



Cover Story Machine Automation 2010 – What's Hot and What's Not

Machine and Robot Builders Look Ahead to the New Decade







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Editor's Note

2010 is well under way. How do you plan to spend your time this year? I plan to spend more time with my family. We plan to do things like volunteer to help charity organizations in the area, focus more on each other's needs instead of our own and get to know more about one another. Come to think of it, our AutomationDirect family is the same in several ways.

We support several organizations from area schools to senior adults. You'll find our team members picking up litter off the sides of the street, working with Meals-on-Wheels, recycling, and lots more; we do all of this while bringing you quality industrial control products at the best prices in the industry.

In this issue of Automation NOTEBOOK, you'll find information on just some of the products introduced last year. You'll also read informative articles of how people like you use AutomationDirect products to control applications, such as sorting material at a recycling business and a process to control algae in cooling towers.

We're also introducing a new section we call the System Integrator's Corner, focusing on one of our systems integrators and how they helped find a solution to a customer's control challenge.

You will find informative technical articles, and we can't forget the Breakroom. Now, turn the page and enjoy...

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TJ Johns Coordinating Editor editor@automationnotebook.com

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Optional hardware keypads are also

available. The plug-and-play keypad

bezels do not require programming or external power. For portrait (vertical)

mounted panels, choose the 21-button

bezel with numeric keypad. For

landscape (horizontal) mounted panels,

a 20-button bezel with numeric keypad

\$399. Optional keypad bezels are priced

at \$99. C-more Micro 6-inch TFT

touch panels are UL, cUL, CE, NEMA 4, 4x indoor rated and carry a two-year

www.automationdirect.com/

The new 6-inch panel is priced at

Learn more about C-more Micro at

is available.

warranty.

C-more-micro

New Product Focus



AutomationDirect offers 6-inch TFT Touch Panel for \$399 custom objects and graphics to software libraries for fast and easy access from multiple projects. A built-in simulator allows users to review projects on the PC before downloading to the panel.

The 6-inch touch panel is equipped with a standard Type B USB programming port and offers 3.2Mb memory, LED backlight, multistate bitmap support and Windows font support. Five durable function keys can be customized to separate settings for each screen. LED indicators can

he C-more Micro family now includes a 6-inch TFT color touch screen panel. The panel's 32,768 colors provide clear and colorful graphics for vibrant and intuitive screens. The larger panel can display even more text, graphics, or bitmaps to effectively communicate and display data to the operator. In portrait mode, the panel can display up to 40 lines by 40 characters of dynamic text with embedded variables and phrases mixed with graphics. When mounted in landscape mode, the panel can display 40 lines by 80 characters of text as well as graphics.

The free downloadable programming software offers the choice of using built-in objects or importing custom graphics. Users can create and save be programmed for alarms or status indication.

C-more Micro's alarm feature can control backlight color change or flash, function key LED flash, controlled beep activation, custom alarm banner display, and supports up to 16 configurable alarm actions.

Recipe functions are a snap with **C-more** Micro. Each recipe button transfers up to 99 values from PLC source registers to PLC destination registers and/or from a recipe table in the **C-more** Micro to PLC destination registers.

An analog meter supports low-low, low, normal range, high and high-high indication, while the real-time graph feature displays up to eight pens with up to 24 values for each pen. "Reason itself is fallible, and this fallibility must find a place in our logic."

- Nicola Abbagnano (1901 - 1990)

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"There are only two people who can tell you the truth about yourself - an enemy who has lost his temper and a friend who loves you dearly."

- Antisthenes (444 BC - 371 BC)

Can't touch this deal! 6-inch color touch panel only \$399

399.00

F2

F3

F4

F5

plus FREE Windows-based configuration software!*

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The C-more Micro family now offers one of the best priced 6-inch TFT color touch screen operator panels on the market. Take advantage of the clear and colorful graphics to create vibrant and intuitive screens. Plus, FREE programming software offers the choice of using many built in objects, or importing your own custom graphics.

Save time by creating and saving custom objects and graphics to software libraries for fast and easy access from multiple projects. Portrait or landscape modes allow for versatile mounting positions when space is a concern. All these features at a competitive price, in a rugged and reliable package, make this Micro one of the best values for any application.

The programming software is free when downloaded from the AutomationDirect Web site, or the CD-ROM package can be purchased for \$25 (part # EA-MG-PGMSW).

Get the most for your money

- 32k Color TFT touch screen display
- LED backlight
- 320 x 240 resolution
- 3.2 MB memory
- Portrait or landscape mounting
- Five durable function keys with LED indicators
- Standard Type B USB programming port



touch panels

· Enhanced objects and graphics • Up to 999 screens (dependent on complexity)

- Recipes
- Built-in project simulator • UL, cUL, CE, NEMA4 and 4X
- indoor ratings



Optional plug-and-play keypad bezels





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Protocols/devices supported

- All AutomationDirect programmable controllers
- * Entivity Modbus® RTU
- * Allen-Bradley® DF1 half/full duplex, PLC-5® DF1 and DH485
- * Siemens PPI * GE Fanuc 90[™] -70 and 90-30 SNPX
- * Omron Host Link and FINS serial
- * Mitsubishi MELSEC®

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Panels in Control Design magazine's Reader's Choice Awards for 2009.

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For complete information or to order online, visit: www.automationdirect.com/c-more-micro or www.c-moremicro.com



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Product Snapshots



Six-inch Color C-*more* Operator Interface Panels



The C-more line of operator interfaces now includes two new 6" TFT color panels with LED backlights. The base model EA7-T6CL-R panel is a 320x240 resolution QVGA display which supports up to 65,536 colors. The analog resistive touch screen supports unlimited touch areas, two USB ports, serial PLC interface (RS-232/422/485), and 10MB project memory. The panel is equipped with an LED backlight with a 50,000 hour halflife. Additional capabilities on the fullfeature EA7-T6CL unit include an Ethernet 10/100 base-T communication port, remote Internet access and data logging. Both panels are NEMA 4/4X, IP65 compliant when mounted correctly for indoor use. Backed by a two-year warranty, the panels start at \$495.

To learn more, visit: www.automationdirect.com/c-more

Stellar[™] Line of Soft Motor Starters



Stellar soft starters are now available as a low-cost motor control alternative.

The SR22 series soft starters, available in 5A to 40A sizes, are overcurrent protected and feature two DIN-rail mountable frame sizes (45mm and 55mm). The microprocessor based starters have an operating voltage range of 208 to 460 VAC. Easily configurable, each unit is equipped with three potentiometers allowing adjustable start and stop times of up to 30 seconds and an adjustable start pedestal voltage ranging from 30 to 100%. A separate 24VDC control voltage is required.

Ideal for applications such as pumps, blowers and conveyors, the SR22 series soft starters use thyristors for controlled reduced voltage motor starting and stopping, and then switch to internal contacts for efficient running at rated speed. When used instead of a line starter, Stellar soft starters provide smoother control resulting in less torque, less shock, and less electrical and mechanical stress.

Backed by a two-year warranty, Stellar soft starter prices start at \$145. To prolong the life of the soft starter, optional cooling fans are available starting at \$45.

See the full line at: www.automationdirect.com/ soft-starters

Space-Saving Molded Case Circuit Breakers Added to Product Offering



Fuji Electric's BW series of molded case circuit breakers are more compact than traditional breakers; this series takes up less space than almost any others on the market.

Suitable for branch circuit protection, the BW series offers standard type and high-interrupting capacities in identically sized housings. The threepole non-adjustable magnetic trip molded case circuit breakers, in sizes up to 800A, are also suitable for reverse-feed applications. All BW series breakers conform to worldwide standards, including UL, CSA, CE, and IEC.

The BW125A models include breakers in 12 sizes ranging from 15A to 125A, while the BW250A models are available in seven sizes ranging from 125A to 250A. Both series are 600V rated and prices start at \$166.

The BW400 series offers four sizes (250A to 400A), the BW630 series is available in 500A and 600A sizes, and the BW800 series is available in 700A and 800A frames. These three series are 480V rated and prices start at \$675.

A variety of accessories is also available, including auxiliary contacts, shunt trips, and undervoltage releases.

For more information on Fuji molded case circuit breakers and accessories, visit:

www.automationdirect.com/mccb

Universal Signal Conditioners Now Available



Universal signal conditioners, in plastic slim-line housings, convert, isolate and transmit scale signals from a wide variety of process sensor and controller I/O. The DIN-rail mountable models (884114 and 84116) support scalable input signals including mA, VDC, thermocouple with internal cold junction compensation, two to four-wire RTDs, linear resistance and potentiometer signals. Both models feature mA and VDC outputs, while the 84116 model adds two individually programmable relays for alarming and control functions. Isolated universal supply voltage input eliminates the need for separate transformers or power supplies.

A menu-structured LCD programming/display module, sold separately, features automatic scrolling text identifying each menu item. The detachable module can store and transfer configuration parameters from one signal conditioner to another, minimizing set up time with multiple unit applications. The module supports seven programming languages and can be password-protected to prevent unauthorized configuration changes. When not used for configuration, the display module can be used to display input signal values, engineering units, output signal, and relay status.

Prices for the universal signal conditioners start at \$175 and are backed by a five-year warranty.

Learn more at: www.automationdirect.com/ signal-conditioners

Hole Saws Added to Product Line



The RUKO family of cutting tools now includes a line of hole saws and accessories. The new bi-metal saws, in sizes ranging from 9/16" (14mm) to 81/4" (210mm), feature up to 11/2" cutting depth and are available in two models. High-Speed Steel saws easily cut materials such as unalloyed steel, nonferrous and light metals, plastics, plasterboard and light building boards, fiberboard, plywood and wood. Cobalt 8 saws, with fine cutting teeth, work well with metals such as alloyed and non-alloyed steels, high chromium alloyed steels, such as stainless steel, steels resistant to rust and acids, non-ferrous and light metals. Constructed with an alloyed steel 6135 jacket, the saws feature high rotational precision, positive chipping and cutting angles and good chip removal. Slots in the jacket side aid in removal of cutouts. The hole saw and shank are in two parts, so hole saws of different diameters can be exchanged and fitted more quickly. Prices for the new hole saws start at \$4.75. A variety of arbor assemblies with pilot drill are available for the hole saws in 7/16" and 3/8" shank sizes. Arbor holder prices start at \$6.25. Pilot drills are also available starting at \$3.50.

View the full line of RUKO hole saws at:

www.automationdirect.com/ hole-saws

Power Distribution Block Line Extended



The Edison power distribution line now includes the HPB series open-style power distribution blocks as a convenient way to manage power distribution needs. Engineered with tin-plated aluminum connectors suitable for copper conductors, the distribution blocks maintain a high SCCR rating of 200kA, with proper fusing, and are suitable for both factory and field wiring. Available in single-pole and three-pole models, the series is available in 175A and 310A blocks. Prices for the HPB series openstyle power distribution blocks start at \$8.00. The series is UL listed and meets UL1953 standards. To increase protection, safety covers are also available with prices starting at \$1.50.

View the full line of Edison power distribution blocks and terminal blocks at:

www.automationdirect.com/ power-blocks

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Cover Story Trends in Automation

Machine Automation 2010 – What's Hot and What's Not **Machine and Robot**

Builders Look Ahead to the New Decade

By Dan Hebert The Hebert Agency

s a new decade dawns, machine and robot builder OEMs are looking to embrace new trends and put the past behind them. Recent economic travails seem to be lessening, especially in the developing world. The hope is for continued improvement in the world economy, spurring manufacturing and increasing demand for new and improved machines and robots.

Automation will play a key role in these improved products, but the old way of doing things will no longer suffice. Instead, new trends must be embraced to satisfy customer demands for increased productivity, greater reliability and lower costs.

The chief focus for many manufacturers in the past decade was high throughput delivered by low cost machines and robots. In the coming years, flexibility and low life cycle costs will become relatively more important.

It will no longer be acceptable for machines and robots to be controlled by automation isolated systems. Connectivity to other manufacturing cells and to higher level computing systems will become a must, and at least some of this connectivity will be delivered through wireless communication systems.

Automation hardware that delivers on these OEM customer demands will encompass the latest in developments from the commercial PC arena including multi-core processing, off-the-shelf operating systems and high-speed Ethernet communications.

Flexibility to the Forefront

The days of high volume single output machines are gone, replaced by a need for flexibility. "We see full and/or partially-automated changeovers as a key trend for our machines and their automation systems," said Dave Zurlinden, the president of Pro Pack Systems (www.propacksystems.com) in Salinas, California in Control Design's December 2009 cover story, "What's Next."

Pro Pack makes case printer/erector/bottom sealers, case packers and case sealers (see Figure 1). They

In the same Control Design cover story, a system integrator discussed how recipes enable flexibility. "Once a recipe is tuned in and programmed into the system, subsequent production runs can be made without the need for manual setup or production tuning steps," noted Michael Gurney, principal at Concept Systems in Albany, Oregon. (www.conceptsystemsinc.com)

"Recipe-based production improves repeatability, and recipe-driven human interfaces enable less skilled operators to run machines," added Gurney.

"One important factor to consider



Figure 1

focus on secondary packaging where corrugated shipping cases are used for cartoned, bottled and bagged products in the food and beverage industries.

"We implement changeovers via recipe storage and retrieval from the HMI. An operator simply selects the desired recipe at changeover, which commands servos to automatically re-size the machine to the next case recipe," related Zurlinden in the cover story.

"The obvious benefit is dramatically reduced changeover time, but the not so obvious benefit is repeatability in the changeover process via the elimination of human-induced setup errors," concluded Zurlinden.

when integrating a recipe management system is the equipment upgrades required to support the automated changeovers. Equipment not initially equipped with a recipe management system likely does not have the level of required automation, typically requiring additional mechanical and control modifications," cautioned system Gurney.

One way to make automation systems flexible is through use of modern automation systems. "More flexible software and hardware automation platforms allow machines to be reconfigured or upgraded," observed Lee Hilpert in the Control Design cover story. Hilpert is the president of system

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integrator HilTech Engineering (<u>www.hiltecheng.com</u>), located in Tomball, Texas.

"Newer automation products are becoming much more flexible, especially on the communication side. On one of our projects, the end user continues to apply the control system in ways never anticipated during initial development. Flexible automation has allowed us to reconfigure communications and functionality without new hardware even though the application is completely different," added Hilpert.

Lower Lifecycle Costs a Necessity

With the emphasis on lean manufacturing and low operating costs, manufacturers are simply not hiring large numbers of highly-skilled people to run their plants. This means that machines and robots must run without the need for extensive and ongoing maintenance. When maintenance is required, it's often the OEM that will be asked to deliver. Machines must also be easy to operate, and automation will be a key to delivering on this demand.

"With intelligent design, automation can be used to make the human interface to machines more efficient. HMIs and PLCs can provide maintenance reminders and include signoffs to indicate when work is done. PLC programming can encompass predictive maintenance based on actual machine use and other measured parameters," explained Zurlinden in the Control Design cover story.

Because they have fewer workers, OEM customers are demanding more support. "Our customers are looking for single source responsibility," said Branko Bekic in the Control Design cover story.

Bekic is the electrical department manager at PMI Cartoning (<u>www.pmicartoning.com</u>) in Elk Grove Village, Illinois. His company makes cartoning machines and case packers for consumer packaged goods companies.

"Our customers need a machine builder that will stay involved with the entire packaging line from initial design through commissioning to after-sales service. We are now required to stock parts for our customers and perform other logistical services, freeing them from warehousing requirements," added Bekic.

If OEMs are to support their products at customer sites in a cost effective manner, open systems and connectivity will be needed.

Connectivity is Key

It costs less to build a standalone machine or robot, but customer demands simply can't be met without including connectivity. Open systems enable low cost connectivity by employing industry-wide standards and technologies including Ethernet, the Internet and existing communications infrastructure.

Connectivity is needed in three dimensions. First is connectivity among all of the manufacturing cells on the plant floor. One machine's output becomes another machine's input, especially in packaging lines. Connectivity eases and coordinates transitions between machines and robots, especially in flexible production systems.

The second aspect of connectivity is with the enterprise. Manufacturing engineers and executives want to know what is happening in their plants, and they want this production data delivered in real-time. The most practical way to accomplish this is through Ethernet links to enterprise wide computing systems, often delivered through middleware.

An emerging aspect of this trend is information delivered through the Internet via browser-based systems. If an automation component like a controller or an HMI has web server capabilities, then authorized users can access the component for both monitoring and control purposes.

Browser-based access doesn't require users to install and support any specialized or proprietary software on their computing platform, and the platform can be anything from a PC to PDA to a smart phone.

The third dimension of connectivity is from the machine or robot to the OEM. Again, browser-based communication is stepping to the forefront. The easiest way to enable this type of connectivity is for the OEM automation system to have web server capability and an Ethernet port. Connecting this port to the Internet then allows OEM technical experts to access, troubleshoot and support their products worldwide. Off-the-Shelf Trumps Proprietary

Myths from the days of yore told us that machine and robot controllers, HMIs and communication networks had to be designed from the ground up for industrial use. Today's reality says that many off-the-shelf technologies developed in the commercial world are finding their way into industrial automation, albeit often with modifications and enhancements.

The aforementioned connectivity tools such as Ethernet, the Internet, Web servers and browsers are a good example of how commercial off-theshelf (COTS) technologies are finding their way into the industrial arena. "Modbus TCP is one of the leading Ethernet standards found in today's industrial market place," says Jeff Payne, product manager of PLC, I/O and PC Based controls at AutomationDirect.

"By adopting Modbus TCP as our default protocol, we have inherently given our users a COTS communications protocol. Ethernet itself, as a transport protocol, brings many advantages by taking advantage of standard wiring and switches, making system design a much easier and less time consuming task," adds Payne.

USB is another COTS technology used by AutomationDirect, in this case in their new Productivity3000 controller. "USB connectivity greatly simplifies initialization and eliminates the cost of expensive proprietary cabling for communications among controllers, PCs and other devices. Our Productivity3000 controller also offers a USB data port which allows communication with a removable mass storage device," notes Payne.

Another example of COTS in Continued, p. 10>>

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Continued from, p. 9

industrial automation is via HMI software packages, most of which run on some type of Microsoft operating system. These operating systems were initially developed for office and home use, but are now being modified and applied to industrial automation.

In the case of PCs, the operating systems are virtually the same as those used commercially. For smaller scale HMIs, more compact operating systems are used, such as Windows CE and XP Embedded. These embedded operating systems are modified, more compact versions of commercial Windows.

The last bastion of proprietary control is the realm of the main machine or robot controller. Stringent requirements for reliability and real-time operation were once barriers to COTS products, but these hurdles have been cleared via two main technologies.

The first is PC-based control. As its name suggests, this method of control uses industrial versions of commercial PCs to perform real-time control of machines and robots. Multi-core processors increase performance in commercial PCs, and they're also a great fit industrial automation.

"PC-based control now uses more recent technologies such as the Windows 2000, XP or Vista operating systems. Using off-the-shelf operating systems simplifies design and implementation while reducing cost," explains Payne.

The second way in which COTS technology are used in machine and robot controllers is via PLCs and process automation controllers (PACs). A peek under the hood reveals that many of these controllers are powered by Intel and AMD processors that were first designed for and used in commercial applications.

Open Networks Replace Hardwiring

Hard wiring used to be the only practical method for connecting I/O and sensors to machine and robot controllers. Most I/O was local, and even when remote I/O was employed, the network connecting the I/O to the controller was proprietary.

But as the song says, the times they are a changing. Rare is the modern controller that doesn't have an Ethernet port for connection to I/O via many vendors' various protocols. Similarly, standard sensor networks like DeviceNet, AS-i and CANopen are proliferating and are commonly supported by industrial controllers.

A modern machine or robot control system will typically employ a mix of hardwired and digital network communications. Local I/O will be hardwired to the main controller, often via a backplane. Remote I/O communications will be via one of the industrystandard digital networks, perhaps a particular flavor of Ethernet.

Some sensors will be hardwired to local I/O, others to remote I/O. For sensors where more diagnostic information is required or for machines where distances are significant, a sensor network will be employed. Communications to motor drives and other complex components will be via an industry standard network, and Ethernet protocols are again a popular choice.

In many developing countries, consumers skipped the hardwired phase and went straight from no phone to cell phone. Similarly, machine and robot builders of the future might be able to build a machine with no hardwiring or industrial networks.

These machines will instead employ high-speed wireless networks for communications among the HMI, the controller, I/O and sensors. These machines and robots will also be wirelessly linked to other manufacturing cells, to enterprise wide computing systems and to remote users.

"Books are the quietest and most constant of friends; they are the most accessible and wisest of counselors, and the most patient of teachers."

- Charles W. Eliot (1834 - 1926)

"You can learn a line from a win and a book from a defeat."

- Paul Brown (1908 - 1991)

Get PAC features at a PLC price with Productivity 3000

Productivity3000, the latest industrial controller from AutomationDirect, saves you time from start to finish! The high-performance CPU has 50Mb memory, fast scan times and industry-leading seven communication ports for just \$599 U.S. It's the heart of a system with so many time-saving features, we could only list the top 20 here!

Productivity

ProductivitySuite software FREE (\$495 U.S. value) We want you to see just how productive this new controller can make you. That's why we're offering the software for FREE (downloadable online) for a limited time - check out the tools, instruction set and programming/debug environment that will let you configure and program a system in less time than you can imagine.



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- Run-time editing
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- Tag database export to C-more HMI

all in an intuitive Windows-based programming environment

TOP 10 HARDWARE HIGHLIGHTS

- High-performance CPU with 50Mb memory, fast scan time, and USB & Ethernet Programming ports for quick and easy connectivity
- Modular rack-based footprint with 36 discrete and analog I/O option modules, up to 115,000 I/O
- Unmatched **built-in communications** capabilities, including local and remote I/O ports and networking
- Integrated drive communications over Ethernet
- LCD display on CPU and Remote Slave for configuration and diagnostics
- Patent-pending LCD display on ALL analog modules - helpful in troubleshooting and reading process values
- Hot-Swappable I/O for advanced troubleshooting and system repair
- No module placement restrictions
 any module in any slot, any base
- No power budget limitations
- Optional I/O terminal blocks or easy ZIPLink plug-and-play wiring

and a two-year warranty to boot!

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▼AUTOMATIONDIRECT the #1 value in automation

System Integrator Corner

Ai controls improves Metal Slitting operation

By Douglas Albright, Ai Control Systems

S ince its inception in 1985, Ai Control Systems of Reading, PA has earned a reputation for excellence and versatility as a Control System Integrator. They offer clients total solutions for their factory automation needs by providing ways to improve productivity, quality, reliability, maintenance, record keeping, and profit margins. and machine wiring also lends itself to this approach.

An example of a project using AutomationDirect products is a slitter line recently completed for a metals finisher. This line had to compensate for variations in thickness of metal sheets, as it cuts a roll of metal into smaller ribbon-like strips. Because the edges tend to be thinner than the middle, the strips of material can vary in length. A pit is used to allow for the increased



As an integrator, Ai Control Systems is an independent value-added engineering organization which focuses on industrial control and information systems, manufacturing execution systems, and plant automation requiring application knowledge and technical expertise in design, implementation, installation, commissioning, and support.

Ai Control Systems ideally serves customers looking for integration services in a tight timeframe with less than exacting requirements specified. Their agile approach to project methodology allows them to turn projects around in short time frames while adjusting for changes and discoveries during the project. With 25-plus years in control systems integration, Ai Control Systems has learned how to quote projects based on general requirements such as IO count and HMI screen elements.

Typical projects range between \$20,000 and \$350,000 and their lean approach typically allows for the designing engineer to be present for the assembly, testing, installation and startup of the project. In-house panel assembly difference in length as the roll is processed by the equipment on the line. The finished product is small-width reels of material to be used for other manufacturing purposes.

The existing machine's controls, dating back the 1980's, were a European PLC and drives, none of which were supportable. When the PLC processor finally failed, the only option was to replace the entire PLC system.

Ai assigned a two-person team to the project, including a senior project engineer and a junior engineer. The first challenge was to get up to speed on the operation and control requirements of the machinery. Next, Ai had to review and validate any work already completed and make changes where necessary.

They chose AutomationDirect's DL405 PLC, along with a 15-inch C-more operator interface panel, to control the tension and speed of the line, instead of using the smart drives the customer had provided. This decision allows more flexibility for replacements when the drives are past their design life.

The final challenge was to complete the PLC and *C-more* HMI programming, start up the system and verify its operation. AutomationDirect's *Direct*SOFT PLC programming tools, such as the I-Box instruction set and HSC Workbench configuration aids, were used extensively to speed development of the drive algorithms.

Ai's team worked closely with the client to assure the final application covered all operational requirements.

The project was completed in less than a month and production began with minor startup issues. Callback issues were minor, and because of Ai's close proximity to the client, could be handled quickly.

This typical application showcases Ai Controls' ability to accomplish control projects which may overwhelm the customer's resources, without driving costs beyond their budgets.

Learn more about Ai Controls and this project at <u>www.aicontrols.com</u>.





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Evolution of the ChemFreePro[®] Ion Generator

By Jerry Nivens, Technical Services Environmentally Engineered Equipment, Dallas, Texas

In the 1960s, NASA conducted a research program to develop a small lightweight water purifier. The purifier was for use in the Apollo spacecraft, so low power usage and minimal maintenance were a must. The 9-ounce purifier, slightly larger than a cigarette pack and completely chlorine-free, was designed to dispense silver ions into the spacecraft's water supply to kill bacteria.



NASA's ingenious device for controlling microbial contamination caught on quickly, opening the doors for safer methods of controlling water pollutants on Earth. Numerous independent lab tests from NASA, health departments and universities along with many years of field testing have confirmed the exceptional sanitizing ability of copper/silver ionization. Studies showed that using a combination of copper and silver was effective against many water borne contaminants, even those resistant to high levels of chlorine.

One of the most promising application areas for this technology is large industrial cooling towers, 15 million of which are installed in the U.S. alone. These towers, some containing several hundred thousand gallons of water, have historically used chemicals to kill algae and to prevent and remove lime and scale deposits. Chemical treatment of cooling tower water requires huge blow-downs of treated water to continually renew the water in use. Some of this chemically contaminated water must be dumped into drains, thereby causing severe damage to anaerobic digesters in sewer systems.

To resolve these cooling tower issues, Environmentally Engineered Equipment developed the ChemFreePro Ion Generator. Starting with a simple prototype, the product has evolved into a highly successful and reliable solution, with testing of the technology already completed in the U.S. and other countries.

The use of water ionization as a maintenance treatment for cooling towers provides operational and maintenance savings. Water ionization acts as a powerful biocide, and ionization eliminates the need to remove and treat cooling tower water.

Ionization of cooling tower water eliminates algae, bacteria and viruses that cause serious health and maintenance problems. In the Ion Generator, ionization is produced through a process where copper ions are emitted into the water by an electrical current. The ions kill algae, bacteria and viruses – all of which are then removed from the water by filters.



The copper alloy ions also strip the bonding properties of the existing scale that adheres to tower pipes and components, reducing the scale to fine particles that can be removed by an automated filtering system. Bacterial counts are also reduced along with a subsequent minimization of the buildup of biofilm on heat exchanger surfaces. The ION Generator uses an AutomationDirect *Direct*LOGIC D0-06AR PLC, F0-04AD-1 analog input modules and RS4N-DE electromechanical card relays. Current is measured by an ACT005-42L-F current transformer, and the generator also employs an H0-ECOM100 Ethernet Module. For the entire generator control and monitoring system, only the pH and conductivity sensors are sourced from other vendors.



These sensors are connected to the PLC analog inputs to allow continual monitoring of water copper content, conductivity and pH levels. Based on these readings, the PLC makes adjustments to the relay outputs to control current to the generator plates. Because the control system is Internet enabled, it can be monitored, programmed and controlled remotely. For locations without Internet connectivity, an MDM-TEL industrial serial modem is used.



As the need to treat drinking water is influenced and increased by bacterial pollution, this technology could migrate from cooling towers to treatment of fresh water for human use, just as NASA first envisioned.

In all our experiences with supply companies, Automation Direct has always been helpful and prompt with technical assistance, or whatever might be needed at the time. Much of our success in this project must be attributed to that impressive service and dedication.

M.M. & I, Inc provides production information 24/7 to Pratt Industries

By Michael Miles Founder/President

ichael Miles and Investors (M.M. & I.) has been in the commercial and industrial electrical markets since 1986. The company began by offering Web-based database and Visual Basic applications supporting school systems. In 1994, we ventured into the computer market, becoming proficient in information technologies and high level programming. In 2002, we saw a need in the market to combine our IT programming services with our PLC/Controls and controls programming. This allowed us to offer our customers the ability to get factory information up into the IT world, over intranets or even over the Internet. We also added a panel shop, giving us the ability to provide complete "turnkey" solutions, with all the control components mounted and wired in a panel. We are also uniquely suited to offer reliable yet affordable UL certified motor control solutions containing integrated data collection and reporting; this technology does not require an IT department to maintain.

Several months ago, Pratt Industries, one of the industry's largest manufacturers of paper and corrugated products, and a company committed to recycling, approached us to install a control and data collection system for a new material recovery recycling plant being built in Shreveport, Louisiana. A sister plant was being implemented in another location, and controls were being installed there by another firm, but they wanted a second solution for comparison. Their request was not only to provide the automation and controls, but to make plant information available to their management teams on a 24/7 basis from anywhere in the world using Web technologies.

A material recovery recycling plant is quite simple. Recyclable material such as cardboard, plastic, glass and aluminum cans arrives at one end of the plant, usually all mixed together from a variety of sources. The plant uses many sorting devices, including screens, magnets, separators, magnetic conveyors and scanners, that sort and separate each of the disparate materials, then convey the material to a series of balers. Each of the materials is baled and moved to their own processing plants, or sold to other plants for producing finished goods and products with recycled content. (Figure 1)



Figure 1, Material handling equipment at the materials recovery facility

While the plant footprint was quite large, we were able to consolidate the controls to a single four-bay control cabinet. Over 65 AC induction motors are used in conjunction with numerous variable frequency drives to control the various conveyors, material handling equipment and processing equipment. Our client wanted the capability to monitor each of these motors, their status, any faults, and be able to view and change variable frequency drive parameters. (*Figure 2*)



Figure 2, One of the bays in the main control cabinet contains the PLC system, a second smaller PLC and some of the motor control components.

We selected AutomationDirect to provide the core of our automation solution, principally due to their "ease-ofuse" and flexibility. All of AutomationDirect's components use Ethernet as the network topology; this provided the flexibility to add the plant networking, as well as the upstream communications. We used several C-more touch screen operator interface panels at various locations throughout the plant; information from each panel is readily available in real-time. We installed C-more touch panels in the pre-sort area, post-sort area, baler, and the main operator console. Each C-more panel is networked via Ethernet to the main PLC, which is a DirectLogic D2-260 unit with two racks of I/O installed. The PLC system also communicates via Modbus (over Ethernet) to 16 AC variable frequency drives. We installed a DL06 unit to serve as an "Estop" PLC dedicated to monitoring the E-stops; it captures the fault conditions

Continued, p. 16>>

User Solutions cont.

Material Recycling

Continued from, p. 15

and reports them to the main control system. This PLC also communicates via Ethernet to the main D2-260 PLC.



Figure 3, The main Operator Console is a 15" C-more panel mounted on the 4-bay cabinet that houses the PLC, drives, motor controls and other control components.

(Figure 3)

As a committed recycling company, Pratt ultimately plans dozens of these material reclamation centers nationwide. Since these will be geographically dispersed, their management team had a requirement to acquire up-to-date information and instant production data from anywhere in the world. The C-more panel has an FTP function that allows us to transfer production data, status information, up-time and downtime statistics, C-more screen captures, trend graphs, and data securely to a server at our facility. We wrote custom software that allows Pratt management the ability to securely and instantly look at nearly any data, any C-more screen, and production statistics, over the Web.



Figure 4, This fault screen monitors the status of every motor and variable frequency drive in the plant, and can be viewed securely over the web by management on a 24/7 basis.

(Figures 4 & 5)



Figure 5, The main operator console allows the operator to manage the follow of all material throughout the plant, as well as call up any maintenance or set-up screen.

The AutomationDirect control system provided all the connectivity we needed in a control system that included 67 motors, 16 variable frequency drives, C-more touch four screen operator interfaces and a mid-range PLC system. We were able to use the FTP transfer function from C-more to provide our customer with the ability to continually monitor production data, plant statistics and fault conditions, all securely over the Web. In the end, the solution achieved all goals the customer had outlined, and we are continuing to add remote monitoring features at the customer's request, while enhancing the solution that we already have in place. We will be adding the C-more remote feature in the near future which adds additional capabilities to the system. We pleased were extremely that AutomationDirect added this feature which greatly enhances our solution, and we are able to offer it to any of our customers with a simple download.



Student Spotlight The Future of Technology

Racing as Field Lab for Automotive Design

Science/Technology Student Spotlight: Wisconsin SAE Racing Team GSXR600 motorcycle engine to a single cylinder KTM 525. The main reason for the change was a new rule which made fuel economy worth double the points it was previously. This change also brought about the implementation of a turbocharger. The team uses an IHI turbocharger to increase the vehicle's



he University of Wisconsin Formula SAE team competes against over 130 universities from around the world in an annual competition held at Michigan International Speedway. The competition is based on the design and manufacture of a small scale open wheel, open cockpit racecar. Teams are usually comprised of engineering students who, in the fall semester, design the car using Computer-Aided-Design programs and, in the spring semester, manufacture these designs to create a competition ready vehicle. In 2007, Wisconsin Racing took 1st Place at the international competition and in 2008 came away with 4th Place and the top United States team. The team also competes at Virginia International Raceway where, in 2008, the team took home 1st Place at the inaugural competition.

In 2009, the team made a drastic switch from a four cylinder Suzuki

performance. Unfortunately, this was a major change made by the team and the vehicle failed to finish the endurance event due to an engine failure. The team was on pace to a top 10 finish, but with the engine failure, dropped all the way to 35th. The 2010 car has focused on increasing the performance while maintaining reliability so that another engine failure does not occur.

Two important aspects of the vehicle are the control strategies used and data acquisition analysis.

One way the team incorporates both of these is with the use of Hall effect proximity sensors (AutomationDirect part number PY4-AN-3A), used as wheel speed sensors by sensing an encoder wheel located within the upright assembly.

One important use of wheel-speed sensors is for the traction control system. Traction control is a useful system which reduces the torque output of the engine in the event of traction loss. Traction control requires feedback from



the wheel speeds on all four wheels, and it uses this feedback to determine the amount of wheel slip on the rear tires in comparison to the front tires. It then takes this wheel slip percentage and retards the spark advance to reduce the torque output of the engine.



This traction control system is very effective in reducing wheel slip and decreasing lap times; it decreases wheel slip a stunning 63 percent. The traction control system reduces lap times by an average of 0.8 seconds over the course of a 30 second lap, and greatly increases the consistency of lap times. This traction control system allows the drivers to focus more on the track rather than focusing on trying to maintain optimum traction.

Another way the proximity sensors benefit the team is through the use of data acquisition. With data logging hardware, the team can analyze each lap by comparing parameters such as the vehicle's speed. This is beneficial in the development of the vehicle and also in the development of the driver. Monitoring the car can prevent potential failures, and aid in troubleshooting any problems that do occur.



Transformers Application, Construction and Efficiencies

Conclusion of a Two-Part series

By Brian S. Elliott

n the last issue of NOTEBOOK, we discussed the two categories of transformers commonly available and typical applications for them. The final category is control transformers, which are commonly incorporated into a machine element. This is the broadest category, as voltage matching situations will almost certainly be encountered which, in most cases, can be easily addressed with a transformer. In this category, high efficiency transformers are quite desirable because they are considerably smaller and produce less heat than their standard counterparts. Figure 6 shows a typical encapsulated transformer that is appropriate for general purpose applications.



Figure 6, Encapsulated General Purpose Transformer

In most machine and automation applications, control circuits operate at either 24 or 120 VAC. These lower voltages produce significantly safer circuits, which can be completely isolated from the higher line voltages used to power the equipment. Control transformers are typically configured specifically for these applications. *Figure 7* shows a typical high inrush "E" core control transformer that is configured with a three-element fuse block. One fuse is used to protect the output and two are used to protect the input.



Figure 7, High In-Rush Control Transformer with Fuse Set

The overall power rating of transformers is typically shown in volt-amps (VA). To determine the VA rating required for any single phase circuit, the total current load is added up and multiplied by the required secondary voltage:

Current x Voltage = Volt Amps (VA) To determine the VA rating for three-phase circuits, use the following formula:

Current x Voltage x 1.732 = 3 PH VA

Therefore, if a 24 VAC circuit has six heating elements at 500 mA each, four indicators at 100 mA each and a panel lamp at 1 amp then: $[(6 \times .5) + (4 \times .1) + 1] \times 24 = 105.6$ VA. This figure is referred to as the "Total Steady State" or "Sealed" rating. When sizing a transformer for resistive loads this method is appropriate; however, when sizing for motors, solenoids and coils, the high inrush current of these inductive loads must be considered. Inrush currents are the high momentary loads generated when a circuit is powered up. For example, the inrush current for threephase induction motors can be as high as seven times the name plate current. For solenoid valves, the holding VA rating may be 16, while the inrush VA may be 27. In these cases the inrush current of the components must be used when calculating the required VA rating of the transformer. Most control transformers are specifically designed to provide the high inrush currents that inductive circuits require. The duty cycle of the transformer is such that it can provide very high momentary currents and then settle back to a steady state current. As components are switched on and off, the surge currents will spike with no adverse effects on the transformer. When considering circuit protection, delayed action or "slowblow" fuses should be selected to accommodate the high inrush currents. Article 450.3 B of the National Electric Code provides guidelines for protecting transformers with either fuses or circuit breakers. This code should be adhered to whenever specifying or installing a transformer. As for control transformers, use the three-slot fuse option whenever possible. The input fuses protect the transformer and the output fuse can be set up to protect the load(s).

The thermal characteristics of most transformers are designed specifically so that the unit can operate in air at full capacity. Although unprotected transformers are the least expensive designs, they must be installed in some sort of housing that can protect the equipment, as well as any personnel that may come in close proximity to the unit. This usually is not a problem for control transformers, however, larger units can be problematic. The transformer must be mounted in an enclosure that provides adequate safety, protection

Continued, p. 22>>

Feature Story

converting Batch to continuous operations

Upgrading from batch to continuous Processes requires high level automation

By Dan Hebert The Hebert Agency

any process plants use batch operations for all or part of their production operations. Some processes are inherently batch oriented, but many others can be converted to continuous. Converting a batch process to a continuous operation has many advantages including, but not limited to, better quality, more throughput and less energy use (*see Table 1*).

These advantages are real, concrete and have been proven in thousands of process plants worldwide. But there's a catch, and it's the complexity inherent in converting a process from batch to continuous. This article features input from numerous end users and system integrators, all recounting their experiences in converting from batch to continuous. Benefits will be examined first, then challenges will be detailed. Finally, solutions will be suggested including a look at how AutomationDirect's new Productivity3000 controller may be used to control continuous operations. Benefits of Upgrading from Batch to Continuous

Upgrading all or part of a process from batch to continuous yields many benefits. "Continuous operations yield more consistent product quality, more predictable behavior and a better opportunity to maintain and perfect a steadystate process," said Carl Wikstrom, PhD and PE in Control magazine's September 2009 cover story, "Batch to Continuous." Wikstrom is the director of research and development at Rineco Chemical Industries in Benton, Arkansas.

Another end user quoted in the same Control cover story agreed with

Wikstrom. "Our continuous polyether polyol reactor is about one third the size of a comparable batch reactor, yet it can produce 1.5 times as much product," related William D. Wray, PE, engineering consultant with Bayer MaterialScience in Channelview, Texas.

"The continuous reactor also features increased energy efficiency as there is less time and energy spent heating and cooling reactor contents as compared to a batch reactor. Pound for pound, our continuous process uses about 25% of the energy used for the batch process," added Wray.

Mark Hron, a cheese and dairy electrical engineer with Kraft Foods, noted the following benefits in the cover story. "You can slow down or speed up production to match packing line speeds. Filling and emptying time lags can be reduced. Less operator input and interaction is needed, so labor is saved".

End users aren't the only ones on board with the benefits of switching from batch to continuous. System integrators agree, and they look at the advantages from their client's point of view.

Integrators Agree

System integrator Bachelor Controls (www.bachelorcontrols.com) is headquartered in Sabetha, Kansas. Working with a brewer, they converted a fermentation process from batch to continuous (see Figure 3, next page). "The new process has resulted in much more consistent alcohol production," said Marvin Coker, senior project engineer with Bachelor, in the Control cover story.

"The brewer has seen reduced fouling in the beer still. Clean-in-Place costs have been reduced dramatically as between-batch cleanings have been completely eliminated. There's also been a reduction in raw material costs as the client has not had to pitch yeast into the process since the project went online," added Coker.

Another systems integrator seconds

Continued, p. 20>>

1. Better quality 2. More throughput

Table 1: Continuous Benefits over Batch

- 3. Better Inventory management
- 4. Less waste
- 5. Less energy use

Table 2: Continuous Process Requirements

- 1. Precise measurement and control
- 2. Continuous process variable measurement
- 3. Modulating valves
- 4. On-line analysis
- 5. Custom controller programming

Tables 1 & 2

Feature Story cont. converting Batch to continuous Processes

Continued from, p. 19



experiences. "Continuous Coker's production minimizes intermediate storage of in-process materials that often have relatively low shelf life," noted Delmar Schmidt in the cover story. Schmidt is an applications engineer with Melfi Technologies (www.melfitechnologies.com) in Ontario, Canada. "Significant safety improvements can also be realized if these in-process materials are toxic or explosive," added Schmidt.

Optimation Technology (www.optimation.us) of Rush, New York, converted a 90,000 gpm 17-cell industrial cooling tower water makeup system from batch to continuous. "A shift operator spent half his time adjusting makeup water to the towers via 17 valves," observed Dan Curry, senior process control engineer with Optimation, in the Control cover story.

"Chemicals for water treatment were also added periodically by operators. The manual/batch operation of water and chemical addition resulted in large quantities of wasted water and water treatment chemicals, as well as inconsistent water temperature and chemical concentration," noted Curry.

Figure 3

"The cooling towers and associated water headers were segregated into five groups and a level transmitter and control valve were used to automate water makeup and chemical additions," explained Curry.

"Benefits included reduced operator involvement, reduced energy consumption, and reduction of heat exchanger and piping fouling due to lower chemical concentrations. Fewer chemicals were sent to the sewer and less water was sent to drains. Finally, the new system exhibited improved stability of chilled water supply temperature and lower demand of water from the central plant," concluded Curry in the cover story.

System integrators and end users agree that the gains from switching from batch to continuous are significant. But as we'll see, so are the automation challenges.

More Precise Control Required

Continuous systems require more precise control than batch processes. "With continuous operation, the control system needs to be able to correct more quickly, reliably and robustly to changes from steady-state," noted

Wikstrom in the Control cover story.

Batch systems inherently include opportunities to pause and make corrections, but continuous processes don't. "We no longer had the luxury of just pausing equipment, so we had to develop isolation strategies to keep an upstream issue from affecting the downstream processes," said an automation engineer with a pharmaceutical company in the cover story.

For brewery fermentation processes like the one previously discussed in this article, level control for fermenter tanks was problematic. "In a typical process, a loop response time might range from a few seconds to a few hours, but this project often had loop cycles of 24 hours or more. Inventive advanced process control techniques were developed to deal with these significant time lags," related Coker in the Control cover story.

"These techniques consisted of using much smaller gains, and then adjusting the bias for the PID loop based on the differences in the control variable (CV) output to the valve for the upstream and downstream fermenter level controls," added Coker.

"Since the flow cascades through the four fermenters to the beer well, the flow out should match the flow in. Flow metering was not available between fermenters, so the differences in the CVs were used to approximate flow and the loop was biased based on that difference," explained Coker in the cover story.

As recounted above, continuous processes require precise control. Continuous on-line measurement of process variables is also needed, often requiring a significant upgrade from offline measurements.

In the Control cover story, Hron of Kraft Foods discussed continuous control measurement issues. "There can be problems when going from a single scale in a batching system to multiple flow meters in a continuous system. Often, extra calibration work is required along with more data monitoring. Most seriously, continuous processes may

need sensors that just don't exist."

Because of the complexity inherent in continuous control, low end PLCs and other controllers are usually not up to the task. What is needed instead is a process automation controller (PAC) with high I/O capability, high speed, advanced control capability and sophisticated communications.

Productivity 3000 a Great Fit

A u t o m a t i o n D i r e c t 's Productivity3000 PAC brings many features well suited for conversion of processes from batch to continuous. "Continuous processes often need expandability and a large I/O count," says Jeff Payne, product manager of PLC, I/O and PC Based controls at AutomationDirect.

The Productivity3000 gives process plant automation professionals the capability to add up to 32 Remote I/O slave bases to the main CPU. Users can also add four expansion bases to the CPU, and four expansion bases to each remote slave. The modular design allows selection of a base size from three, five, eight or eleven I/O module slots.

"Combining the large number of allowable bases with our high density I/O modules, up to 64 points per module for 24VDC inputs or 24VDC outputs, creates a system that can control and monitor many data points. The Productivity3000 can also be used to adjust system controls on the fly for real time process adjustments," adds Payne.

"Greater processing power, fine tuning PID loop control, and advanced math and data statistics instructions give users the tools required for control of continuous processes," explains Payne.

Continuous processes are usually more heavily instrumented than batch processes, and many of these instruments and analyzers aren't available with standard communication ports and protocols. "The addition of our Custom Protocol Instruction greatly simplifies the task of interfacing the Productivity3000 with the process analyzers and proprietary instrumentation required in many continuous process applications. Without this feature, establishing communications to these devices would require the addition of costly hardware along with many hours of complicated coding," concludes Payne.

For processes that can be upgraded from batch to continuous, benefits are significant. Making the upgrade raises numerous automation issues - but these can be addressed with the right combination of hardware, software and intelligent engineering. Process plants that convert from batch to continuous will reap the benefits and be rewarded for their efforts.

"If the world should blow itself up, the last audible voice would be that of an expert saying it can't be done."

- Peter Ustinov (1921 - 2004)

"An inventor is simply a fellow who doesn't take his education too seriously."

- Charles F. Kettering (1876 - 1958)

"A goal without a plan is just a wish."

– Antoine de Saint-Exupery (1900 - 1944)



Tech Brief cont.

Electrical wiring

Continued from, p. 18

from the elements and sufficient cooling. This usually translates to a rather large, and expensive, enclosure.

An excellent alternative to the above situation is to use an encapsulated transformer. In these cases, the manufacturer places the transformer into a compact enclosure and fills the gaps with a thermally efficient potting compound. This arrangement provides a number of distinct advantages including compactness, operator safety, superior cooling, resistance to shock and vibration, ready conduit connections, facilities for convenient mounting, low purchase cost and extended life. When considering installation and service life, encapsulated transformers are typically the best choice for general purpose, marine and building distribution applications.

Principally, losses through transformers are due to heat dissipation. The core of any transformer heats up because of the eddy currents that form in the conductive material making up the core. An eddy current is a complete electrical circuit contained entirely within a conductor. Any conductive material placed in close proximity to rising and falling magnetic fields is subject to the formation of eddy currents and associated heat rise. To mitigate eddy currents, transformer cores are typically constructed by stacking laminations together. This stacked core provides an excellent magnetic mass, while limiting the electrical path where eddy currents can form. Higher efficiency transformers commonly use very thin laminations, while inefficient, low quality units use thicker laminations. These lower efficiency units can typically be identified by their size-to-VA ratio. Higher efficiency transformers will be significantly smaller than a low efficiency unit carrying the same electrical rating.

As of July 2006, the federal government has mandated, through the Department of Energy (DOE), 10 CFR-Part 431, that all low voltage, drytype distribution transformers manufactured after January 1 2007 must have the minimum efficiency ratings shown in *Figure 8*.

Single Phase		Three Phase		
kVA	Efficiency	kVA	Efficiency	
15	97.7	15	97.0	
25	98.0	30	97.5	
37.5	98.2	45	97.7	
50	98.3	75	98.0	
75	98.5	112.5	98.2	
100	98.6	150	98.3	
167	98.7	225	98.5	
250	98.8	300	98.6	
333	98.9	500	98.7	
-	-	750	98.8	
Source: N	IEMA TP-1-2002	1000	98.9	

Figure 8, Mandated Transformer Efficiency

Brian S. Elliott Bio Brian S. Elliott is the



Chief of Engineering for Air Options, Inc. in Houston, Texas. He is the author of the Compressed Air Operations Manual and Electromechanical Devices & Components, both published by the

McGraw Hill Book Co. He is a regular contributor to several industrial publications, including the Automation NOTEBOOK.





Automation Talk

New Talk Shows for 2010!

By Tom Elavsky AutomationDirect, Technical Training Developer

e're well into 2010 and excited about new topics added to the Webinar schedule. We have produced talk shows on PLC/PAC Programming, Dinnectors and ZIPLinks, CLICK Software Advanced, and the Productivity 3000 PAC. If you missed the live shows, look for the pre-recorded episodes at www.automationtalk.com.

You can register for upcoming live Web seminars at: www.automationtalk.com. Seminars planned so far include:

February 24 –	CLICK Software
	Advanced

- March 17 <u>Productivity3000 PAC</u> <u>Overview</u>
- April 7 <u>Productivity3000</u> <u>Advanced</u> April 28 – <u>C-more Touch and</u>

May 19 - DC Motors

We also have planned additional talk shows to cover areas such as Pneumatics and Motion Control.

C-more Micro



Figure 1, http://www.automationtalk.com

Since the previous issue of Automation NOTEBOOK, we have added more videos to the LEARN Web site, most of which focus on PLCs. Topics covered include:

- CLICK PLCs <u>Getting Started</u> <u>Part 7 Write Project</u> <u>to PLC</u> CLICK PLCs - <u>Getting Started</u> <u>Part 8 Place PLC in</u> <u>Run Mode</u>
- CLICK PLCs <u>Getting Started</u> <u>Part 9 Test Project</u> <u>using Data View</u>

CLICK PLCs - <u>Getting Started</u> <u>Part 10 Y001</u> <u>Output On?</u>

You can check them out at http://learn.automationdirect.com. These videos can also be viewed on our YouTube channel anytime at: www.youtube.com/

automationdirectvids.

The learn.automationdirect.com site is divided into seven major areas: PLCs, Operator Interface, Software, Sensors, Motor Controls, Drives/Motors and Miscellaneous. Videos are listed in posting order, with the most recent at the top. Beneath the viewing screen are links to related reference materials, AutomationTalk seminars, other Web sites and technical articles which have appeared in Automation Notebook.

We have several new topics planned for the LEARN site during the



Figure 2, http://learn.automationdirect.com

first half of the new year which cover recently launched products such as the Productivity3000 PAC, *C-more* and signal conditioners.

Be sure to bookmark these sites as we continually update and expand technical content. We also invite your feedback regarding various topics provided and additional topics you would like considered.

"I would never die for my beliefs because I might be wrong."

- Bertrand Russell (1872 - 1970)

"Those who would give up essential liberty to purchase a little temporary safety deserve neither liberty nor safety."

– Benjamin Franklin (1706 - 1790)

FYI Productivity3000

FYI - Productivity3000

By Jeff Payne, AutomationDirect Product Manager, PLC, I/O and PC Control

What how is your e

What is a "PAC" and how is it different from your existing PLCs?

A. PAC is the acronym for Programmable Automation Controller where PLC is the acronym for Programmable Logic Controller. The Wikipedia* definition for a PAC is broad, but accurate; "A Programmable Automation Controller (PAC) is a compact controller that combines the features and capabilities of a PC-based control system with that of a typical Programmable Logic Controller (PLC). A PAC thus provides not only the reliability of a PLC, but also the task flexibility and computing power of a PC. PACs are most often used in industrial settings for process control, data acquisition, remote equipment monitoring, machine vision, and motion control. Additionally, because they function and communicate over popular network interface protocols like TCP/IP, OLE for process control (OPC) and SMTP, PACs are able to transfer data from the machines they control to other machines and components in a networked control system or to application software and databases. A PAC at the core of an automation system can integrate multiple field bus networks like RS-485, RS-232, RS-422, CAN, Ethernet, EtherNet/IP, and others."

The Productivity3000[®] started with a solid historical PLC foundation and added several new capabilities. Tag-name-based programming gives users the freedom to identify data types they need, and identify their tags with real word names. In typical fixedaddress-based PLCs, you are allocated a fixed amount of memory for Timers, Counters, integers, register, etc. and use abstract nomenclature, all of which mean nothing to real world users, to identify data registers.

An additional feature not found in our *Direct*LOGIC PLCs is direct Enterprise connectivity. When used in conjunction with our DataWorx P3K software, the Productivity3000 interfaces with a standard database through a Modbus TCP server. With the simple configuration you can retrieve, add, delete and update records in a Microsoft Access, SQL or ODBC compliant database.

Another feature which sets this product apart from our PLCs is the seamless integration with our *C-more* operator interface panels and GS series variable frequency drives. Users can save countless hours of development by sharing the tag name database between the Productivity3000 and *C-more* operator interface panels.

With our Ethernet Remote I/O network, the user can connect Ethernetenabled GS drives and use the autofeature discovery in the Productivity3000 project's Hardware Configuration. From here you can modify the drives' configuration and save the project; you also have the option of writing the drive configuration to each drive connected to the network each time you transfer the project to the PAC. You can also take advantage of the standard GSR and GSW (Read and Write) instructions which greatly simplify communications to the drives.

Q. Does the Productivity3000 support Motion Control?

A. This has been a frequently asked question since the launch of the Productivity3000. As mentioned above, our variable frequency drives are tightly integrated to the product, both from a hardware and software standpoint. However, the initial release of the Productivity3000 does not include a high speed counter or pulse output module.

Both modules have been planned since the very beginning of the

development project, and the engineering and development efforts for these modules are ongoing. When available, they will be accompanied by the same type of easy-to-use, fill-in-the-blank style instructions that are the hallmark of the Productivity Suite programming software.

In the meantime, we have recommended that customers with appropriate applications connect their Productivity3000 PACs to a Terminator I/O CTRIO high-speed counter and pulse output module (T1H-CTRIO) over Ethernet via Modbus TCP (also requires a Terminator I/O Ethernet Base Controller, T1H-EBC100). This offers the possibility for high-speed I/O, including motion control from the Productivity3000. (This is an interim solution, and may not be suitable for all applications.)

For servo and stepper applications, we recommend that customers consider SureServo™ and SureStep[™] our product lines. Both products communicate with the Productivity3000 via a Modbus connection. SureServo drives have a built-in indexer which can control various types of single-axis moves; use Modbus to adjust the indexing parameters on-the-fly and to initiate moves. Connect and communicate with several drives at the same time for loosely coordinated motion. Electronic gearing between SureServo axes is also possible. If your application requires tightly coordinated multi-axis control, our current offering may not suffice.

Q. What are Arrays and how can they be useful?

A. An Array is a storage area for a group of tags of a common data type which have some relationship to each other and need to be manipulated as a group. The Productivity3000 allows you to work with one-dimensional and two-dimensional Arrays (1D or 2D).

Each data location within an Array is called an Element. An Array may contain 65,536 Elements maximum, regardless of the data type.

Continued, p. 26>>

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 - 4 DC In / 4 DC Out (sourcing), 2 analog in, 2 analog out (current / voltage selectable)
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AC input module, eight 100-120 VAC points	\$40.00 CO-08NA

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Continued from, p. 24

In the Array example shown below, the origin is at the upper left and is addressed as 1,1. The Y axis is labeled "Rows" and the X axis is labeled "Columns" (*Figure 1*) Column Index is specified. For example, in the 1D Array below, the Array is named Widget Progress. To address the element in Column 2 of this 1D Array, use Widget Progress(2). *(Figure 3)*

Q. How do I use pointers or Indirect Addressing in the Productivity3000?

A. This method of programming is handled using Arrays. Simply create an Array table and type in the index of the desired element or elements, Array

2D Array Example			C	olumr X Axis	ns ;		
	1, 1	1, 2	1, 3	1, 4	1, 5	1,6	1,7
	2, 1	2, 2	2, 3	2, 4	2, 5	2,6	2, 7
Rows	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6	3, 7
V Avic	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6	4, 7
	5, 1	5, 2	5, 3	5, 4	5, 5	5,6	5, 7
	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6	6, 7
	7, 1	7, 2	7, 3	7, 4	7, 5	7,6	7,7
1D Array Example			C	olumr	าร		
Rows	1	2	3	4	5	6	7
			Figure	1			

		W	idget	Progre X Axis	ess Arı	ray		Name (),(). A tag name may also be specified as the index, Array Name (Row Tag),(Column Tag).
	1, 1	1, 2	1, 3	14	1, 5	1,6	1, 7	
	2, 1	2, 2	2, 3	2,4	2, 5	2,6	2,7	
Y Axis	3, 1	3, 2	3,3	3, 4	3, 5	3, 6	3, 7	
	4, 1	4, 2	4, 3	4, 4	4, 5	4, б	4, 7	
	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6	5, 7	
	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6	6, 7	
	7, 1	7, 2	7, 3	7, 4	7, 5	7,6	7,7	
								1

Figure 2

Individual Elements are addressed by their Index. In a 2D Array, the format is Array Name(Row),(Column). Row and Column Indexing begin at 1. In the 2D Array example below, the Array is named Widget Progress. So to address the Element highlighted in this 2D Array, use Widget Progress(4),(2). (*Figure 2*)

A 1D Array consists of a single Row and multiple Columns and only the



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Business Notes

Inexpensive online PLC training now available

Interconnecting Automation, an independent training company that offers regional training and video courses on AutomationDirect products, has launched a subscriptionbased online training program. Initially focused on PLCs such as the CLICK micro-brick series, the site will continue to expand coverage to topics such as **C-more** HMIs and other industrial controls.

The online training section is a component of:

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Libraries currently available include:

- Introduction to PLC Principles (For the novice-non user with limited controls knowledge)
- CLICK series PLC Training (includes Introduction to PLCs library)

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Bio for Doug Bell, Interconnecting Automation

The bottom line is that a class is only as good as its instructor, and Doug Bell is the best! He is good at what he does because he loves it! He has spent over 20 years implementing several combinations of hardware and software to develop Control System Solutions. He's worked with several brands of PLC's and brings his variety of knowledge to the classroom. This way Doug can relate to each individual student regardless of that

student's experience. You will learn everything you need to know about *Direct*SOFT in Doug's class! But you won't learn about it in some abstract marketing way. Instead you'll learn how to make PLC Based control systems work for you in real applications. Doug will take you all the way through the application development process. From system design, logic development, and HMI all the way to system installation, check-out and debug. By the end of the class you will see your own program mimicking and real-world solution! Although this seems like a lot to cover in 3 days we assure you Doug will not fall short simply because he's good at what he does. Reserve your place today!

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Extra Credit: How fuel efficient would the Priuses have to be in order to best the 2 mpg increase in the Suburbans?

Credit: Seth Godin

Crosscut

2.) Can you cut a symmetrical "Greek" cross (shown) into five pieces, so that one piece will be a smaller symmetrical Greek cross, and the other four pieces will fit together to form a perfect square?



<u>Crossways</u>

3.) Can you arrange these four pieces (cut from a square as shown) to form a symmetrical Greek Cross?



Greek Cross puzzles credit: Henry Dudeney (1857-1930) "A business that makes nothing but money is a poor business."

– Henry Ford

"People are trapped in history, and history is trapped in them."

- James Baldwin

"A compromise is an agreement whereby both parties get what neither of them wanted."

– Author Unknown

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