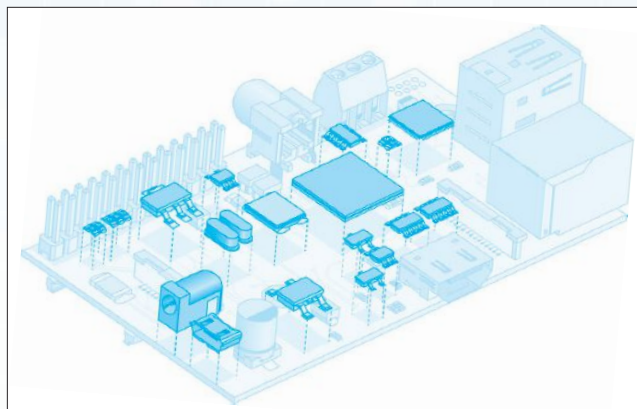
Perhaps even more impressive is the Interactive PCB Product Finder. This fully rendered circuit board presents a variety of common components, all of

which can be highlighted and viewed. Select one of the six capacitors, for instance, and all are highlighted. A simple click reveals a choice of capacitor types, such as Aluminum Electrolytic, Ceramic, Film, Metalized, and Tantalum, from such noted manufacturers as Cornell-Dubilier, Kemet, Vishay, Panasonic, and Nichicon.

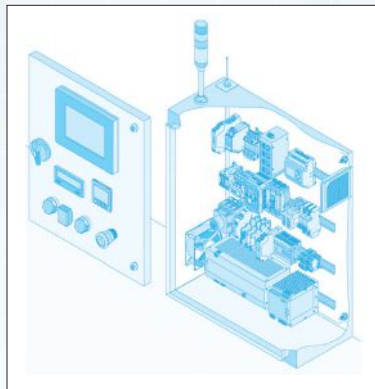


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Other online help includes frequently asked questions, application examples, and product selection guides.



INNOVATIONS FROM THE INDUSTRY

EZAutomation



EZAutomation, a division of the AVG Group, is a manufacturer of Industrial Automation products including HMI/Operator Interface Panels, Programmable Logic Controllers (PLCs), Power Supplies, Sensors, Industrial PCs, Programmable Encoders, all-in-one HMI-PLC combo units and much more.

AVG Automation and its three divisions, Autotech Controls, Uticor Technologies and EZAutomation, have been in business serving the automation industry since 1968, and is proud to be one of the only automation suppliers to continue to manufacture in the USA.

Innovation at its best

We are always at the fore-front of technology, innovating new concepts based on industrial automation needs. With our Exclusive White LED backlights on our HMIs for extreme temperature and humidity controls, unique integrated TouchPLC combo units for small enclosures, Smart Encoders that are field programmable without cables, software or a PC, and Smart Power Supplies with a display for voltage, current and maintenance alerts, AVG Automation has taken industrial automation to the next level. This innovation is why we continue to be awarded Control Engineering's Engineer's Choice Awards.

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With the latest and greatest technology and features across the entire AVG product line, we guarantee that our customers will have the lowest overall cost of ownership in the industry when using our products.

Customer Service & Technical Support:

Our business model focuses on providing customers with the best quality of US based service that will put a smile on your face. With Customer Service available from 6:00am to 7:00pm (CST), we have you covered from the East Coast to the West Coast, with same-day shipping until 7:00pm. Technical Support is available from 6:00am to 12:00am (midnight) and also as weekend emergency support. It is our mission to make sure that our customers are never down.

New Ideas?

At EZAutomation, we strive to have the latest technology available on the market and value customer feedback on new ideas. We are always excited to hear about your applications, giving us new ideas for products that may be lacking in the industry, or that may improve automation controls, so please feel free to contact us anytime.

EZAutomation.net
A Division of **AVG**



EZAutomation, Division of AVG | sales@ezautomation.net | 1-877-774-EASY (3279)
www.ezautomation.net

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INNOVATIONS FROM THE INDUSTRY

Beckhoff Automation



Beckhoff Automation is a provider of advanced, open automation products based upon proven industrial technologies. Beckhoff has been a long-time proponent of open controls architectures, full system interoperability, seamless machine-to-machine communication and lean automation solutions. As more technology companies are calling for these types of cost-efficient solutions, Beckhoff is well-positioned today to support them. Beckhoff is also continuing the implementation of next generation industrial innovations, including forward-looking concepts for machine builders and manufacturers that promote Industry 4.0 and the Internet of Things.

Problem-Solving Technologies

Beckhoff's product range includes PC-based control, Industrial PCs, Embedded PCs, operator interfaces with optional multi-touch technology, I/O compatible with over 15 different fieldbuses, EtherCAT (next generation

Ethernet fieldbus technology),

TwinSAFE safety solutions, servo drives and motors.

Another advanced solution from Beckhoff is TwinCAT 3, which represents a convergence of automation and the IT world. The increasing range of available tools from automation technology (AT) and computer science/IT is referred to as eXtended Automation Technology (XAT).



*Graham Harris,
President
Beckhoff Automation*

This gives programmers far more tools than they've had in the past to add intellectual property value and implement industry-leading automation and control concepts.

Feature-Laden Solutions

While supporting all IEC 61131 programming languages and providing active support of multi-core Industrial PC systems, Beckhoff advances leading edge automation solutions that deliver high performance at a low cost. This includes Scientific Automation, which merges automation, PLC, motion control, safety and robotics with advanced condition monitoring and precise measurement technologies. This all can be handled on one powerful, PC-based automation controller and cost-effective EtherCAT Terminals, eliminating the need for many expensive and highly specialized "black boxes."



Worldwide Presence

The Beckhoff Automation North American headquarters is located in Savage, Minn. (Minneapolis area). At this location, administration, product and engineering management, warehousing and training occurs. There are also regional sales and support facilities located in the Chicago area; San Diego; Charlotte, NC; the Seattle area; and Mississauga, Ontario. Beckhoff's global headquarters, which includes product design and assembly facilities, is located in Verl, Germany. Between direct owned subsidiaries and worldwide cooperation with partners, Beckhoff is well-represented in 60+ countries.

BECKHOFF

INNOVATIONS FROM THE INDUSTRY

Maximize Savings with the Right Variable Frequency Drive



For its Ste. Genevieve cement manufacturing facility, Holcim (US) engaged Danfoss for advanced VFD technology to assist in making the site one of the most energy-efficient cement plants in the world.

"It's well known that variable frequency drives can dramatically cut energy costs in fan applications. For example, if speed can be reduced 20 percent, then kW consumption can be cut up to 50 percent due to the physics of motor Affinity Laws. The critical engineering decision is to select and configure the right kind of VFD for the application," said Michael Ifurung, electrical engineer at the facility.

After careful consideration of VFD suppliers and equipment capabilities, Kendall Walden, Holcim's electrical and process controls manager, and Ifurung selected Danfoss VLT® Automation VT Drives, which are designed to handle industrial applications.

"These are variable-torque type drives," Ifurung continues. "At faster speeds, a fan encounters more pressure. That requires more torque to spin the fan. Because torque reductions vary as the cube of speed, every time you can reduce torque you can reduce RPMs. Thanks to Affinity Laws, that means you can cut kW exponentially. That's how the VLT® Drives

slashed the utility bill by enough to pay for the project in less than two years. Plus, they reduced utility demand charges by reducing inrush current at start-up."

Danfoss VLT® Drives are soft-start devices that gradually ramp voltage up and down when starting and stopping, which eliminates sudden fluctuations in amperage that may result in demand charges. In operation, the drive can vary the current frequency from 0 to 32 kHz to deliver a variety of AC motor speeds. Motor speed can then be matched to the required fan RPM to maintain process quality and reduce electric consumption whenever full torque is not required.



The bottom-line benefit of the VLT® implementation at the facility was the substantial energy savings. "Everyone knows that anytime you can reduce fan motor RPMs you can get exponential energy savings," says Walden. "In our case, the results are significant. This technology has aided our overall electrical efficiency. And for the second year in a row, our plant has received EPA's ENERGY STAR® for Super Energy Efficiency. Danfoss VLT® Drives are helping our Ste. Genevieve plant build a solid reputation for saving energy."

INNOVATIONS FROM THE INDUSTRY

Dataforth's MAQ®20 System Raises the Bar



Founded in 1984, Dataforth is a recognized global leader in the design and manufacture of data acquisition and control, signal conditioning, and data communication products for industrial applications. From the beginning, our mission has been to set new standards of product quality, performance, and customer service. All 1000+ Dataforth products are manufactured in Tucson, Arizona. The Quality Management System is ISO9001:2008 registered.

conditioning I/O modules and communication modules. It offers the industry's lowest cost per channel and allows up to 384 channels in a standard 19" instrumentation rack. Key features include 1500Vrms channel-to-bus isolation, $\pm 0.035\%$ accuracy, -40°C to $+85^{\circ}\text{C}$ operating temperature, two dedicated monitoring and control software packages, and integral PID control.

Designed for rugged industrial use, the MAQ®20 is ideal for factory, process, and machine automation; military and aerospace, power and energy, oil and gas, and environmental monitoring applications.



MAQ®20 Industrial Data Acquisition and Control System

"The MAQ20 – Dataforth's 3rd generation data acquisition system – incorporates many leading-edge elements, like our advanced method of Cold Junction Compensation and unique power boost module design, that set us apart from the competition," says Robert Smith, VP, Sales and Marketing. "It is an exceptionally powerful, flexible, and compact system that is based on our 30+ years of experience in the industrial test and measurement and control industry."

The MAQ®20 system consists of a family of DIN rail mounted, programmable, multi-channel, signal

The Dataforth System Builder

This innovative, interactive online feature allows you to build your own data acquisition system, module by module. Based on stated requirements and parameters, suggestions are automatically given on which products will best

meet your needs, while continuous pricing updates ensure the most cost-effective system price.

Ongoing Innovation

Dataforth products connect directly to most industrial sensors and are designed specifically to protect measurement and control signals and connected equipment from the degrading effects of noise, transient power surges, internal ground loops, and other hazards.

"As always, our commitment is unwavering to the ongoing development of new industrial electronic products and systems that will continue to satisfy our customers' stringent requirements," Smith says.



INNOVATIONS FROM THE INDUSTRY

Pneumatic and Electric Drive Technology for Factory & Process Automation



Festo is a leading global manufacturer of pneumatic and electromechanical systems, components and controls for process control and factory automation solutions, with more than 55 national headquarters serving more than 180 countries. With over 40 years of innovation in the United States and over 80 years globally, Festo has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performing, more profitable automated manufacturing and processing equipment.

Our dedication to the advancement of automation extends beyond technology to the education of current and future automation and robotic designers with simulation tools, teaching programs, and on-site services.

Full Range of Standard and Customized Products

With a comprehensive line of more than 30,000 automation products, Festo can support the most complex automation requirements.

- Pneumatic Drives
- Servo Pneumatic Technology
- Handling & Vacuum Technology
- Air Preparation, Pneumatic Connections and Tubing
- Valve and Valve Manifolds
- Sensors and Machine Vision
- Control Technology
- Electromechanical Components

Industry Specific Expertise

Whether designing new machinery or modernizing existing systems, Festo can provide the resources you need to

meet your unique requirements in every stage of industrial production and manufacturing.

- Automotive
- Biotech/Pharmaceutical
- Electronics/Light Assembly
- Flat Panel/Solar
- Food & Beverage
- Lab Automation
- Printing, Paper & Converting
- Water/Wastewater

Complete System Solutions

Our experienced engineers provide complete support at every stage of your development process, including: conceptualization, analysis, engineering, design, assembly, documentation, validation, and production.

- Engineering & Design
- Control Systems
- Handling & Custom Assembly

Training & Consulting

Our dedication to the advancement of automation extends beyond technology to the education of current and future automation and robotic designers with simulation tools, teaching programs and on-site services. Festo Didactic, our knowledge and learning division, provides automation technology training for manufacturing employees at our industrial customers worldwide. From basic training packages to the planning, control and handling of complex networked CIM systems and complete, fully equipped learning centers – we can create a customized offer to suit your personal requirements for efficient learning and guaranteed results.



FESTO

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INNOVATIONS FROM THE INDUSTRY

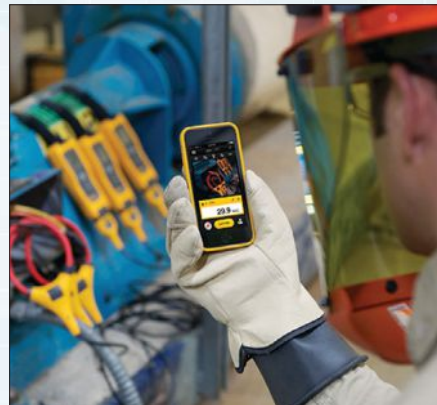
New Fluke Connect™ system transfers measurement data from test tools to smart phones and the cloud, improving maintenance team communication, safety and productivity

The largest system of connected test tools in the world

Maintenance technicians make better, faster decisions when they have field access to maintenance records and when they can review measurements in real time with team members and supervisors. The Fluke Connect™ system provides faster decisions while increasing the safety of technicians working with energized equipment.



Team collaboration is made easy with ShareLive™ video calls, where technicians can share measurements with other team members in real time, get approvals for repairs or get questions answered without leaving the field.



The Fluke Connect app features EquipmentLog™ history, which allows technicians to assign measurements to specific equipment, creating a cloud-based history of test measurement data for easy access during both troubleshooting and reliability maintenance. And TrendIt™ enables technicians to instantly graph data, helping to identify trends and quickly make informed decisions.

The Fluke Connect system allows maintenance technicians to wirelessly transmit measurement data from their test tools to their smart phones for secure storage on the cloud and universal team access from the field. More than 20 Fluke tools connect wirelessly with the app, including digital multimeters, infrared cameras, insulation testers, process meters, and specific voltage, current and temperature models.

Technicians can AutoRecord™ measurements and infrared images to Fluke Cloud™ storage from wherever they're working, without writing anything down. Everyone on the team with a smart phone and the app can see the data.



Fluke Cloud storage is built upon state-of-the-art security, including secure access, electronic surveillance, multi-factor access control systems, built-in firewalls, and encrypted data storage.

The Fluke Connect app can be downloaded for free from the Apple App Store and the Google Play Store.



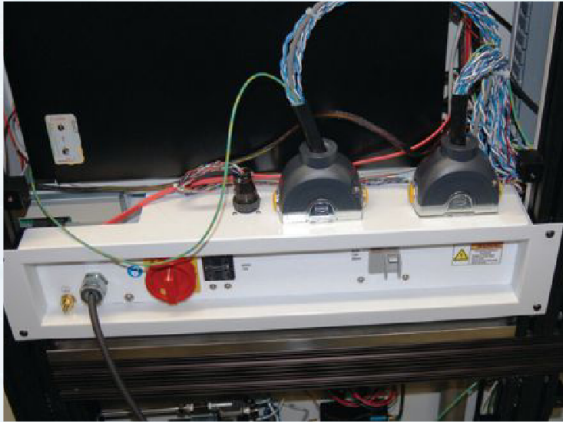
FLUKE®

For more information about the Fluke Connect, visit: www.flukeconnect.com.

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INNOVATIONS FROM THE INDUSTRY

Benefits of connectors compel many to switch



Industrial connectors or hardwiring? More and more machine builders comparing the cost of using both wiring approaches in their operations find connectors more economical and practical.

Many thousands of equipment manufacturers have switched from point-to-point (hard) wiring to connector-based cable assemblies in factory and process automation and control systems. Adopting progressive connectivity solutions has improved their unit costs and productivity. It allows them to turn around orders and complete installations much faster. With margins under increasing pressure, many OEMs have come to regard these benefits as a must-have. For many of their customers, the principal argument for connector-based wiring over hardwiring – a lower total cost of ownership over the service life of the machine – is equally compelling.



Today's connector lineup includes more user-friendly and application-specific choices that can further enhance reliability and convenience. Connectors offer excellent mechanical stability and are available with high ingress, temperature and vibration resistance, harsh weather durability and multiple termination options. Most rectangular connectors are modular and user-configurable. Using different inserts each can be configured for different voltages for example, signal and power, or combinations of different transmission media: power, signal, fiber optic, coax, D-Sub and pneumatic. Recent innovations like quick-lock termination, click-and-mate assembly and twist-top locking make installation and maintenance faster and simpler than ever.



HARTING has based its leadership on developing new connector concepts and adapting existing ones to more precisely meet the evolving needs of its customer base. Choosing the right connector solution for the job will optimize the benefits of connectorization, improving the OEM's margins while giving end users the lowest possible cost of ownership and greater peace of mind.



Pushing Performance

For more information about connectorization, please visit www.harting-usa.com.
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INNOVATIONS FROM THE INDUSTRY

Honeywell Process Solutions changes the way we think about transmitters



Just when we thought all automation innovations were happening only in the control room, Honeywell takes a fresh look at the bedrock of automation, the field instruments. After countless hours listening to and watching technicians and instrumentation engineers struggle through daily tasks, waste time and miss out on opportunities to optimize the process, Honeywell has innovated once again.

Field Modularity to the Rescue

Modularity allows you to stock only the parts you need, not combinations of complete units. While many components can be considered modular, they are still difficult to remove or need to be managed in the store room, adding multiple trips to and from the field.

Honeywell's SmartLine transmitters offer a level of modularity which makes it easy to make field replacements. The modules are robust; they may be removed under power and in most all electrical and safety environments except explosion proof where opening the field enclosure is not permitted.

This means even intrinsically safe SmartLine devices can be repaired in the field without



removing power and without violating approval agency guidelines.

SmartLine modules are also designed to be easily removed and reinstalled with connection schemes which provide good registration and tactile feedback.

As a result, companies can lower their inventory costs, make their employees more efficient and even increase safety, which is what we all want.

Talk to Me

The HART 7 protocol provides the ability for handheld devices and hosts to send 32 character messages to field devices. These messages reside in the device memory and are available for reading by handheld and other host type devices supporting this HART 7 feature.

Working within the HART 7 protocol guidelines, Honeywell takes this technology one step further. In addition to supporting the message in the device memory, SmartLine transmitters post these messages on the transmitter's advanced graphics display.

This allows the message to be read at the device without the need for a HART hand held or other host device providing time savings and employee efficiency.

Honeywell

For more information, visit www.honeywellprocess.com/smartline.

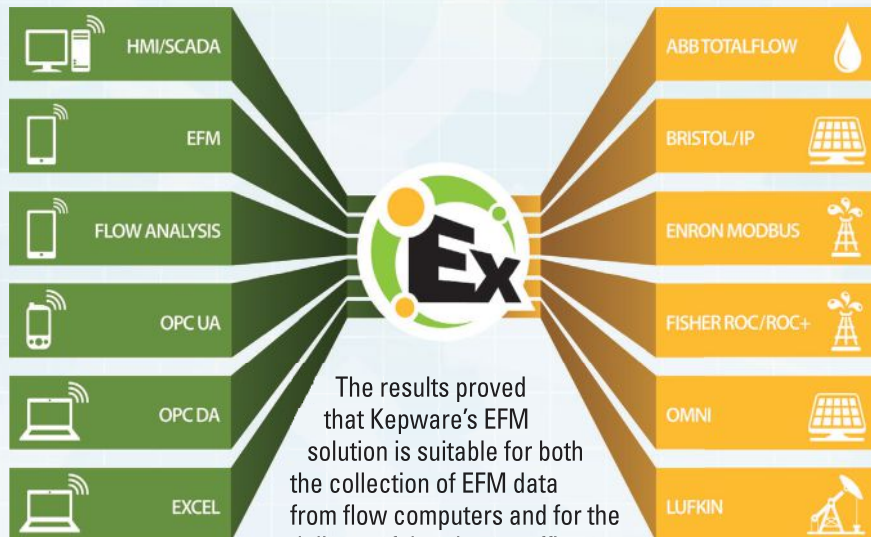
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INNOVATIONS FROM THE INDUSTRY

Kepware Receives Third-Party Validation for EFM Data Collection Solution

EFM Data Collection

Collecting Electronic Flow Measurement (EFM) data from flow computers—which are often found in remote locations with limited communications and power—is both critical and sensitive. Inaccurate flow measurement, collection, or analysis could result in millions of dollars of lost revenue. Therefore, it's vital that the solution that acquires and manages this EFM data be reliable, robust, and easy to configure and troubleshoot.



The results proved that Kepware's EFM solution is suitable for both the collection of EFM data from flow computers and for the delivery of that data to office measurement accounting systems. The report also notes, "The Kepware product is a user-friendly package that can be loaded and configured with minimal effort by persons familiar with gas flow computers and SCADA system topology. The general conclusion is that the product functions as expected."

Adding EFM data collection capabilities to KEServerEX was a natural progression for Kepware. The server was already being used in critical pipeline applications and to control and monitor equipment in the field. Soon enough, Kepware's existing customer base requested the additional functionality of collecting EFM records and formatting the data for importation into flow analysis and accounting software solutions (like Flow-Cal and PGAS).

Third-Party Validation

The independent laboratory institution that conducted the testing maintains a policy to remain anonymous and non-biased in publications; however, the complete report of their findings is available from Kepware upon request.

During testing, KEServerEX was configured to collect EFM data once per hour from flow computers on the laboratory's test bench. ABB Totalflow, Fisher ROC and ROC+, and a SCADAPack using Enron Modbus for API21.1 audit file collection were included. Output files were exported and analyzed after data collection.



About Kepware

Kepware Technologies is a private software development company headquartered in Portland, Maine. Kepware provides a portfolio of software solutions to help businesses connect diverse automation devices and software applications. Established in 1995 and now distributed in more than 100 countries, Kepware's software solutions help thousands of businesses improve operations and decision making.



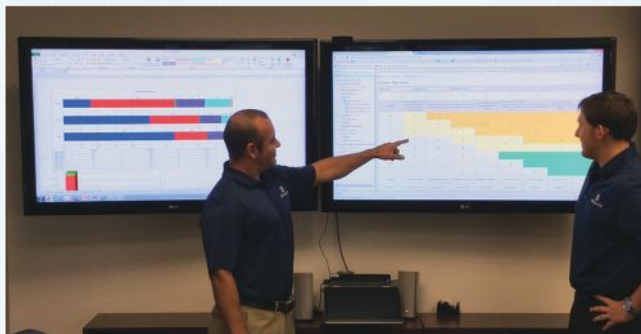
+1 207-775-1660 | sales@kepware.com
www.kepware.com

INNOVATIONS FROM THE INDUSTRY

Mangan Software Solutions - Providing Solutions with 'Engineered' Software Products

Mangan Software Solutions (MSS) was founded by its parent company Mangan, Inc. after the culmination of twenty-five years of experience executing projects in the oil and gas market sector.

As a control system Integrator operating primarily in the Midstream and Downstream environs, Mangan had witnessed firsthand how many of even their most sophisticated customers struggled with the development of standardized workflows, specifically when dealing with regulatory driven projects.



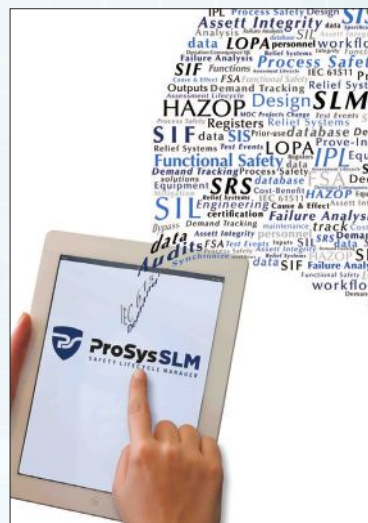
Being in the business of providing innovative solutions in process control and safety instrumented systems, Mangan's team had for many years used 'in-house' software products that it developed in order to provide value added solutions to their clients needs. These tools were used by both Mangan, Inc. project teams, and the client end users. Significant cost savings and greater efficiency in project execution were net results in this process. Advances in cyber security and the growing requirements imposed by corporate IT groups suggested that a more formal approach was necessary.

MSS is committed to creating software products that are in step with the everyday challenges that folks in process industries are faced with. In addition, MSS creates software products that will fulfill pertinent regulatory requirements while also providing end users with the confidence that their facilities are operating at the highest levels of compliance. MSS's affiliation with

Mangan, Inc. gives their products a differentiator in that Mangan, Inc.'s industry knowledge is fused with the software development process.

Currently, MSS has two products on the market with several new releases scheduled in 2014/2015. ProSys SLM is a SQL based software system designed to facilitate Safety Lifecycle Management. This suite of software modules provides automated and standardized workflows coupled with a unified data repository to achieve best practices and satisfy regulatory requirements.

The second is SPInspector, a software empowerment tool designed to maximize the ROI of customers SmartPlant Instrumentation investment. SPInspector provides owner/operators a full real-time assessment of the SPI database, enabling complete data accuracy while improving production by identifying problems prior to merge.



INNOVATIONS FROM THE INDUSTRY

Getting Free from Wires: The THZ WirelessHART Solution

It can be difficult to get accurate temperature measurements in remote locations where wiring for power and signal connections are limited. Even in wired locations, adding loops is costly and time-consuming.



*The THZ
WirelessHART
assembly.*

The THZ *WirelessHART* solution eliminates these problems in one affordable and reliable package. It combines a rugged battery-powered HART temperature transmitter with the BULLET *WirelessHART* Adapter by MACTek. It transmits temperature measurements and critical HART diagnostic information to a *WirelessHART* gateway – even if power is not readily available.

Cost Savings

The THZ *WirelessHART* solution is more affordable than competitive products and is designed to reduce long-term costs. As a

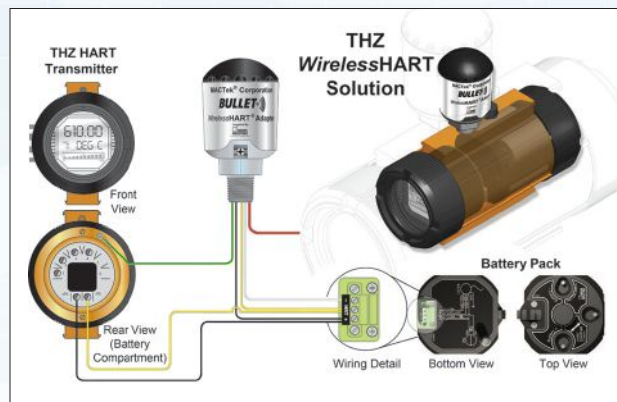
wireless, battery-powered solution, it can be installed without the need for additional power or signal wiring. This saves installation costs along with long-term maintenance and repair costs associated with wiring.

The design of the THZ *WirelessHART* assembly also helps to reduce battery replacement costs with a projected battery life of more than five years. The BULLET provides battery power management by cycling the transmitter's power and taking periodic readings. This optimizes the balance between power

needs and wireless communications bandwidth. There is no need to stock or purchase special batteries since it uses off-the-shelf D-type lithium batteries.

Dependability

The THZ reliably provides accurate temperature readings. It has an industry-leading 20-bit input resolution and long-term stability specifications, providing up to five years of service between scheduled calibrations. The BULLET prevents the loss of critical temperature readings by monitoring the battery voltage and setting a HART alarm bit when it nears critical levels. The weatherproof IP66 NEMA Type 4X housing is available for installation in rugged field and hazardous areas.



Wiring for the THZ WirelessHART solution with the battery pack.

Ease of Use

The THZ *WirelessHART* solution is easy to set-up and install and can either be factory configured or field configured using standard HART handheld communicators or HART-capable host systems. It has easy access to HART handheld connections and battery voltage monitoring terminals.

**MOORE
INDUSTRIES**
WORLDWIDE

Demand Moore Reliability

Learn more at: www.miinet.com or contact us today at info@miinet.com and 800-999-2900

INNOVATIONS FROM THE INDUSTRY

Making Industrial Networks Smarter, Tougher, and More Reliable



27 Years of Experience with Industrial Networking Technology

Since 1987, Moxa has been designing and manufacturing hardened networking and communication equipment for mission-critical applications. Our Ethernet switches, wireless access points, IP cameras, computers, and more are specially designed and tested to ensure highly reliable operation and connectivity for industrial users and harsh environments.



Concurrent Dual Radio Technology for Highly Reliable Wireless Connections

On Moxa's AWK-5222 and AWK-6222 industrial wireless access points, concurrent dual-radio technology is used to establish an exceptionally stable wireless connection that is practically immune to interference. Two RF modules simultaneously transmit duplicate packets on separate wireless channels. Instant and seamless failover occurs if one channel experiences wireless interference or other disruption. Since no additional time is required for signal recovery and renegotiation, there is absolutely no interruption or delay in data transmission.

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Hardened Power over Ethernet (PoE) Switches for Heavy Duty Requirements

On Moxa's EDS-P510A-8PoE industrial PoE switch, 8 Ethernet ports supporting 802.3af (PoE), and 802.3at (PoE+) are available to supply up to 36 watts to heavy-duty PoE devices, such as IP surveillance cameras with wipers/heaters, high-performance wireless access points, and rugged IP phones. With built-in management functions, Gigabit SFP fiber ports, and a rugged wide-temperature design, it is an ideal solution for outdoor PoE installations that have demanding requirements for power, reliability, and bandwidth.

Easier Protocol Management

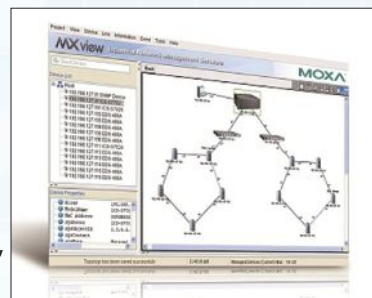
Moxa offers highly reliable industrial Ethernet switches that are designed to be managed directly over PROFINET, EtherNet/IP, or Modbus/TCP, so you can have full control over your network without having to learn new software. With Moxa's industrial Ethernet gateways, you can also manage attached devices that were designed for different protocols.

Easy Network Monitoring and Management

Moxa's MXview software allows industrial users to see their entire Industrial Ethernet network in a glance, with live status for every switch and connection.

Designed for high flexibility and interoperability with other hardware and software, it offers free software updates. Key features include:

- Simple graphic network visualization and event log list on one screen
- Automatic network topology mapping with drag and drop adjustment
- Automatic OPC tag generation and new group tag for overall network health
- Event recording and playback of network events
- Interoperability with other NMS through SNMP traps
- Native support for other Moxa networking devices (serial, I/O, and fieldbus)



MOXA
Reliable Networks ▲ Sincere Service

INNOVATIONS FROM THE INDUSTRY

Unbeatable Control, Precision, and Flexibility



Lowering cost, increasing productivity, and shortening design times are just some of the challenges industrial engineers face. The graphical design approach combines productive software and reconfigurable I/O (RIO) hardware to help you meet these challenges. This off-the-shelf platform, customizable to solve any control and monitoring application, integrate motion, vision, and I/O with a single software development to build complex industrial systems faster.

Accelerate your productivity at ni.com/industrial-control-platform.



NI Trend Watch 2014

"Because NI tools are used in so many different industries and applications, NI is in a position to examine the latest trends in measurement, sensors, networks, test, and more—as they happen. NI isn't just a supplier—we're a technology adviser. We hope this information helps you be more productive and focused on what you were hired to do."

*- Eric Starkloff, Senior Vice President
of Global Sales and Marketing, National Instruments*

Big Analog Data

Connecting IT infrastructures and analytic tools, such as the cloud, with data acquisition systems to make faster decisions on test data.

Cyber-Physical Systems

Developing systems that continuously and dynamically interact with their environment through coupling of distributed computational and physical components.

To learn more about latest technology trends visit, ni.com/trendwatch.

NI helps engineers and scientists solve the world's greatest engineering challenges with powerful, flexible technology solutions that can be tailored to virtually any engineering need. Our customers have brought hundreds of thousands of products to market, overcome innumerable technological roadblocks, and engineered a better life for us all. If you can turn it on, plug it in, or put a battery in it, chances are NI technology helped make it happen.



INNOVATIONS FROM THE INDUSTRY

groov[®] connects your system to your mobile

Rockwell Automation/Allen-Bradley, Siemens, GE, Schneider Electric, Yokogawa ... Now *groov* from Opto 22 makes it easy to monitor and control your automation system or equipment from your smartphone or tablet.

Imagine what you can do...

Troubleshoot equipment in the field with your smartphone. Check a live video feed and production figures from a tablet. Control equipment in hard-to-reach areas from a laptop. Use a tablet as an operator interface for your machine.



groov

Gauges, buttons, labels, even live video all scale to fit, but never become too small to use.

But should you use off-the-shelf mobile devices in automation?

Before you do, take a good look at the pros and cons. Read four key considerations plus practical advice for choosing mobile devices in the white paper, *Using Commercial Off-the-Shelf Mobile Devices in Industrial Automation: "Russian Roulette" or the "New Normal"?* <http://op22.co/cots-mobile-wp>



Mobility—Securely view a *groov* operator interface on any mobile device with a modern web browser, regardless of its size or brand. Android, iOS, Windows. Your choice.

Simplicity—Build a *groov* mobile interface using just a web browser. No plugins. Drag and drop gadgets to build screens; tag gadgets from your existing tag database. No coding. No programming.

Connectivity—Connect to industrial automation systems, building automation systems, power systems, and more. No per-device or per-user fees.

How can *groov* connect to all these systems and work on any mobile device? It's simple: *groov* is built on industry standards rather than proprietary systems. OPC-UA lets *groov* connect to your systems and equipment.

Standards like HTML5, CSS3, and SVG let your *groov* interface scale gracefully to match mobile screen sizes.

About Opto 22

groov comes from Opto 22's 40 years of experience pushing the boundaries in industrial automation, remote monitoring, and data acquisition. Like all our products, *groov* is based on open standards, built by engineers, and manufactured and supported in the U.S.A.



Get your *groov* today and see what you can do. See the demo and find out more at groov.com.

groov

from OPTO 22

INNOVATIONS FROM THE INDUSTRY

Going Green with Free Energy



We once believed that we had nearly infinite amounts of natural resources and unlimited technology that we could use to create anything. Now we know that we have limited natural resources, and some technologies that were once cutting-edge were discovered to be quite harmful to ourselves and our environment. One example of our company taking innovative steps to go green can be seen when we re-considered the powering of the digital bar meter.



Analog meters are the most energy conservative meters, since they are signal powered. However, they are susceptible to wear, tear, shock and vibration. They are cheap and easy to connect, yet they are also inaccurate and unreliable. Their digital counterparts make up for most analog deficiencies.

Digital meters have no moving parts, making them durable and reliable. Some units can communicate with supervisory computers or control the processes they measure. Unfortunately, they require external power and do not conform to pre-existing installations, requiring a more complicated installation. The typical cost to a power plant interested in converting is estimated to be over \$20,000,000.00! We thought there had to be a better way.



For our company, the better way is harnessing and using the energy wasted in most electrical processes. We began by designing a highly linear miniature current transformer which uses the extra energy from the input signal to power the

electronics. Our automatic tri-color bargraph uses ultra-efficient LEDs which require ~1/100 the energy of a standard LED, and we even include color set-points and alarms.

The green design incorporates parasitic ASIC that uses ~1% of the energy of a regular microcontroller, and features our custom symbiotic software which shares the 10-100mW of reclaimed power.

Our meters can also detect when the signal has gone dead and enable alarms by using the stored excess energy. New Technology meters not only consume ~1% of the energy of comparable meters, they reclaim and use wasted energy. Capturing wasted energy is a smart way to go green!

OTЕКTM CORP.

Tel: 520-748-7900 | sales@otekcorp.com
www.otekcorp.com

INNOVATIONS FROM THE INDUSTRY

RED LION CONTROLS - Industrial Automation & Networking



For over forty years, customers and partners around the world have relied on Red Lion Controls. Our industrial automation and networking products provide critical information and controls to improve productivity, working with numerous devices and diverse protocols to access data.

We are a company that people trust.

- Our company invests in research and development.
- Our company manufactures reliable, high-quality products.
- Our company stocks product that can ship today.
- Our employees care.

Our products solve problems.

- Our products are high performance and dependable.
- Our products interoperate to create systems.
- Our products provide business insight.
- Our products improve productivity to increase the bottom line.

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- **Panel Meters:** a wide range of models and sizes with expansion capabilities that easily adapt to changing requirements
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- **RTUs & I/O:** provides a simple yet powerful monitoring and control system for remote sites



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- **Cellular M2M Routers:** provide uninterrupted, secure communication for remote sites



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INNOVATIONS FROM THE INDUSTRY

A trusted leader in the field of drive technology



Engineering excellence and customer responsiveness distinguish SEW-EURODRIVE, a leading global manufacturer of integrated power transmission and motion control systems.

MOVIDRIVE®

Got lean staffing? Then, lean on SEW-EURODRIVE. Their MOVIDRIVE inverter requires zero programming. So, you don't need an engineer who speaks IEC 61131, C#, or C++. Simply enter your parameters into its solution modules. Startup couldn't be easier or faster! MOVIDRIVE also substantially reduces the load from your main PLC and dramatically improves the PLC's performance. Plus, you can even use your existing control system because MOVIDRIVE speaks your fieldbus language.



MOVIGEAR®

The MOVIGEAR® Mechatronic Drive System for horizontal material handling from SEW-EURODRIVE sets new standards in efficiency and functionality. MOVIGEAR® combines the gear unit, motor and drive electronics within one highly efficient and hygienically designed unit. Independent research has proven that MOVIGEAR® reduces total start-up cost and annual operating costs in material handling by 20-30%. However, actual installations have shown even higher savings to 50% or more! If that's not enough, MOVIGEAR® even reduces your inventory expense with its unique ability to cover a broad range of gear ratios with a single unit. Less really is more...



PT Pilot® Drive Selection Tool

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TIME = MONEY. That is why SEW-EURODRIVE developed PT Pilot®. This online program quickly provides a complete quote with options, parts lists, and 2D/3D CAD drawings for a gear unit or gearmotor.

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PT Pilot® contains a special section for design engineers. Its engineering calculator automatically sizes a drive for conveyors, travel cars, and hoists – with or without an inverter. Just enter the design parameters and let PT Pilot® do all the work.

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INNOVATIONS FROM THE INDUSTRY

SAMBA™ - A New Market Category

The very first All-In-One Controller—HMI+ PLC + onboard I/Os—was released by Unitronics nearly 25 years ago. An early pioneer of this market,

Unitronics is a global trendsetter in developing and manufacturing All-In-One Controllers with a price/performance profile that boosts competitive advantage.

Unitronics brings innovations to market by closely monitoring industry channels in packaging, HVAC, food, dairy, chemical,

wastewater, boiler industries, plastic

extruders and more, then using this data to develop a broad range of PLCs to answer the exact needs of emerging market trends.

The recent release of the palm-sized SAMBA™ All-In-One controller is an example. SAMBA™ specifically targets tightly-budgeted applications that require a Colour-Touch HMI screen, full-function PLC, and I/O in a single, low-cost unit. Programmed and configured via free Visilogic™ software, and communicating via industrial protocols such as TCP/IP, CANopen, and MODBUS, SAMBA™ is an optimal solution for machines with low I/O requirements.

SAMBA™ is priced to enable OEMs to avoid using outdated text displays and smart relay combinations. Instead, OEMs can present clients with an elegant colour-touch screen and PLC, while saving money on time-intensive configuration, programming, and physical wiring.

UniStream™, category winner in Control Engineering 2014 USA Engineers' Choice Awards, is another

ground-breaking control platform launched by Unitronics. A completely modular system, UniStream™ offers a variety of high-quality HMI touch panels, I/O modules, and powerful dual CPUs that snap together into a compact, all-in-one controller. Remote I/Os enable up to 2048 I/O. Embedded 'UniApps™' allow data access, troubleshooting, debugging, and VNC Remote Access.

The user codes Ladder, designs beautiful HMI screens, configures Hardware & Communications with UniLogic™, software so intuitive it cuts development time in half.

Unitronics innovations include continuing development of flagship products, such as the palm-sized Vision350-S™ that withstands extreme temperatures ranging from -30°C to 60°C.



Customer Retention

With Unitronics, there are no hidden costs. Software and technical support are always free. Nataly Turgeman, Unitronics global marketing manager: "Our customers stay with us—because of our high level of customer service, and because we re-invest most profits into R&D to produce products that match their requirements."



INNOVATIONS FROM THE INDUSTRY

WAGO: Innovations that make industry safer and more efficient



As the innovators of the world renowned CAGE CLAMP® concept, WAGO® is the global leader in the design and manufacture of Electrical Interconnect and Automation products incorporating this screw-less, spring pressure, wire termination technology. Today, WAGO® offers an unrivalled range of products including PCB mount terminal blocks and connectors, PUSH WIRE® splicing connectors, chassis mount terminal blocks, DIN rail mount terminal blocks, relay modules, signal conditioners, interface modules, power supplies, HMIs, as well as PLCs, bus-couplers and I/O modules – a.k.a. the WAGO-I/O-SYSTEM.

CAGE CLAMP® an Industry Changing Concept



1951 marks the beginning of WAGO's success story. In this year, the first terminal block with spring pressure termination technology was born. This innovation led to the first PUSH WIRE® connection in 1968, and then in 1977 to the

industry changing termination technology known as CAGE CLAMP® - the universal connection technology for solid and stranded conductors.

In contrast to traditional screw-type termination technologies, WAGO's screw-less, spring pressure termination technologies reduce wiring by up to 75%. Even more important is the fact that, because the

clamping force automatically adjusts to the size of the conductor being terminated, it provides a highly reliable, maintenance-free connection that is independent of operator skill. The end result is a safe, secure, vibration proof, corrosion resistant, temperature cycling resistant, and cost saving connection every time – wire it once and forget it.

An Automation Company is Born

The beginning of the 1990s signaled a shift from centralized control to decentralized control. Recognizing this and building on the success of its' modular terminal blocks and electronics with CAGE CLAMP spring pressure technology, WAGO launched the industry's first finely modular, slide in, fieldbus independent input/output system in 1995 – known globally today as the WAGO-I/O-SYSTEM (US patent 5,716,241). Since then, the WAGO-I/O-SYSTEM has grown to include programmable controllers, support for more than 16 fieldbus networks, and offers 400+ digital, analog, and special function I/O modules.



For eXTReme Applications... The WAGO-I/O-SYSTEM 750 XTR

Recent Innovations

Not resting on its' laurels, WAGO continues to develop new innovative electrical interconnect and automation products. Recent developments include; the WAGO-I/O-SYSTEM XTR for eXTReme applications such as -40° C to -70° C operating temperature, Perspecto – PLC + HMI all in one solution, and more.



INNOVATIONS FROM THE INDUSTRY

Yaskawa Quality: More than a Measurement... It's an Experience.



We take quality personally at Yaskawa. Our drives and servo packages offer the highest MTBF in the world. The relationships we have with our customers ensure mutual benefits. The partnerships we cultivate with our distributors add value to the way we work with you. We hire great people and continuously train them to be able to serve your needs better. We deliver product on time. It works out of the box. We answer questions promptly and never back down from challenges.

To us, quality means doing everything we can to make our customer, partner and employee experiences great ones. We commit to that philosophy every day. We make it happen. We can because, to us, IT'S PERSONAL.

We're the only industrial drives and motion control manufacturer to win the Deming prize – the most prestigious quality award in manufacturing. But we know that tells only part of the quality story. What about innovative design, knowledgeable, responsive engineers who understand your business, and superior support and training?

Those crucial assets are a vital part of how a company is ultimately judged and what we mean by the Yaskawa Quality Experience. At Yaskawa, Quality is more than numbers, more than awards – it's the total experience of purchasing and owning Yaskawa products and working with Yaskawa people.



Motion Control Products:

Our broad product range of servo systems includes rotary, linear, and direct drive motors, matched with digital SERVOPACKS.

These best-in-class servo systems can be matched with our single or multi-axis machine controllers for a system solution with the best quality and reliability in the industry.



Variable Frequency Drives:

Yaskawa low voltage industrial AC drives offer the greatest selection of size and performance, with power ranges from fractional HP to 2250 HP. Yaskawa Commercial AC drives for HVAC applications combine reduced size and cost with step changes in performance and quality. They feature extensive parameter selection to enhance energy efficiency and closed loop control.



Select and specify control circuit fuses

Bussmann's Fuses Made Simple program aims to help control engineers select and specify the right fuse. Bussmann hopes to take the guesswork out of the selection process for branch circuit or control circuit (UL supplemental) fuses. Replacing control circuit fuses with six, voltage-based color codes can help make



it easier to identify the right fuse needed for the task at hand. Control circuit fuses have many voltage ratings, ranging from 32 to 600 V ac. Because physical size does not vary with voltage ratings, the most frequent cause of misapplication is due to im-

proper voltage selection, something this product aims to eradicate. Each fuse label has a unique identifying color band that represents the fuse's maximum voltage rating. This eases the selection process, simplifies the replacement procedure, and enhances system safety. The control circuits help minimize the risk of misapplication by clearly and consistently indicating the voltage rating and interpreting rating on the fuse label. Critical fuse information is presented in an easy-to-read format to help speed replacement. Find the right circuit fuse in three steps: 1) Type—Select the fuse type. 2) Voltage—Select the voltage rating needed. 3) Interpreting rating—Verify that the interrupting rating of the fuse selected is sufficient for the circuit application.

Bussmann

www.cooperbussmann.com/FMSCC

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Capture and share real-time meter data anywhere

Fluke's new app-based wireless system can capture, analyze, and share test and measurement data from remote devices. The Fluke Connect system allows electrical and maintenance personnel to wirelessly capture and transmit measurement data through a smartphone app to other plant personnel or other remote locations. The system allows for real-time data capture, trending, video and audio notes, and automatic transmission to cloud storage systems. The free app is available from the Apple App Store, and is expected to be available for Android devices this summer.

The new system can be retrofitted on 20 Fluke metering devices with four functions: 1) AutoRecord, which transmits measurements and infrared images to the Fluke Cloud for storing and sharing information. 2) ShareLive can share measurements in real time and get approvals or questions answered without leaving the field. 3) EquipmentLog is a historian. 4) TrendIt allows technicians to instantly graph and trend data.

Fluke Corp.

www.flukeconnect.com

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Operator interface graphics 101

Use these tips to create simple to complex operator interface graphics.

Most automation and process control projects provide an operator interface presenting the current state of the system. These can range from the very simple to the extremely complex. The one aspect that they exhibit—perceived or real—is a reflection of the total job quality. The quality of the graphics will certainly leave a lasting impression because they are in the operator’s view every day. Developing a guide on how to create graphics would fill volumes. On top of that, some customers have standards on how graphics are to be done. There are some design points, however, that go a long way in making graphical screens look polished.

Lines should be horizontal or vertical. Angled lines must appear intentional. Nothing looks worse than a line that has a slight “jog” in it. When lines are being used to represent process piping, lines meet to represent a “Tee” as well as touch the equipment to indicate connection. Pipes in reality do not just hang in the air.

There are two basic choices when using lines: straight lines and poly-lines. Which to use has occasionally been a point of contention among designers. In the end, the only thing that really matters is consistency and construction. If you’re using line segments, then, once again, they must meet.

Colors: The color of screen items has meaning, and this should be uniform throughout the system. Nothing is more disconcerting than when the meaning of screen color changes when “Phase 2” is implemented for the same process element. For example, if water is blue on most of the graphics, it should be blue on all of the subsequent graphics.

Valves are typically shown on process graphics as a “bowtie.” The bowtie needs to be centered on the pipe and/or line. The line representing the process piping is not to be visible behind the bowtie.

Text: First, it must be accurate. After accuracy, the rest is aesthetic. Align text appropriately, and don’t assume that center alignment is appropriate for all cases. Pick one or two fonts and stick with them. By all means, do not change a font’s size by dragging the sizing handles, as some systems treat text as a drawing object and this can yield uneven results. Change text size by adjusting the font point size.

3-D and animated items: These items look

great in the brochure. However, the excessive use of these types of items is distracting and consumes needless screen space. When you throw in animated pipes, fans, motors, and other gizmos, the screen can be a “flashy” place—and not in a good way. Screens need to provide a quick reference of information. Flashing and moving items catch your eye. Therefore, use them only for important things, such as alarms.

Location: A screen needs to be developed around the center point. That doesn’t mean that the main equipment or device is in the center, but that the screen is balanced around that point. Allowing the operator to focus his or her attention on the center allows for smoother screen-to-screen transitions. While developing the focal point around the center of the screen, keep certain elements consistent from screen to screen, such as menus and banners.

Spacing: Like location, this is somewhat subjective, but it needs to be considered. Similar or related elements need to be evenly spaced. Nothing looks worse than seeing valves and the associated tag name haphazardly spaced and scattered around a screen. Fields also need to be consistent so that they appear more grid-like.

Plan for the future: It is important to leave graphics that are easily maintained. There are a couple of things that most systems provide, such as Grid and Snap, which allow for rapid development and ease in modification. These also help with most of the points mentioned above. These are provided in so many systems for a reason. Use them. You might not be the developer who does the next phase or modifications, but you might.

In the end, none of these points will lead to a perfect system. Careful planning, layout, and execution will lead to a successful implementation. These points just make the system you deliver look professional and a cut above. Despite all of the wonderful, technical wizardry that you developed in the background, this is the lasting, visible impression you leave. **ce**

This information, originally a Real World Engineering blog post at www.controleng.com/blogs was written by Jeff Monforton, a senior engineer at Maverick Technologies.

- Edited by Jessica DuBois-Maahs, associate content manager, CFE Media, jdmaahs@cfemedia.com.

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