Your guide to practical products, technologies and applications

Automation NOTEBOOK®

Fall 2011 Issue 21

Feature Story: Internet Use Clicks with Machine, Robot Builders

New Product Focus
Motors and Drives

User Solutions
Small-Scale Hydroelectric Plant Promises Profit

Technology Brief
Top 10 Tips: Specifying VFDs (Part two of a two-part series)

C-more® Remote HMI

mobile application for iPhone® and iPad®

Available on the App Store

Remote HMI works with iPad 2, iPad, iPhone 4, iPhone 3GS, iPhone 3G, and iPod touch®.

$4.99

Automationdirect has released its first mobile application for the iPhone and iPad! The Remote HMI app is just one of the many advanced features you will find in the C-more product line.

The Remote HMI App lets you remotely monitor or control the machine process from an iPhone or iPad as though you're standing at the C-more panel.

Do all this from the palm of your hand!

- Monitor and control screen operations of the C-more panel as if touching the panel itself
- Save JPG screen captures to review, email and print if needed
- Zoom in on specific objects on the screen and then save a screen capture if needed (using iPhone or apple Zoom feature)
- Multilevel Logon Security supports three Remote Access user accounts
- Multilevel Access Control allows each account to be configured in one of the following levels of access: Full control, View only, View and Screen Change only.
- Screen Lock/Unlock button reduces unintentional activation of the remote C-more panel inputs
- Remote HMI app requires software and firmware Version 2.73 or later*, and an Ethernet-enabled C-more panel to function.)
- Activation or Notification Tags allow each account to have associated user configurable TAGS so the Panel project or PLC project can indicate that a remote user is connected, or to enable or disable the remote access feature. These tags can activate alarms, events or notifications to alert local operators that a remote user is connected.

*For complete details on **Remote HMI** or to order, visit:*
http://www.c-moreHMI.com/app

C-more touch panel line-up:

* Software and firmware are downloadable for authorized customers from:
www.automationdirect.com

www.automationdirect.com

Go online or call to get complete information, request your free catalog, or place an order.

1-800-633-0405

Order Today, Ships Today!*

* See our Web site for details and restrictions.

VOTED #1 Best in SERVICE 11 YEARS 2001 - 2011

AUTOMATIONDIRECT.com

the #1 value in automation

Automation NOTEBOOK

Your guide to practical products, technologies and applications

Contributors

Publisher Tina Gable

Managing Editor Joan Welty

Coordinating Editor TJ Johns

Design Manager Justin Stegall

Contributing Writers

Tom Elavsky
Joel Froese
Joe Kimbrell
Greg Philbrook
Chip McDaniel
Tim Roberts
Jack Smith

CONTACTS
Automationdirect.com Inc.
3505 Hutchinson Road
Cumming, GA 30040

Phone 1-800-633-0405
or 1-770-889-2858
Fax 1-770-889-7876

Monday - Friday
9 a.m. to 6:00 p.m. EST

www.automationdirect.com

If you are a non-subscriber and would like to be included in the next mailing of AutomationNotebook, please visit:

http://www.automationnotebook.com/freestuff.html on the Automation Notebook Web site, and complete the details. You can also request FREE stuff, including our catalog and our CD-ROM featuring the entire catalog and demo software. If you provide your email address, we will send news and product information from time to time as well.

For those who prefer to speak with us in person, please call 1-800-633-0405 x1845. Thanks for your interest, and we look forward to hearing from you.

Editor's Note

Is it just me, or is this year flying past us? What a year it's been, too. We've seen so much. We've experienced so much. We've remembered the 10th anniversary of 9/11 by witnessing the opening of the beautiful memorial park at Ground Zero in New York City. We learned of the fall of the mastermind behind that brutal attack on freedom. We've also experienced advances in technology. Do you have the latest iPad®, iPhone®, or any of the smart gadgets and technological toys? I don't know which technology gadget I like better, my smart phone or the toaster which also poaches my egg each morning. But let's not stop there. Let's continue to face forward. Personally, I am excited to see the technological advances headed our way in 2012… and beyond.

This issue of NOTEBOOK is filled with interesting articles and bits of information that just might inspire you to try something different. We have the low-down on our newest products. An informative application story shows how a family in South Carolina built a hydroelectric plant to reduce energy costs. Our Student Spotlight segment provides details on two students at Southern Polytechnic University in Marietta, Georgia. With products from AutomationDirect, they designed and constructed a pad printing machine.

There's a lot more, including the ever-popular Breakroom. Test your wits to see if you can solve the brain teasers. But, most of all, sit back, relax, and turn the page…

Coordinating Editor
editor@automationnotebook.com

Table of Contents

New Product Focus

what's new

Motors and Drives

Premium Efficiency Motors

The IronHorse™ general purpose AC motor line now includes cast iron three-phase premium efficiency motors available in horsepower ranges from 1 to 200 hp. Motors are available in speeds of 1200, 1800, and 3600 RPM and are electrically reversible.

The three-phase industrial duty T-frame (priced from $155) and TC-frame (priced from $182) TEFC motors feature ribbed cast iron frames to ensure maximum cooling. They are equipped with solid full frame-length cast iron mounting feet, cast iron junction box with rubber gasket and rubber dust cover. Motor sizes 10 hp and lower are equipped with maintenance-free bearings. Larger motors feature NSK/NTN/SKF brand premium quality ball or roller bearings. These premium efficiency motors are CSA, CE, ISO9001 certified. IronHorse premium efficiency motors are ideal for applications such as pumps, material handling, metal and textile processing, and test stands.

Accessories for IronHorse premium efficiency AC motors include C-flange kits, starting at $14, which can be used for C-face mounting of the MTCP T-frame motors. Replacement parts include TEFC fans priced from $22, TEFC fan shrouds starting at $18, and junction boxes priced from $18.

The new IronHorse premium efficiency motors are available for same-day shipping and are backed by a two-year warranty. View the IronHorse general purpose premium efficiency motors at:
www.automationdirect.com/premium-cast-iron.

Premium Efficiency Motors

Line Reactors

AutomationDirect's LR series of input and output line reactors for AC drives are available in sizes from 0.25HP to 300HP and in single-phase (115-230 VAC) and three-phase (230, 460, 575 VAC) models. Designed with universal mounting feet with multiple mounting slots, LR series reactors can replace most reactors using existing mounting holes. Starting at $58, LR series line reactors are backed by a 10-year warranty.

For more information, go to:
www.automationdirect.com/line-reactors.

Class J Fuses

The Edison JHL series of Class J fuses are now part of AutomationDirect's line of circuit protection products. The JHL series 600 VAC/450 VDC fuses combine the performance of high-speed semiconductor fuses and the convenience of Class J branch-circuit fuses in one small package, allowing maximum protection for AC and DC drives and controllers. The extremely fast-acting fuses are also ideal for use with power semiconductor devices which utilize diodes, GTOs, SCRs, or SSRs, as well as electronic motor controllers. Available in one to 600 Amp sizes, the fuses are current limiting and are designed with no intentional time delay to open quickly on overload. The JHL series Class J fuse prices start at $117 for a 10-pack. Fuse blocks start at $16. To see the full line of Edison JHL Class J fuses and fuse blocks, visit:
www.automationdirect.com/drive-fuses.

Premium Efficiency motors

... at AutomationDirect prices!

IRONHORSE

AC *TC-Frame*

AC *T-Frame*

Premium Efficiency motors that pay for themselves...

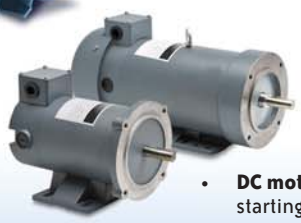
IronHorse™ Premium Efficiency AC electric motors meet the requirements of the Energy Independence and Security Act of 2007. Starting at $155, the MTCP Series gives you a low cost of entry so you get a quicker payback on your investment.

All our Ironhorse motors are in stock and ready for **same-day** shipment; if your order is over $300, you get **free shipping** too!

Also Available

- Single-phase and Three-phase **Rolled steel general purpose motors** up to 2 hp, starting at $78

- **Inverter-duty AC motors** up to 100 hp, starting at $141



- **DC motors** up to 2 hp, starting at $131

Features

- **Meets or exceeds Premium Efficiency standards**
- **T-frame motors from 1 to 200 hp; TC-frame models from 1 to 100 hp**
- **T-frame EPACT motors in 250 and 300 hp also available**
- **1200, 1800 and 3600 rpm, electrically reversible**
- **Ribbed frame design for maximum cooling**
- **Maintenance free bearings (10hp and below)**
- **V-ring shaft seals on drive end and on opposite drive end**
- **Class F insulation**
- **Class I, Div 2 hazardous locations**
- **cCSAus certified, CE**
- **Two-year warranty**

www.automationdirect.com/motors

www.automationdirect.com

Go online or call to get complete information, request your free catalog, or place an order.

1-800-633-0405

Order Today, Ships Today!*

* See our website for details and restrictions.

VOTED #1 Best in SERVICE 11 YEARS 2001 - 2011

AUTOMATIONDIRECT.com

the #1 value in automation

Product Snapshots

Press Releases

Industrial Ethernet Unmanaged Switches

Stride™ Ethernet products include industrial-grade unmanaged Ethernet switches and media converters. All models feature multiple 10/100BaseT RJ45 Ethernet ports, while several also include an ST type fiber optic connection. Recently added are units with an SC fiber optic connector. Plastic case models are designed for standard temperature range (-10 to +60 °C) while aluminum case models are designed for a wider temperature range (-40 to +85 °C). These DIN rail-mountable true plug-and-play devices automatically determine and remember devices connected to each port and only route messages through the appropriate ports, increasing speed and bandwidth. Prices start at $99. Learn more at: www.automationdirect.com/ethernet-switches.

24 VDC Temperature Controllers

SOLO 24 VDC powered process/temperature controllers are powerful process tools offering flexibility and simplicity. Available in four standard DIN sizes, these single-loop units are

equipped with a dual four-digit, seven-segment display, and offer dual output control, making them ideal for managing heating and cooling processes. The built-in autotune function with PID control feature allows for fast and easy startups. Flexible control modes include PID, Ramp/Soak, ON/OFF and Manual operation. Prices start at $89. Learn more at: www.automationdirect.com/temp-controllers.

Multi-Wire Connectors

The ZIPport™ product line now includes standard series multi-wire connectors. The heavy duty connectors are designed to maintain reliable electrical connections while providing protection against dirt, moisture and mechanical stress common in industrial environments.

Available in five frame sizes (3A, 6B, 10B, 16B and 24B), heavy-duty metal housings are constructed of polyester powder coated die-cast aluminum alloy. Self-extinguishing thermoplastic housings are also available in the 3A frame size. Connector hoods are available with top entry and side entry cable passages. All housings are available in a standard profile; several are offered with a high construction profile to allow more room for wiring higher density inserts. All housings feature Pg threaded cable passages; optional Pg thread to NPT adapters are available. A single or double lever locking system assures coupling stability and protection against accidental opening.

ZIPport multi-wire connectors require one male and one female insert. The inserts, suitable for use with alternating (AC) or direct current (DC), are available in multiple pole configurations from 3 poles plus ground up to 108 poles plus ground and with termination sizes ranging from 14 to 5 AWG; units are rated for 10 to 80 amps. ZIPport inserts are made of UL 94 V-0 rated self-extinguishing thermoplastic resin rated at a maximum temperature of 125°C (257°F). The inserts are available in screw terminal and crimp style contact block connections. The contacts are copper alloy with hard silver plating. The plastic insulators are numbered on both sides by laser printing or molding in accordance with EN 60068-2-70.
A wide variety of accessories includes NPT adapters, cable glands, DIN-rail mounting kits, plugs and crimp tools.

The full line of ZIPport standard multi-wire connectors can be seen at: www.automationdirect.com/multi-wire-connectors.

Heavy-Duty Pneumatic Air Cylinders

NITRA™ pneumatic products now include D-Series heavy-duty air cylinders ideal for applications where abusive conditions are a concern.
NITRA D-series heavy-duty pneumatic air cylinders are interchangeable with other popular brands of NFPA cylinders. The heavy-duty double-acting

cylinders are constructed with high quality aluminum components, including a magnetic piston fitted with a PTFE wear band. The magnetic piston can be used along with solid-state or reed switches for rod position sensing. The cylinders are also fitted with a Teflon-impregnated and hardcoat anodized heavy–duty external rod bearing to ensure smooth rod motion while maintaining rod rigidity and stability.
With a maximum operating pressure of 250 psi, this series includes bore sizes from 1 ½ inch up to 4 inches; depending on bore size, available stroke lengths range from one inch to 24 inches.
Optional flange attachments, as well as nuts and rod clevises, are available. Prices for NITRA D-series NFPA air cylinders start at $95.50.

The complete line of NITRA pneumatic NFPA air cylinders can be seen by visiting: **www.automationdirect.com/air-cylinders-NFPA**.

Compact Limit Switches

The AEM2G series compact limit switches feature 35 mm wide die-cast housings and are equipped with one normally-open and one normally-closed contact; all units include a three-meter cable. The IP67-rated series utilizes standard 25 mm hole spacing and a wide variety of head actuators is available. Almost all actuator styles are available in both snap-action and slow-make/slow-break contact versions. Prices for AEM2G series compact limit switches start at $24. Learn more at **www.automationdirect.com/limit-switch**.

Wera Hand Tools

Wera standard, insulated, and miniature screwdrivers in six-piece sets are now available. Screwdriver handles are marked with a screw symbol and the tip size for easy identification. A laser treatment provides a microrough surface on the tip of the blade for less slipping. Also available are bayoneting screwdriver and driver bit sets, as well as torque tools and screwdriver bits. Screwdriver prices start at $28.50 per six-piece set; individual tools start at $3.25. Hex L-keys are also available in nine-piece metric sets and 13-piece standard sets. Wera offers a limited lifetime warranty on all screwdrivers. Driver bits and hex keys have a lifetime warranty against manufacturer's defects.
See the full line of Wera tools at **www.automationdirect.com/screwdrivers**.

Modular Solenoid Valves

NITRA™ pneumatic BVS series modular solenoid valves are body ported, three-port (three-way), two-position poppet valves available in normally-open or normally-closed configurations. Models are available with removable flying leads or 8 mm micro DIN connectors; units are DIN rail mountable when used with BVM series manifolds. Featuring flow coefficients from 0.02 to 0.05, models are available with 12 VDC, 24 VDC or 120 VAC solenoid coils, with LED status indicators and a pushbutton manual operator. Backed by a two-year warranty, NITRA BVS series solenoid valves start at $28.

NITRA pneumatic BVM series modular manifolds simplify the mounting and wiring of BVS series solenoid valves. Available in four and eight-station models with 35mm or quarter-inch tube inlets, the manifolds are made of sturdy glass reinforced thermoplastic with DIN rail mounting clips included. Push-to-connect inlet and outlet connections and a nine-pin D-sub connector allow for quick and easy tubing and wiring. Backed by a two-year warranty, NITRA BVM manifold prices start at $54.

The complete NITRA line can be seen by visiting: **www.automationdirect.com/pneumatic-parts**.

Continued, p. 9>>

Use our tools ...

... and build your panel for less!

We've got what you need to build your control panel, in stock and ready to ship. With direct prices, fast shipping and free tech support, you can count on us for the best value in automation.

Wire Duct

Wire duct and flexible tubing

Wire

MTW, THHN, and TFFN in a variety of colors

Power

Portable cord, plugs, connectors

Terminal Blocks

Signal and sensor terminal blocks and power distribution blocks

Pushbuttons

Pushbuttons, switches and indicator lights

Enclosures

Over 1,600 Hubbell/Wiegmann enclosures across NEMA 1, 3S, 3R, 4, 4X, 6P, 12, 4/12, and 13 ratings

NEW! Screwdrivers and Torque Tools

Wera, a leading manufacturer of screwdriving tools, is known for their attention to quality, ease of use, and a safety-friendly design. We now carry a wide selection of standard (non-insulated), insulated, and miniature screwdrivers and sets, as well as driver bit sets, hex torque drivers and hex key sets in metric or inch sizes. Individual tools start at just $3.25!

CHECK OUT JUST A FEW PRICES ON TOOLS

Product Description	AutomationDirect Wera Price/Part Number
Standard screwdriver, flat (slotted), 3.15 inch long blade	$3.25 TW-SD-SL-1
Insulated screwdriver, flat (slotted), 1000V rating, 4.92 inch long blade	$8.00 TW-SD-VSL-4
Driver bit set, 6-piece in carrying case with 1/4 inch hex driver adapter, 2 flat and 4 phillips drivers	$34.25 TW-DB-SET-6A
Torque driver, 2.5 to 11.5 in-lb. adjustable setpoint, 1/4 inch hex driver. Bits not included.	$85.50 TW-TD-2-11

AutomationDirect prices are U.S. published prices as of June 2011. Prices subject to change without notice.

For complete information or to order online, visit:
www.automationdirect.com/screwdrivers

www.automationdirect.com

Go online or call to get complete information, request your free catalog, or place an order.

1-800-633-0405

Order Today, Ships Today!*

* See our Web site for details and restrictions.

VOTED #1 Best in SERVICE 11 YEARS 2001 - 2011

AUTOMATIONDIRECT.com

the #1 value in automation

Product Snapshots Cont.

Press Releases

Continued from, p. 7

Modbus Gateway Communications Module

The MB-GATEWAY is a single port Modbus Gateway module which converts Modbus TCP to Modbus RTU. The gateway module features an automatic read function and is equipped with one RJ45 10/100 Mbps Ethernet port and one RS-422/485 2 or 4-wire serial port. It supports up to 12Modbus TCP Client (master) Ethernet connections and up to 128 RTU Server (slave) serial connections. The gateway module is 35mm DIN-rail mountable and supports NetEdit or Web browser configuration tools. The MB-GATEWAY communications module is priced at $185. More information is available at: www.automationdirect.com/modbus-gateway.

Basic Sensors

Two series of low-cost high-performance sensors have been added. The FB series M18 plastic DC photoelectric sensors are 18mm sensors in diffuse, polarized reflective and through-beam models with sensing distances ranging from 70mm to eight meters. All models feature M12 quick-disconnects and are available in NPN and PNP output logic configurations. FB series photoelectric sensors are priced starting at $21.50.

Also added are the PB series inductive DC proximity sensors. Twelve models are available in 12mm, 18mm and 30mm sizes, with shielded and

unshielded housings and sensing ranges of 2mm to 15mm. Fitted with M12 quick-disconnects, the nickel-plated brass sensors are IP67 rated and feature either NPN or PNP logic outputs. PB series sensors prices start at $13.50.

To see the complete line of sensors, visit www.automationdirect.com/sensors.

ProSense™ Pressure and Temperature Transmitters

The ProSense line of pressure sensors and temperature transmitters now includes IP68/IP69K-rated 5,000 psi pressure transmitters available in zero to 10V and 4 to 20mA output models. Offering higher operating and burst pressures, the transmitters are ideal for use in applications such as hydraulic systems, paintball changing systems, biotechnology and more. ProSense PTD25 series pressure transmitter prices start at $97.

New TTD temperature transmitters, for use with RTD probes, are available in three temperature ranges. Equipped with M12 quick-disconnects for fast wiring, the transmitters provide a high accuracy two-wire or three-wire 4-20mA signal output. The IP67 rated transmitters convert low-level RTD temperature probe output signals to high-level analog signals, making them more appropriate for long-distance transmission.

Backed by a three-year warranty, ProSense temperature transmitter prices start at $65.

To see the complete ProSense line, visit: www.automationdirect.com/sensors.

ZIPLink cables and modules

ZIPLink connection systems eliminate the normally tedious process of wiring between devices by utilizing prewired cables and DIN rail mount connector modules. ZIPLink cables reduce the time to wire Productivity3000 PAC, *Direct*LOGIC and CLICK PLC I/O modules to terminal blocks and third party devices. For additional application solutions, new cables include prewired connections for AutomationDirect's motion and drive products to complete communications control networks. Prices start at $19 for feedthrough connector modules and $5 for associated connection cables. View the full line of ZIPLinks at www.automationdirect.com/ziplinks.

Feature Story
Trends in Automation

Internet Use Clicks with Machine, Robot Builders

By Jack Smith

Machine and robot builders are increasingly turning to the Internet for product research.

The Internet has become a legitimate avenue for researching automation products needed by machine and robot builders, and the use of vendor websites is emerging as the primary method for doing product research.

Control Design magazine began asking its readers about their product research and buying preferences in 2006. The results of the annual survey appear in the magazine (and online)—highlighting product research trends, issues and occasional surprises.

In 2007, the magazine began including questions about use of videos, podcasts, blogs, and webcasts. This year, the magazine asked about social media as an information delivery tool. The respondent demographics for this year's survey are listed in (*Table 1*).

Demographics

Respondent industries	
Assembly	8%
Electronics pick and place	3%
Heavy equipment	8%
Machining centers	3%
Material handling/transport systems	7%
Metalworking	8%
One-off, custom	13%
Packaging	9%
Paper industry	2%
Plastics/thermoforming	3%
Printing and converting	4%
Rolling mills	2%
Semiconductor tools	4%
System integration	17%
Textile	2%
Utilities equipment	3%
Woodworking	2%
Other	5%
Job function	
Control system design/engineering	61%
Company management	20%
Tech support	6%
Research/development	9%
Other	4%

Responses from 250+ study participants

Table 1: Respondent Demographics

Changing preferences

Control Design always asks the study participants about their primary method for doing product research. "For the first time since we began this annual study, the use of vendor websites significantly outpolled the use of local distributors as the single most-preferred product research method," said Joe Feeley, editor-in-chief and author of Control Design's March 2011 cover story, "Sign of the Times." "Meeting directly with the manufacturers' product experts took a significant dip, returning to 2009 levels," added Feeley.

The survey results reveal some differences among the age groups. In response to the question: "What is your primary method to do product research?", the findings were that: "Overall, 33% said searching supplier websites is their primary method," observed Feeley (*Table 2*). "But 44% of the 30-39 year-old group noted that as their primary method, compared with 28% of the 40-49 year-old group and 37% of 50-59ers," said Feeley.

"Speaking/meeting with local distributors (26% overall) was the primary method of 44% of the 40-49ers, but only 24% of the 30-39ers, and 19% of the 50-59ers said it was their primary method," summarized Feeley.

Product Research Preferences

What is your primary method to do product research?	2011	2010	2009	2006
Meet/speak with local distributors	26%	31%	34%	31%
Meet/speak directly with automation suppliers' technical engineers/product managers	25%	33%	25%	15%
Visit suppliers at trade shows	1%	2%	1%	1%
Amend supplier(s) user group conference/event	2%	1%	N/A	N/A
Search independent, non-vendor websites (automation communities, magazine websites)	9%	5%	9%	20%
Search the suppliers' websites	33%	26%	28%	30%
Read trade magazines	4%	3%	3%	2%

Table 2: Product Research Preferences

Technical search using global search engines

You agree or strongly agree that:	2011	2010	2009	2008
The first page (or more) of results contains well-focused hits	78%	76%	82%	82%
A position at the top of the list simply is bought and paid for regardless of its relevance	64%	72%	81%	78%
Too many results are biased, vendor product plugs	61%	70%	69%	68%
Too many results have nothing to do with what I'm looking for	47%	52%	51%	61%
It's a pain to sift through the results, but at this point there's no better web-based research tool	74%	73%	76%	82$
I've gotten better at search strategies and techniques, and that has helped get better results	90%	N/A	N/A	N/A

Table 3: Technical search using global search ngines

Previous surveys show that most respondents use global search engines such as Google when they don't go to a supplier's website first. Recent trends indicate slightly more satisfaction with this method than before (***Table 3***).

"For the first time, less than half the respondents agree with the statement that global search turns up too many outdated results. In 2008, 61% agreed with the statement," Feeley said in the cover story.

"One reason for the overall better search experience is 90% of the respondents agree with the statement that they've gotten better at search strategies and techniques. Also, in 2008, 78% agreed that the results at the top of a search list were probably bought and paid for, regardless of relevance. This year, that sentiment is shared by only 64% of respondents," added Feeley.

Supplier Website Usefulness

Although more machine and robot builders are using supplier websites to do product research, some vendor websites don't make the cut. The Control Design survey asked questions about what makes supplier websites useful, and what makes a website bad.

"First, give me ready access to all pricing information, even if it is only a nominal list," said John Raynes, owner of Raynes Engineering, Torrey, Utah, (**www.re-solar.com**) in the cover story. "I want to know within a minute or two if we're even in the ballpark before spending more time. Second, I want ready access to all relevant product information (datasheets, manuals, etc.) in PDF format."

In the cover story, Feeley said that about 15% of those responding to their open-ended questions about good and bad vendor websites cited having to register as a negative, many calling it a reason to leave and not revisit the site. Many others said they're turned off by "too much marketing stuff before you can find the product info and specs." They also are wary of sites with unsubstantiated product performance claims.

Many of those responding to the Control Design survey want easier, faster access to product pricing and they don't want to jump through hoops to get there. "Don't make me register/login just to browse basic catalog information," Raynes continued in the cover story. "I don't mind giving my name and simple contact info, but creating a login account when I don't know if I'll ever be back is just stupid."

Another annoyance is "elaborate, showy Web animation that slows down the process of getting to the relevant information quickly," noted Feeley.

The State of Supplier Relationships

Meeting with a manufacturer's product expert or local distributors used to be how most machine and robot builders learned about products. However, maintaining distributor relationships is giving way to product pricing.

In its annual survey, Control Design asks questions that gauge the stability and volatility of the relationships between survey participants and suppliers. Survey results show that consistently more than half of the respondents changed suppliers for at least one primary automation component.

Although 55% of the respondents said they made at least one change in the past year, the survey indicates increased stability (***Table 4***). "This is less churn than the 59% we found last year, and the troubling 62% from the 2009 study results," the cover story said. "Although fewer changed suppliers, those that did made changes in more product categories than last year, and comparable to the 2009 churn that was more price-related than anything else."

According to Feeley, "Some 72% of the 20-29 year-old group of participants said they changed a major supplier in the past 12 months, compared with 56% of the 30-39 year-olds and 52% of 50-59 year-olds. The 30-39ers and 50-59ers indicated that they on average changed suppliers in 3+ product categories, while the 40-49ers averaged just over two product category supplier changes."

Product pricing still dominates. "Price still is the biggest change agent, but it declined to 29% from 33% in 2010, and 38% in 2009, during the economic meltdown when cost-cutting pressures were even more rampant than

Continued, p. 12>>

Feature Story Cont.

Trends in Automation

Continued from, p. 11

Changes in Suppliers

Did you change your primary supplier for these types of control and automation components in the past year?

Yes? Which Ones?	2011	2010	2009
Controllers	47%	27%	40%
Machine safety components	45%	23%	32%
Motors/drives	45%	29%	44%
Sensors/measurement	42%	31%	43%
Operator interface/HMI	40%	26%	17%
I/O	39%	16%	35%
Mechanical components	31%	29%	16%
Why?	**2011**	**2010**	**2009**
Price	29%	33%	38%
Quality/performance	24%	29%	29%
Discontinued product line	12%	14%	9%
Poor after-sales support	12%	14%	9%
Wanted open-standards architecture	14%	11%	9%
Architecture	8%	5%	6%
Hard to contact/get info/help	7%	4%	6%
Old supplier merged/was bought by another company	5%	5%	4%

Table 4: Changes in suppliers

usual. Poor quality/performance was noted by fewer (24%) responders than previously," continued Feeley.

"With some relief from the pricing pressure, we find upticks of poor after-sales support causing users to switch," the Control Design cover story said. "Although only 14% of the respondents say they changed suppliers because of it, that's twice the rate of 2008. After price and quality/performance, 19% of the 40-49ers noted poor after-sales support as their reason to change suppliers, compared with only 7% of the 20-29ers and 9% of the 50-59ers."

Internet Importance Increasing

While searching supplier websites is apparently emerging as the primary product research method for machine and robot builders, vendor sites are not the only information-delivery tools. The Internet continues its evolution by delivering Web-based tools such as webcasts, podcasts, videos, forums and blogs. Emerging social media such as Twitter, Facebook, and LinkedIn are among the latest information avenues included in the Control Design survey (*Table 5*).

According to Feeley's cover story, some of the choices in digital tools show a slowly growing trend. "In 2008, 16% of respondents said they used webcasts occasionally," the Control Design story said. "This year it's 29%—and that's a bump of 6 points compared with 2010, with the biggest support (44%) coming from the 30-39 year-old study participants. Although there's been no change in those who claim more frequent use than monthly, those who say they have never used webcasts for their job dropped to 5% compared with 26% in 2008."

According to the cover story, an open-ended question about which of these delivery vehicles provides the most help made it clear that the participants overwhelmingly prefer an on-demand webcast option. However, it also revealed worries about webcast events—whether live or on demand—being just a product fluff piece keep many of the respondents from trying them out.

In the cover story, the thoughts of many of the survey's responders are summarized by the comments of one of the participants: "Webcasts are good, but they take a long time, they're usually biased towards a certain vendor, and they often trigger a flood of junk email after you register for one. Forums and bulletin boards are often outdated and not moderated, so there's a lot of bad information out there from self-proclaimed 'experts.' We're not allowed to use Twitter/Facebook/LinkedIn on the company network. Technical information/videos/manuals from the manufacturers and vendors are usually the most current, relevant sources of information."

Emerging social media has been slow to catch on as an information delivery tool. According to the Control Design cover story, almost 80% of the respondents don't use Twitter for any purpose, and only 3% report occasional or more frequent use.

Feeley's article said that Facebook shows similar results, except three in 10 do say they have Facebook activities outside of their jobs. "As more companies raise their visibility via Facebook, perhaps we'll see an increase in job-related activity moving forward more quickly than the other digital tool options have. It's only among the less-than-40-year-old respondents that we find any (12%) weekly job-related Facebook use," the article said.

How Respondents Value Web-based Methods of Information Delivery

	Use often (weekly) for job		Use occasionally (monthly) for job		Use rarely (monthly) for job		Never use for job, but use socially		Nope, not even socially	
	2011	2008	2011	2008	2011	2008	2011	2008	2011	2008
Webcasts	5%	5%	29%	16%	45%	38%	5%	26%	17%	15%
MP3s/podcast (interview vendors)	0%	2%	12%	5%	47%	25%	4%	46%	37%	22%
Videos from/about vendors/products (interview machine builders)	2%	2%	8%	4%	46%	21%	5%	51%	39%	22%
Videos from/about vendors/products	2%	3%	36%	20%	49%	49%	5%	19%	10%	10%
Video interview of machine builders showing automation on machine	1%	3%	35%	8%	46%	34%	5%	42%	13%	13%
Forums/bulletin boards	15%	14%	32%	41%	32%	29%	6%	11%	15%	4%
Blogs	4%	7%	18%	19%	38%	30%	11%	29%	29%	15%
Twitter	1%		2%		6%		11%		79%	
Facebook	1%		2%		5%		30%		62%	
LinkedIn	4%		14%		18%		17%		47%	
Virtual trade shows	0%		11%		40%		3%		46%	

Table 5: How Respondents Value Web-based Methods of Information Delivery

However, there's evidence that companies are using social media to reach out to current and potential customers. "As an electrical and controls engineering consulting firm, social media allowed us to reach out to clients locally, and prospective clients outside our usual territory of the Pacific Northwest," says Josh Sherman of Trindera Engineering (www.trindera.com), Coeur d'Alene, Idaho, in the cover story.

"Our company shares current projects, services, presentations, photographs, and fliers on Facebook, Twitter, and LinkedIn. Followers view our posts and comment that they weren't aware Trindera worked on a certain project or provided a certain service, and new teaming arrangements are born," added Sherman.

According to the Control Design story, Sherman noted that Trindera attempts to help educate its followers using social media for upcoming presentations, lessons learned, technical tips, and promoting seminars such as Arc Flash or others that it hosts.

"Lessons learned, tips for contractors on our projects, and customer appreciations are all key factors in what we try to do using Facebook," he said. "Twitter, we use as a tool to reach out to fans, letting them know what we are doing and what we can do for them, as well as sharing information in a real-time method," concluded Sherman.

Although 90% of respondents don't use podcasts—even occasionally—the frequency of use among those who do has doubled since 2008. "Those who stated no use at all plummeted from about half the respondents in 2008 to around 5% this year," the cover story said.

The jury is still out regarding blogs. According to the cover story, blog use is age-dependent, while the four-year trend remains mixed. "Although this group of respondents still makes little regular use of them, the group that says it uses blogs at least once or twice a year has grown to nearly 40% from 30% in 2008, mostly drawing recruits from the group that said they never used to use blogs for their jobs. The 'never' group stands now at 11%, a significant change from 29% in 2008. Only 6% of the 50-59ers use blogs occasionally or more, compared with 32% of 40-49ers and 42% of the 30-39ers," said Feeley's in the cover story.

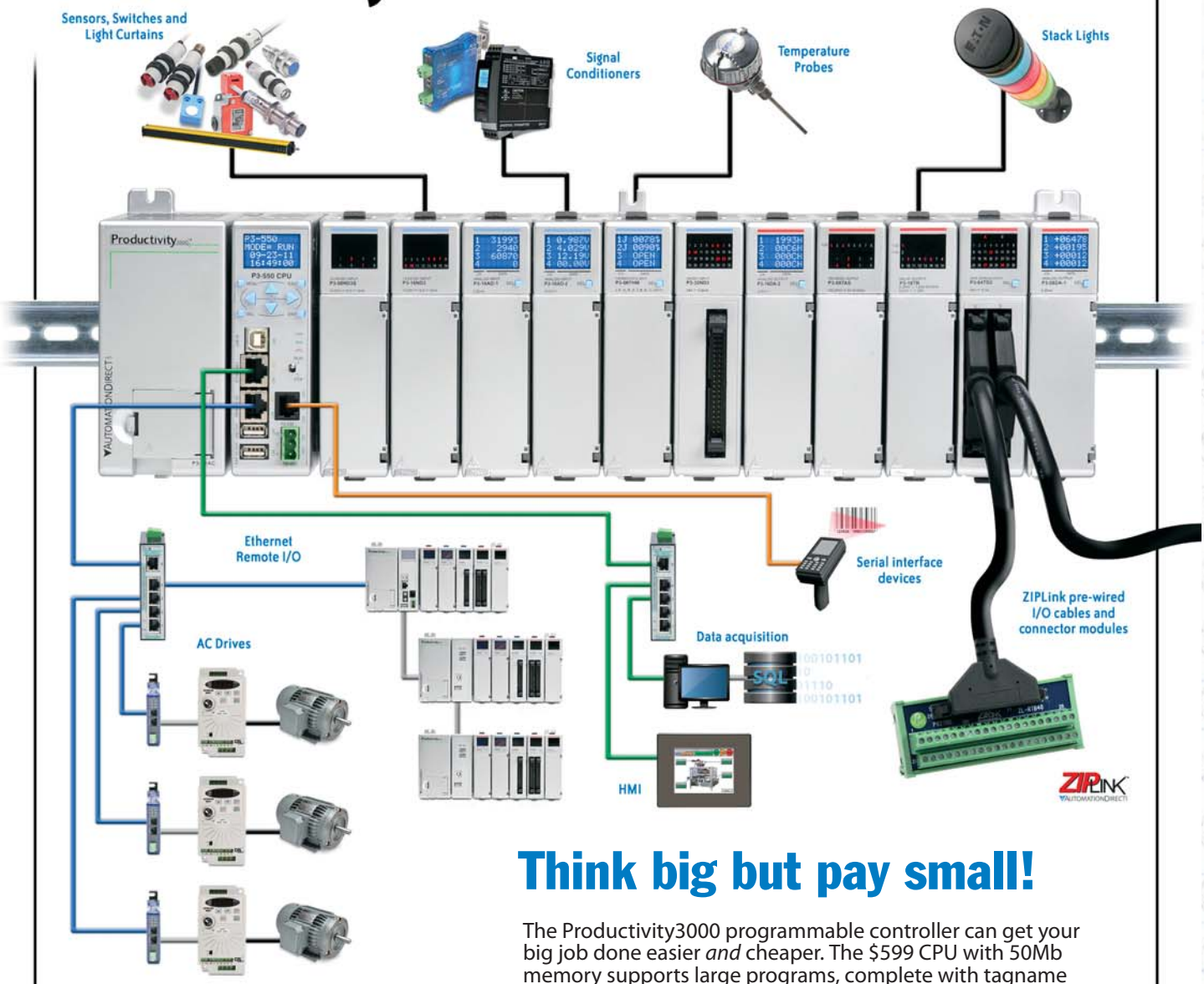
According to the story, product videos and machine automation videos have a long way to go before they'll be considered a mainstream tool for this audience, but use at an occasional level has grown to more than one in three, compared with about one in seven in 2008.

Article originally published as the Control Design magazine, March 2011 issue cover story

TECHNOLOGY THAT MAKES YOUR JOB EASIER

more

Of what you want in a controller



Think big but pay small!

The Productivity3000 programmable controller can get your big job done easier *and* cheaper. The $599 CPU with 50Mb memory supports large programs, complete with tagname database and program documentation stored onboard. The huge (100,000+) I/O capacity gives you plenty of room to plan and expand. And the CPU's seven communication ports make integrating a large system easier than you can imagine.

Download the free programming software and check it out!

- **USB local I/O expansion port -** supports up to four additional local I/O bases
- **Ethernet remote I/O expansion port -** supports 32 remote I/O racks and up to 64 GS series AC drives
- **High-speed Ethernet port for network of HMI** (up to 32 C-more panels)**, other controllers, and enterprise system communications**
- **Two serial ports for peripheral device interface or simple controller networking**
- **USB port for data logging to removable drive, and project transfer**

Read more, watch free videos, and download the FREE software at:

www.productivity3000.com

AUTOMATIONDIRECT.com

VOTED #1 Best in SERVICE 11 YEARS 2001 - 2011

PERFORMANCE + VALUE = PRODUCTIVITY

System Integrator Corner

Control Solutions

By Tim Roberts,
AutomationDirect

SIDIRECT
AUTOMATIONDIRECT

IAS (Industrial Automation Specialists) began in a small rented office in Newport News, Virginia back in 1992. Since then, owner Kathy Burton and Vice President of Operations Preston Burton have built a reputation for accomplishing the impossible. With the motto, "There is always a way," IAS Corp. continues to grow and now operates out of a 15,000 square foot full service facility in the NASA / Langley Research and Development Park in Hampton, VA. Additional fully equipped machine shop locations in Chester, Virginia, and in Houston and Humble, Texas offer custom-built machines, automation systems, and quality control equipment in use world-wide.

A member of AutomationDirect's SIDirect Program, IAS Corp. offers time and money-saving mechanical and automated solutions from giant wind turbines to microscopic vision testing systems.

As a custom machine builder, IAS Corp. fits machines to customers' exact needs. In many cases, new equipment is not needed. Instead, the best solution may already be on the floor of the customer's facility. IAS Corp. has the engineers, technicians, and in-house resources to retrofit outdated machines with custom controls, making old machines new again.

IAS Corp. has more than 30 years combined engineering expertise, providing a solid track record for developing innovative machines, practical tools and software applications, saving clients time and money.

IAS Corp. also specializes in automation and efficiency systems. IAS Corp. builds systems that make industrial applications easier to operate, more efficient, and offer a greater return on investment. Services offered include:

- Electrical components and installation
- Pneumatic components and installation
- Electrical and Pneumatic schematics
- Assembly Machines and Lines
- C++ Programming
- *Direct*LOGIC PLC Programming
- Integration into existing equipment
- Operator training and manual
- Remote monitoring

The combined practical experience of the IAS Corp. team of engineers and technicians enables quick solutions to complex electrical, mechanical, chemical, and software issues, from which others have walked away.

For your next industrial automation control solution, contact IAS Corp. directly:

IAS Corp.
Industrial Automation Specialists
800.916.4272 757.766.7520

IAS Corp.
17 Research Drive
Hampton, VA 23666
Phone: 757-766-7520
Contact: Dave Wallace
E-mail: **dwallace@iascorp.net**
Web: **www.iascorp.net**

"We are here on Earth to do good to others. What the others are here for, I don't know."

– W. H. Auden (1907–1973)

User Solutions

creative control solution

Small-Scale Hydroelectric Plant Promises Profit

By Joel Froese

If there's access to a stream, the only requirements to generate electricity are a 2 ft. drop in water level and two gallons of flow per minute. A hydroelectric system isn't overly complicated, it isn't difficult to operate and maintain, it has longevity and it's often more cost-effective than other forms of renewable power.

Some experts say a successful micro hydroelectric plant will pay for itself in 15 years. At Red Bank Hydro in West Columbia, South Carolina, we implemented our own micro hydro system and expect to see a complete return on the investment after only eight years. After that, it will be money in the bank.

Although we'd never built such a system before, we were able to do so by using low-cost components and free technical support, both supplied by AutomationDirect.

Building a Hydroelectric Plant

The land is situated near the dam of a 64-acre communal lake, allowing access to the 10 ft. height differential between the lake and the tail water on the other side of the dam.

The amount of water flows over the spillway at an average of 40 cubic feet of water per second, making it a marginally feasible hydroelectric project.

Excavation began on March 4, 2004. By the end of 2006, the underwater portions of the plant had been built, a four-foot aluminum pipe through the back of the dam was in place, the dam was restored, and the temporary cofferdam was removed.

On December 2, 2006, a refurbished 50 horsepower Francis turbine was purchased and installed. The turbine was tested and it was determined that the optimal speed would be 150 rpm. The next step was sizing the electrical generation equipment and designing the automation system.

Designing the Automation System

The hydroelectric system is powered by water draining from the lake and through a turbine which drives three generators via a belt and pulley system. The generators are actually three 15hp single-phase induction motors.

When an induction motor is driven at greater than normal speed, it generates electricity. Output from the three motors was tied into the local electric grid via the same transformer that formerly only provided power to the property. The utility's meter now turns backwards when the plant is supplying more power than consumed by the home and office.

The turbine has an integral control gate that is used to adjust how much water flows through, from 0 to 100%. This control gate was designed to be opened and closed by a 12-inch double-acting hydraulic cylinder, so the first piece of automation equipment installed was a 24 VDC hydraulic reversible pump to operate the gate.

We realized that as a grid-tied induction-based generation system, the generator/motors would freewheel if the excitation current from the grid was lost. We therefore needed to be able to automatically shut down our hydro plant in case of a grid power failure.

When a shutdown signal from the control panel or a fault condition occurs, the shutdown procedure is simply to run the pump in the "close" direction for 60 seconds and to open the contactor to the generators. The hydraulic pump has a built-in pressure relief valve that allows it to safely run a minute or two after maximum extension or retraction of the cylinder.

It was crucial that the system also monitor rpm and shut down based on either over-speed (caused by a disengaged generator or broken belt) or under-speed (insufficient power generation) conditions, so it was time to purchase and install a controller.

I decided a *Direct*LOGIC 05 Micro Brick PLC would be sufficient for this purpose. I placed our first order with AutomationDirect for the PLC, a proximity sensor to count shaft revolutions, a NEMA 1 enclosure, and various pushbuttons, terminals, DIN rail and

Figure 1: Micro hydroelectric plant

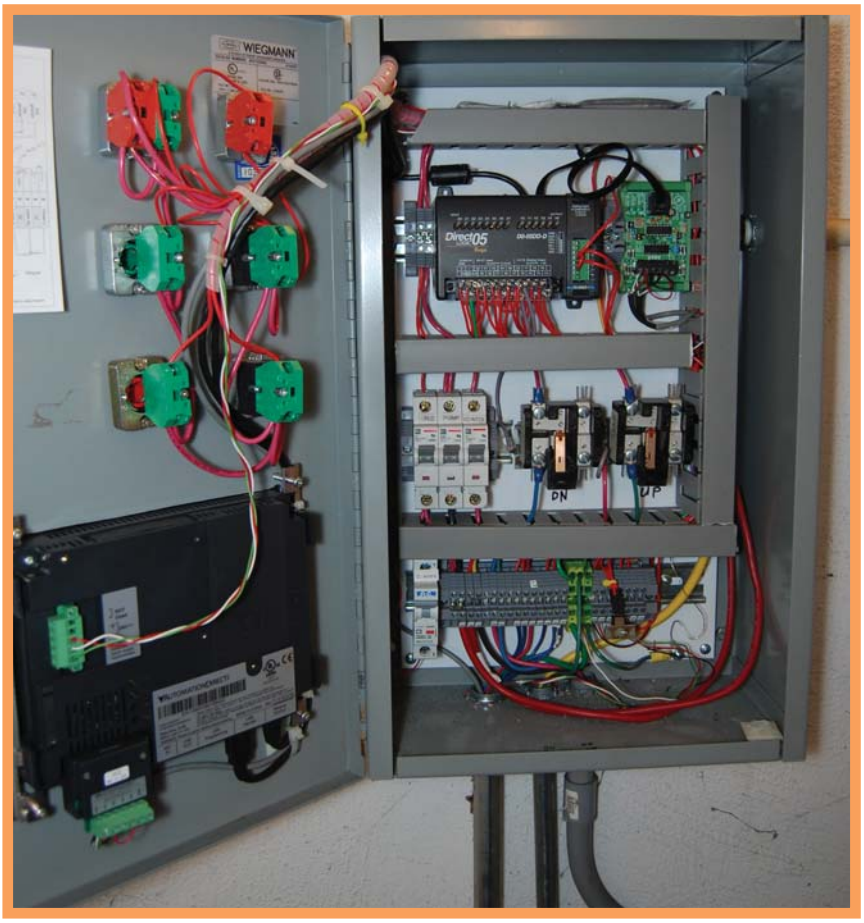


Figure 2: Micro hydroelectric plant control cabinet utilizing AutomationDirect components including a *C-more* Operator Interface Panel and a DL05 Micro brick PLC.

Figure 3: Turbine uses pulleys and belt drives to operate three electric motors.

wire ducting. After a couple of weeks of learning ladder logic, I began to install the basic automation system.

A local bearing distributor determined what belts, sheaves and shafts were needed to transfer rotation of the turbine to the three induction motors. In early February 2008, the first kilowatts of power were generated.

Using only the demo version of the *Direct*SOFT 5 programming software, which limited me to 100 instructions, I programmed the DL05 for the following operations:

- an always-running "monitoring" stage that counts revolutions and calculates rpm
- a startup stage that activates upon pushing the startup button, opens the turbine, and engages the motors at the prescribed RPM
- a shutdown stage which fully closes the turbine and disengages the motors.

The shutdown stage was triggered by any one of three conditions: the shutdown button being pushed, an auxiliary contact on the motor contactors opening (meaning ac control power was interrupted), or RPM out of normal operating range.

Making, Measuring and Monitoring Power

In May 2008, we signed an interconnection agreement with Mid-Carolina Electric Cooperative (MCEC) and its supplier, Central Electric Power (CEP). In June 2008 we began feeding power into the grid.

Throughout the summer, we started and shut down the plant manually, taking into account the lake level and the utility time-of-use tariffs.

The utility paid us nearly twice as much for power generated during the peak demand summer hours from noon until 10pm, a financial incentive that remains to this day.

Later that summer, we bought and installed a submersible water level sensor to monitor the lake level. This

Continued, p. 20>>

Tech Thread

Stepper Systems

"Starting With Steppers" (Part one of a two-part series)

By Tom Elavsky, AutomationDirect

You've determined that an open-loop motion control system will handle the accuracy and requirements of your application and therefore you have chosen to use a *Sure*Step Stepping System. The following is a complete reference to the technical information available at this time from AutomationDirect which can aid you in understanding and selecting components and determining the best method for controlling your system.

Stepping System Components and Control Methods

The *Sure*Step Stepping System includes:

- One DIP-switch configurable microstepper drive
- Two software configurable advanced microstepper drives
- Four step motor power supplies
- Nine stepper motors (NEMA 17, 23, 34 frame sizes)
- Two stepper motor extension cables
- FREE stepper configuration software for advanced drives

As a starting point, you can review the five-page overview on *Sure*Step Stepping Systems on AutomationDirect's Web site at: **http://bit.ly/rscNQR**.

The overview includes discussions on microstepping, motor speed, torque, performance, and details the steps for selecting a motor, drive, power cable, and properly sized power supply.

Additional information is available in the *Sure*Step Stepping Systems User Manual, p/n STP-SYS-M-WO, which can be viewed or downloaded at: **http://bit.ly/r5dgUO.**

The user manual contains detailed specifications on the microstepping drives, stepper motors, cables, power supplies, configuration software, and wiring. Appendix A will walk you through typical applications by defining useful relationships and equations. Appendix A also covers how many pulses are required for a given move, how to calculate speeds, determine required motor torque, etc. Lead screw, belt drive and index table applications are included with example calculations. Refer to Appendix B for information on using *Sure*Step with ***Direct***LOGIC PLCs.

Quick reference data sheets for the microstepper drives, motors, cables and power supplies is available at:

- Microstepping Drive (p/n STP-DRV-4035): **http://bit.ly/oh9MiI**
- Advanced Microstepping Drives (p/ns STP-DRV-4850 & STP-DRV-80100): **http://bit.ly/oCa1P2**
- Bipolar Step Motors (p/ns STP-MTR-17040, 17048, 23055, 23079, 34066, STP-MTRH-23079, 34067, 34097, 34127, and Motor Extension Cables, p/n STP-EXT-020, STP-EXTH-020): **http://bit.ly/rhEcyt**
- Stepping System Power Supplies (p/ns STP-PWR-3204, 4805, 4810, 7005): **http://bit.ly/oRYdXe**

Once you have the components for your stepping system, you will need a way to tell the microstepping drive what to do. Currently there are two control methods available. The first uses pulse and direction signals from PLCs with built-in high speed pulse outputs, or using a high speed counter interface module specific to certain PLCs. The second method uses ASCII commands via a serial communications connection that is a feature of the advanced microstepping drives. See ***Diagram 1*** (Page 21) for the choices available among AutomationDirect PLCs and specialty modules to any one of the microstepping drives.

There is also a two-page technical specification in the AutomationDirect catalog titled "Controller Compatibility" that details functions and features when using a *Sure*Step Stepping System with ***Direct***LOGIC PLCs and high-speed specialty modules. The specification is available at: **http://bit.ly/oRYdXe**

Please keep in mind that although most of the following control solutions can be used for multiple stepping systems from one PLC or controller, the ability to perform coordinated moves between multiple stepping drives, as might be found in a Computer Numerical Control (CNC) machine, is not supported.

The *Sure*Step Stepping System can also be controlled from sources other than PLCs. In general, a device with the ability to produce 5 volt TTL level sinking or sourcing outputs (or with the addition of resistors, 12 to 24 VDC signals), or differential output signals, can be used as step inputs for either pulse/direction, clockwise/counter clockwise, or quadrature control of all three stepper drives. With the advanced microstepping drives, another choice could be a device that can produce ASCII data via RS-232 serial communications (in the form of the Serial Command Language (SCL) command packets) for controlling the stepping system motion.

Pulse/Direction Control

The pulse and direction signals method is usable with both the DIP-switch configurable microstepper drive, p/n STP-DRV-4035, and the advanced software configurable microstepper drives, p/n STP-DRV-4850 and STP-DRV-80100.

Currently there are three hardware solutions available from AutomationDirect that can produce the pulse and direction signals. The first is a built-in capability on ***Direct***LOGIC micro PLCs referred to as the High-Speed Input and Pulse Output feature (for this discussion referred to as Mode 30 Built-in Pulse/Direction Control).

Mode 30 is also available for the *Direct*LOGIC DL205 CPUs that do not have the built-in capability by using a Counter Interface Module (D2-CTRINT) inserted into a slot of the DL205 base. We'll refer to this solution as Mode 30 D2-CTRINT Pulse/ Direction Control. The third solution is the use of a specialty module that can be plugged into an open slot in a PLC's base. These modules, provided by Host Engineering, are referred to as High-Speed Counter I/O Modules (Hx-CTRIO). For our reference we will refer to this as CTRIO Pulse/ Direction Control.

1) Mode 30 Built-in Pulse/Direction Control

The *Direct*LOGIC DL05, DL06 and DL105 micro PLCs have a built-in feature referred to as High-Speed Input and Pulse Output. The high-speed input feature is available on the PLC models with DC inputs, while the high-speed pulse output is available on models with DC outputs. The number of high-speed inputs varies with the particular PLC, while all three PLC series mentioned have two high-speed outputs. There are several modes of operation available for the inputs and outputs, designated as Modes 10, 20, 30, 40, 50 and 60. The majority are for the inputs that allow high-speed counting, encoder input, interrupts, pulse catching and filtering. Mode 30 is reserved for high-speed pulse output that will control the *Sure*Step Stepping System. Mode 30 is the normal function used to control direction, speed and profiles for pulses going to the stepping motor drives. Only one high-speed I/O mode can be in use at one time.

For an example of using the built-in high-speed I/O features, refer to Appendix E of the DL06 PLC User Manual:

http://bit.ly/p4cE8p

Appendix E provides programming examples for creating motion velocity profiles, trapezoidal profiles, velocity control, and home search. Also covered are methods for programming acceleration and deceleration values, position and velocity target values.

User manuals for the DL05 and DL105 micro PLCs that include similar details for their built-in high-speed I/O features is available at:

http://bit.ly/nEOlPQ

2) Mode 30 D2-CTRINT Pulse/Direction Control

A Counter Interface Module (D2-CTRINT) can be used in systems with the DirectLOGIC D2-240, D2-250-1 and D2-260 CPU modules only. The user manual for the D2-CTRINT is available at: **http://bit.ly/qZV1zm**

The D2-CTRINT has the same abilities as the built-in high-speed I/O feature found on the *Direct*LOGIC micro PLCs, but in the form of a plug-in module. The D2-CTRINT must be installed in slot 0 (next to the CPU); therefore only one D2-CTRINT module can be used per DL205 PLC system. Mode 30 is used with the D2-CTRINT through ladder logic programming to set up and configure profiles for controlling the *Sure*Step Stepping System.

3) CTRIO Pulse/Direction Control

Another option to produce pulse/direction signals that allows greater flexibility in controlling a *Sure*Step Stepping System is to use one of AutomationDirect's High-Speed Counter Modules. These are available for use with DL05 and DL06, DL205, and DL405 PLCs, as well as Terminator Field I/O. The part numbers for these modules include H0-CTRIO, H2-CTRIO, H4-CTRIO and T1H-CTRIO. The user manual covering all CTRIO modules is available at:

http://bit.ly/pn6Gau

The CTRIO module is set up and configured using the CTRIO Workbench software utility that can be installed during the installation of *Direct*SOFT programming software.

Additional information and the latest firmware updates are available from Host Engineering's Website:

http://www.hosteng.com/

Firmware upgrades are done through the CTRIO Workbench software utility.

The total number of CTRIO modules that can reside in a system depends on the particular PLC model or control system. The two-page Controller Compatibility Specification mentioned earlier gives detailed information on the total number of modules that can be used in various control schemes.

For example, the DL05 family, with only one expansion slot, can only have one CTRIO module installed, while the DL06 with its four expansion slots can accept up to four CTRIO modules.

With a DL205 system, the H2-CTRIO module plugs into any I/O slot of any base (except slot 0) when using a *Direct*LOGIC CPU, WinPLC or H2-PBC I/O controller. Slot 0 is available for the H2-CTRIO module when using the H2-EBC Ethernet Remote I/O Base Controller. (Slot 0 is the I/O slot adjacent to the CPU). The H2-CTRIO cannot be used in DL205 local expansion bases or in serial remote I/O bases.

The H2-CTRIO (DL205) and T1H-CTRIO (Terminator I/O) modules can also be used to control the *Sure*Step Stepping System in PC-based control systems with Think & Do software, or with theWinPLC/Think & Do module inserted into the CPU slot of a DL205 base.

(Please note that the T1H-CTRIO is only supported by the T1H-EBC, T1H-EBC100 and T1H-PBC network modules.)

All of the hardware solutions for producing pulse and direction also include features for high speed counting, encoder input, interrupts, pulse catching and filtering, but in most cases only one feature can be used at a time.

"Closing the Loop"

The subject of closing the loop comes up quite often, meaning we get requests to use a stepping system to

Continued, p. 20>>

User Solutions Cont.

creative control solution

Continued from, p. 17

4-20mA device was wired into an AutomationDirect 4-channel analog current input module which we added to the DL-05 PLC. We also bought the full version of *Direct*SOFT 5 software to add needed capacity and programming capabilities.

I was now able to program the system to automatically shut down when the lake level fell below a certain point. I also added an auto-start function that started generation whenever the level rose above the spillway in the dam. Again, this arrangement worked well, but we also needed to know how much power we were producing.

To do that, we purchased an AccuEnergy Acuvim II panel-mounted power meter. By installing the meter and an AutomationDirect RS-232/RS-485 converter, I was now able to poll the power meter over Modbus to determine not only volts and ampsbut also instantaneous kW, cumulative kWh produced, the power factor, frequency and other relevant power parameters.

However, all this time I was only able to see these operating parameters by remotely logging into the computer and looking at the "data view" window of the *Direct*SOFT 5 programming software. I was also able to do some rudimentary remote control such as starting or shutting down the plant, but it certainly wasn't user friendly.

At about this time, AutomationDirect announced that the *C-more* touch panels had IP-based remote operation capability and a built-in Web server. I purchased a *C-more* panel, installed it, and began learning how to program it with the *C-more* programming software. By April 2010, I had four screens of valuable information and graphs that could be accessed not only in the power plant, but also computer via a web browser.

To avoid running an Ethernet connection 100 feet between the power plant and house, I installed an inexpensive Asus WL-220gE portable wireless adapter (powered from a USB port on the *C-more* panel) in the window of the hydro plant building.

AutomationDirect proved to be a valuable asset to this project in many ways. Their easy-to-use Web site has free, comprehensive, and well-written documentation for each item in their catalog, which helped me design the automation system and select the components.

Return on Investment

Depending on rain and how much electricity is used by our home and office, we make between $30 and $300 per month in direct revenue from the power company. This does not include the savings on the power bill, which has gone down from almost $1,000 to around $300 each month.

With the micro hydroelectric plant making about $900/month, this means that in three years, we've recovered about $30,000 of our $70,000 investment. Only five more years are needed to completely pay back the investment.

Beyond the financial benefits, we now have the satisfaction of owning and operating our own hydroelectric power plant, as well as the pride of knowing we're contributing to a sustainable environment.

"I think it's always a good move to listen to that inner voice, if it doesn't lead to a crime."

– Lisa Kudrow

Tech Thread Cont.

stepper systems

Continued from, p. 19

position a device, such as a ball screw linear slide; if the end user needs to confirm slide position, they would like to add an encoder to the ball screw and have the PLC count pulses at the same time the stepping motor is being driven. Although the ability to do this type of control scheme is possible, the programming can get complex, and much depends on the particular application; therefore we strongly recommended that a servo control system be used in these instances.

Part Two of this series will discuss the serial communications control methods and include additional reference document links.

"I have never let my schooling interfere with my education."

– Mark Twain (1835–1910)

"Happiness is having a large, loving, caring, close-knit family in another city."

– George Burns (1896–1996)

Tech Thread Cont.

Stepper Systems

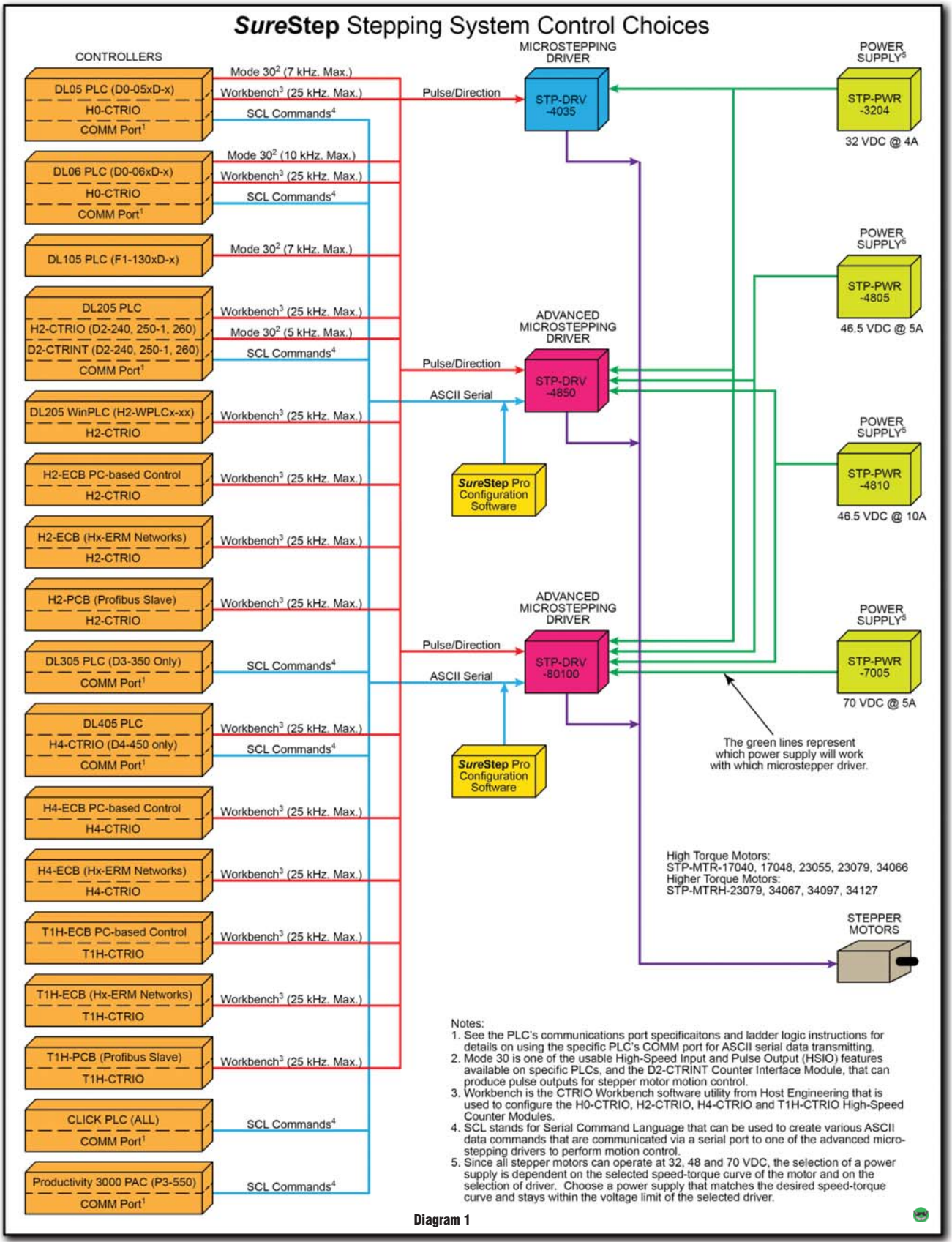


Diagram 1

Product Manager's Corner

Remote HMI

C-more Remote Access for iPhone®, iPad®, and iTouch®

By Greg Philbrook
AutomationDIrect
HMI & Communications Product Manager

In late 2009, AutomationDirect released the Remote Access and Control feature for the *C-more* operator interface product line. This feature allowed users to connect to a *C-more* panel via the Internet and remotely view and control the panel application as if they were on site. The primary objective was to add remote accessibility without requiring customers to purchase more hardware components or software utilities; we accomplished this by making this feature available for all *C-more* panels which support Ethernet. Although *C-more* was not the only operator interface in the market to support this type of feature, AutomationDirect was one of the few companies to develop its own native client/server application specifically designed to make the best use of the performance and project runtime capabilities of the *C-more* panel. The user does not need to purchase, download and install a client software program on their PC. Instead, the user needs only to enter the panel address into most any Windows Internet browser and activate the remote connection.

Remote access and control has quickly become a feature that is used in many different types of applications. However, as the use of mobile devices has increased, so too has the need for more industrial devices to support mobile applications. So it stands to reason that creating an application for the iPhone and iPad became one of our most popular customer requests. It is this demand that led to the development of a dedicated *C-more* Remote HMI application for the iPhone and iPad which AutomationDirect released in July of 2011. This client application allows users to view and

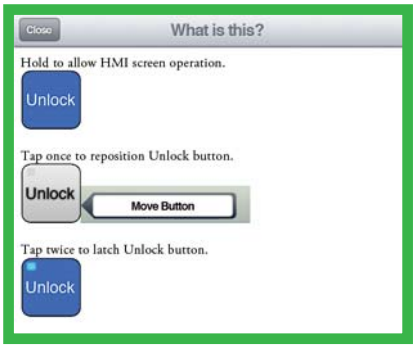
control a *C-more* panel in the same manner that the PC browser version allows, only now they simply download, install and use a dedicated app created for the Apple iOS.

The Remote HMI App allows users to control the machine or process from an iPhone, iPad, or iPod touch as though they are physically in front of the *C-more* Panel (with 'Full Control mode'), or the ability to configure the settings for 'View Only', or 'View and Screen Change Only' for those applications that are more presence sensitive.

The *C-more* Remote Access feature supports the iOS with the *C-more* Remote HMI App for the iPad, iPhone (3G or later), or iPod touch. Users need only to configure the network settings in the panel project and connect the panel to a network.

Key Remote HMI App Features:

Unlock Safety Button



The Unlock Safety Button feature helps reduce unintentional activation of the remote *C-more* panel inputs, such as button and keypad entries. Mobile devices are susceptible to being dropped or the screen being touched by a user unintentionally. When the button is in the "Off State", the *C-more* Remote HMI App workspace tools are active and allow the user to interact with the app menu items, zoom/pan actions, and control all touch interface features. The device functions as an iPhone/iPad/iPod touch in this state.

Zoom

For those users who might be connecting with an iPhone, the zoom feature can be very handy. Connecting to a 15-Inch *C-more* panel is one example. Although the iPhone display is very clear, the viewing area is not very large. Therefore, trying to display the entire screen can be a challenge, but is not impossible. To help resolve this issue, a zoom feature was added to allow users to zoom in on specific objects or areas of the screen for better viewing clarity.

Save Screen

Users may also want to make a record of the screen that is being displayed. For this reason the app was also designed to allow users to capture and save the active screen (at any zoom level) to review, email or print if needed. This comes in handy when there are items such as trend graphs or other critical data points being displayed on the screen.

Multi level User accounts

The Remote HMI App also supports three remote access user accounts which can be configured with unique user names and passwords and stored in the panel project, which allows for multiple levels of access. Other remote access apps do not offer multi level log-in accounts.

Each account allows up to five remote users to be connected simultaneously. This feature offers different types of log-in accounts – "Full Control", "View Only", and "View & Screen Change". The "View & Screen Change" option is specialized for the *C-more* app and is not supported in competitors' apps.

Business Notes

Goings-on in the Industry

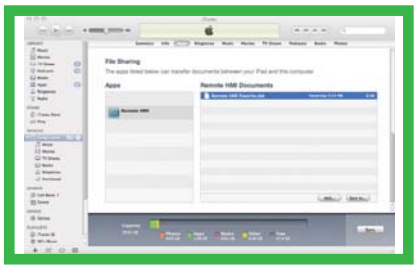
Lockout/Tagout Functionality

Activation or Notification Tags provide an option for each account to have associated user-configurable TAGS that allow the Panel project or PLC project to indicate when a remote user is connected, or to enable or disable the remote access feature. These tags can be used to activate alarms, events or notifications to alert local operators that a remote user is connected. The Disable/Enable TAGS can be assigned to a switch to give local operators the ability to enable or disable the remote access feature for security or safety reasons.

Status Notifications

There are many new possibilities available when the advanced features in the ***C-more*** panel are used. For example, when an alarm or event occurs, the ***C-more*** panel can send an email to managers or maintenance personnel's iPhones or iPads. They can then use the Remote HMI App on the iPhone to connect to and monitor the application or even control the application and make the needed adjustments.

Saving Favorites File



Using iTunes 9.1 or later, you can copy files between your computer and apps on your iOS device which support File Sharing. The Remote HMI App creates a ".dat" file that stores the favorite ***C-more*** panel connection settings created by users. This allows users to copy, save, or move the favorites from one device to another, or create backup files for when an iPhone/iPad may fail or need to be reset. Please refer to iTunes help for more details on file sharing if needed.

The ***C-more*** Remote HMI app is available on the App Store℠ store for only $4.99.

By Joan Welty,
Managing Editor

New PLC tutorial libraries and hardware trainers from ICA

Our favorite PLC trainer Doug Bell continues to add helpful training products to his Online Automation School site on **www.interconnectingautomation.com**. Now you can purchase low-cost CLICK PLC trainers to use in your own training program or in the CLICK PLC training section of ICA's online school. Through November 30th, orders receive free shipping on any of these low-cost trainers. You can also purchase custom-made PLC trainers, built to your specifications, in quantities of four or more, eligible for free imprinting of your brand logo. Visit the Web site to get a no-obligation quote.

Doug currently has educational incentives available. From now through December 31, 2011, registrants for any of Doug's regular scheduled regional courses (for 2011 or 2012) will receive the "PLC Logic and Principals" DVD set ($395 value) at no charge. Also, customers who register for one of Doug's online courses will receive a $100 discount on any regular scheduled in-person courses offered around the country.

Doug recently expanded his online tutorial libraries in the PLC and communications areas. "***Direct***SOFT and ***Direct***LOGIC PLCs 101" is based on the wealth of knowledge Doug imparts in his face-to-face seminars. This in-depth look at ***Direct***SOFT software and the ***Direct***LOGIC PLC series offers more than 60 tutorials which run an average of eight minutes each. Topics include inputs, outputs, programming instructions and more. For students unfamiliar with PLC theory, note that this library includes all the videos from the "Intro to PLCs 101". The ***Direct***LOGIC library is $39.95 for a 30-day unlimited access subscription.

With the new "Networking" library, Doug presents the basics of RS-232, RS422, RS485 and Ethernet communications. These on-demand videos discuss the often difficult-to-master features such as master \ slave, client \ server, IP Addresses and subnet masking. More than 17 segments are available, with unlimited access for 30 days with a paid subscription ($24.95).

Also new are 25 videos added to all CLICK PLC online libraries and courses. These additional videos cover:

Event Drum
Timed Drum
Analog In
Analog Out
Shift Register
Subroutines
Copy instruction

Other libraries available include Productivity3000 controller, ***C-more*** HMI, drives and motors, and data collection.

FIRST Robotics student interns at NASA, works on Mars Rover

Last year in Issue 17's Student Spotlight, we featured a Beverly Hills High School FIRST robotics team that was using the *C-more* touch panel as an interface to the robot. One of the driving forces on the team, Alex Kern, spent last summer in a dream internship (if you're a technofreak!) – testing code for NASA's next-generation Mars Rover, the Curiosity, whose mission deployment is set for late November 2011. Read how Alex spent his summer vacation in this article on the FIRST Web site at **http://bit.ly/rgwhLP**. To read the original Automation Notebook article on Alex and his team, MorTorq, visit **http://bit.ly/pSQoOE**. And for more details on the Mars Rover Curiosity and its mission, and to check the countdown clock, go to: **http://mars.jpl.nasa.gov/** .

Tech Brief

variable frequency drives

Top 10 Tips: Specifying VFDs (Part two of a two-part series)

By Joe Kimbrell,
AutomationDirect
Drives, Motors, and Motion Control
Product Manager

In Part One, we discussed how choosing the right variable frequency drive (VFD) can reduce energy consumption, improve realtime control, and lengthen motor life. Here are more expert tips to consider.

Select the proper control mode

VFD control mode choice greatly depends on the application. The three VFD control modes are volts-per-Hertz (V/Hz), sensorless vector (sometimes called open-loop vector), and closed-loop.

V/Hz-type VFDs use the ratio between voltage and frequency to develop the operating flux to supply operating torque to the motor. Sensorless-vector VFDs have accurate torque control over a wide speed range without having to use encoder feedback. Closed-loop VFDs use encoder feedback to obtain motor speed and slip information.

V/Hz control is adequate for many applications such as fans and pumps. However, for applications that require greater degrees of speed regulation, sensorless vector or closed-loop control types may be necessary. Applications such as paper mills, web printing presses, or material converting require the added speed regulation that closed-loop control provides.

Understand your control profile requirements

Selecting the proper VFD control profiles is critical and depends greatly on the application. Control profiles to consider include acceleration, deceleration, ramp linearity, torque control, braking, and PID. Most of these parameters are available on nearly every VFD type on the market, but PID may not be offered on very basic models.

These parameters are programmable and can be selected using the operator keypad, or by digital communications. Understanding these parameters (and how they affect integration of the VFD into the process) is imperative; to this end, VFD user manuals typically provide the information required to select and program the right control profiles.

Know your communication options

Many VFDs have one or more built-in digital communication interfaces. Even the most economical models typically include a serial interface such as a Modbus RS-232 /RS-485 connection. Ethernet and fieldbus communication are options offered with many VFDs.

A digital communication interface can be used to connect the VFD to other devices that can function as a master device such as a PLC or PC-based controller. The master device can control the VFD with this interface instead of using the discrete and analog I/O. The master can also use this interface to monitor the status of various VFD parameters such as speed, current, and fault status.

An RS-232 connection is somewhat limited as the maximum RS-232 network cable length is 50 feet. Also, the RS-232 interface is one-to-one, allowing connection of one VFD to one controller. An RS-485 network cable can span up to 4,000 feet and allows connection of multiple devices. However, extra adapters may be required to make this type of connection.

An Ethernet interface provides a low-cost, high-performance link between the control system and multiple VFDs. Some VFD Ethernet interfaces are even available with a Web server that allows users to configure and control the VFD from any Web browser. Ethernet protocols such as Modbus TCP/IP and EtherNet/IP take the guesswork out of VFD control over Ethernet and make setup easy for non-IT users.

Don't overlook installation and operating requirements

VFDs generate a significant amount of heat. This heat can cause the internal temperature of an enclosure to exceed the VFD's thermal rating. Enclosure ventilation or cooling may be necessary to keep enclosure temperature within specified limits. Ambient temperature measurements and calculations should also be made to determine the maximum expected temperature.

Operating precautions must also be considered. One should avoid running a standard induction motor at low speed for an extended period of time, as this

Continued, p. 27>>

Control mode comparison

	V/Hz	Sensorless vector	Closed loop
Operating complexity	Low	Moderate	High
Performance	Good	Good	High
Starting torque (typical)	150 to 175%	200%	200%
Speed regulation (typical)	±2%	±1%	±0.2%

VFD Control Modes

Save on energy costs
with AC drives

High-quality AC drives pay for themselves in a hurry

Variable speed drives can improve your bottom line by reducing your application's energy consumption. An investment of as little as $99 can start paying off immediately.

- **GS1 AC drives *(1/4 to 2 hp)* offer simple Volts/Hertz control for general purpose applications. Built-in I/O, Modbus communications capability and programmable preset speeds increase its flexibility.**
- **GS2 AC drives *(0.5 to 10 hp)* feature built-in PID control, dynamic braking and Modbus communications.**
- **DuraPULSE AC drives *(1 to 100 hp)* add sensorless vector control, a removable keypad that stores up to four different application programs, and built-in discrete and analog I/O. Communicate via built-in Modbus or an optional Ethernet connection.**

www.automationdirect.com/drives

Universal line reactors for all

Line reactors improve performance and protection of the AC drive and the motor load as well. They protect against transient overvoltage, reduce harmonics and allow the motor to run cooler. At these prices, it's low-cost insurance for your valuable equipment.

- **0.25 to 300 hp ratings, single or three-phase, work with any manufacturer's AC drives**
- **110V, 230V, 460V, and 575V models**
- **Universal mounting feet with multiple mounting slots; can replace most reactors using existing mounting holes**
- **Use on both input and output (load) side of AC drive for maximum protection**
- **CE marked, cULus listed (E197592), RoHS**
- **10-year warranty**

www.automationdirect.com/line-reactors

High-Speed Class J Fuses

JHL series fuses combine the performance of high-speed semiconductor fuses and the convenience of Class J branch-circuit fuses in one small package, giving you maximum protection for AC and DC drives and controllers.

- **1 to 600A, 600VAC / 450VDC**
- **Space saving design fits readily available Class J fuse blocks, holders, and switches**
- **High-speed interrupting rating: 200,000 RMS Symmetrical Amps; 100,000 DC Amps**
- **Meets UL, CSA, and NEC requirements for branch circuit protection devices**

www.automationdirect.com/drive-fuses

www.automationdirect.com

Go online or call to get complete information, request your free catalog, or place an order.

1-800-633-0405

Order Today, Ships Today!*

* See our Web site for details and restrictions.

VOTED #1 Best in SERVICE 11 YEARS 2001 - 2011

AUTOMATIONDIRECT.com

the #1 value in automation

Just CLICK!

for built-in discrete and analog I/O

Plant Engineering PRODUCT of the YEAR Finalist 2009

Complete PLC starting at $69

Mighty as a stand-alone unit, or expand to 142 total I/O

- Eleven stand-alone DIN-rail mountable DC-powered CPU combinations including:
  - **8 DC In / 6 DC Out (sinking) -Basic and Standard**
  - **8 DC In / 6 DC Out (sourcing) - Basic and Standard**
  - **8 DC In / 6 Relay Out -Basic and Standard**
  - **8 AC In / 6 Relay Out -Basic and Standard**
  - **4 DC In / 4 DC Out (sinking), 2 analog in, 2 analog out (current / voltage selectable)**
  - **4 DC In / 4 DC Out (sourcing), 2 analog in, 2 analog out (current / voltage selectable)**
  - **4 DC In / 4 Relay Out, 2 analog in, 2 analog out (current / voltage selectable)**
- Built-in communication ports *(two in Basic CPUs, three in Standard and Analog CPUs)*
- Battery-backed memory and real-time clock *(in Standard and Analog CPUs)*
- Removable terminal blocks for easy wiring
- Eleven stackable, discrete I/O option modules
- Program AND documentation stored in CPU
- Supported by FREE, high-feature programming software

With CLICK PLCs, you get a lot of application control in a small package. The new Standard CPUs feature the discrete I/O configurations of the Basic CPUs, plus battery-backed memory, real-time clock and a third communication port. Download the free programming software now and see how easy automation can be.

CHECK OUT JUST A FEW PRICES ON CLICK

Product Description	AutomationDirect CLICK Price/Part Number
PLC CPU with 8 DC inputs / 6 DC outputs (sinking), two communication ports	$69.00 C0-00DD1-D
PLC CPU with 4 DC inputs / 4 DC outputs (sinking), 2 analog inputs / 2 analog outputs, three communication ports, real-time clock	$129.00 C0-02DD1-D
Auxiliary power supply (0.5A), 100-240 VAC input, 24 VDC 0.5A output	$29.00 C0-00AC
AC input module, eight 100-120 VAC points	$40.00 C0-08NA

AutomationDirect prices are U.S. published prices as of October 2011. Prices subject to change without notice.

http://www.automationdirect.com/click-plc or ***www.clickplcs.com***

www.automationdirect.com

Go online or call to get complete information, request your free catalog, or place an order.

1-800-633-0405

Order Today, Ships Today!*

* See our Web site for details and restrictions.

VOTED# 1 Best in SERVICE 11 YEARS 2001 - 2011

AUTOMATIONDIRECT.com

the #1 value in automation

Tech Brief

variable frequency drives

can cause the motor temperature to exceed its rating due to limited airflow produced by the motor's fan.

When a standard motor operates at low speed, output load must be decreased. If 100% output torque is desired at low speed, it may be necessary to use an inverter-duty rated motor.

Don't use a contactor or disconnect switch for run/stop control of the VFD and motor: this reduces VFD life. Cycling the input-power switching device while the VFD is operating should be done only in emergency situations.

Beware of harmonics

Any non-linear load, which includes anything with rectifiers, generates harmonics — including VFDs. If excessive, harmonics can overheat and damage equipment, transformers, and even power distribution wiring.

Two types of filters can mitigate the harmonics associated with VFDs. Passive harmonic filters include AC line reactors and chokes. Reactors and chokes reduce VFD-related harmonics and line notching, and are recommended for all installations. They also protect the VFD from transient overvoltages, typically caused by utility capacitor switching. Active harmonic filters sample the harmonic current waveform, invert it, and feed the inverted waveform back to the line to counteract harmonics. Some active filters also have dynamic braking circuits that allow motor deceleration to place regenerative current back on the ac supply line.

Output, or load, reactors protect motor and cable insulation from VFD short circuits and insulated gate bipolar transistor (IGBT) reflective wave damage. They also allow the motor to run cooler by smoothing the current waveform. Output line reactors are recommended for operating non-inverter duty motors and for where VFD-to-motor wiring exceeds 75 feet.

For more information, call (800) 633-0405 or visit **automationdirect.com**.

This article originally printed in the February 2011 issue of MSD magazine and on:
http://motionsystemdesign.com/motors-drives/top-10-specifying-vfds-0211/?imw=Y.

"I don't feel old. I don't feel anything till noon. That's when it's time for my nap."

– Bob Hope

"Before I refuse to take your questions, I have an opening statement."

– Ronal Reagan

"Talent hits a target no one else can hit; Genius hits a target no one else can see."

– Arthur Schopenhauer (1788-1860)

Student Spotlight

The Future of Technology

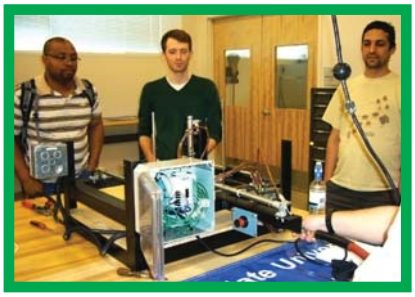
Sergio Acevedo and Randle Johnson

Provided by Chip McDaniel, AutomationDirect

Students Sergio Acevedo and Randle Johnson are two of the first students to complete their degrees in Mechatronics Engineering at Southern Polytechnic State University in Marietta, GA. The Mechatronics program at SPSU is a recent four-year degree offering, begun in 2007, which combines topics from Mechanical Engineering, Electrical Engineering and Computer Science to prepare graduates to "work effectively in all aspects of robotics, automated manufacturing, and the design of mechanical devices with imbedded intelligence." The culmination of the degree program is the capstone project, which includes the design, fabrication, testing and presentation of a machine or mechanical system. Sergio and Randle decided to produce their own pad printing machine.

Pad Printing

Pad printing is an indirect offset printing process used typically for printing on irregularly shaped objects with uneven, curved or recessed surfaces such as golf balls, test tubes, toys, and many other items. It involves the use of a (typically) silicone pad to transfer an image from a printing plate onto a substrate. The unique properties of the silicone pad enable it to pick up an image from a flat plane and transfer it to a variety of surfaces, including flat, cylindrical, spherical, compound angles, textures, concave surfaces, convex surfaces. The image to be printed is often distorted on the printing plate in such a way as to appear correctly on the printed item.



Sergio and Randle decided on the Pad Printing machine in part because it features a good cross section of the various Mechatronics disciplines. The interdisciplinary design elements include: the mechanical structure, the materials, an actuation system, the controls and PLC programming, various electrical components, and finally the automation of the printing process. The students defined the following as their criteria for success:

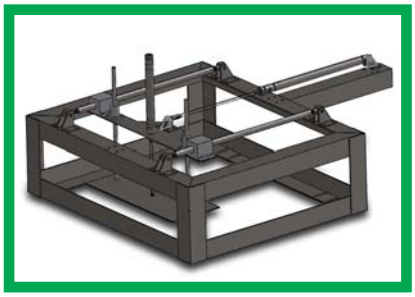
a.) build a structure to support 65 pounds of force attributed to weight and actuators

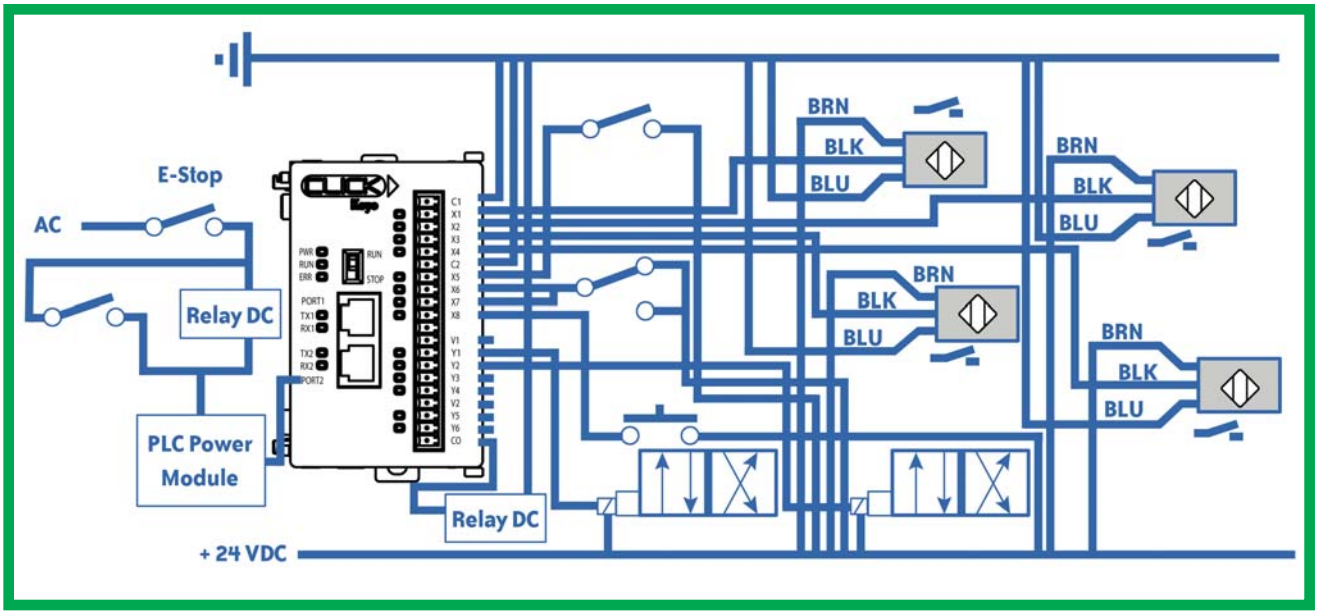
b.) complete one print cycle in 10 seconds or faster

c.) a manual mode that completes one actuation cycle

d.) an automatic mode for continuous actuation performance

e.) the capability to print a surface with dimensions up to 10.75" X 6" X 2.75".

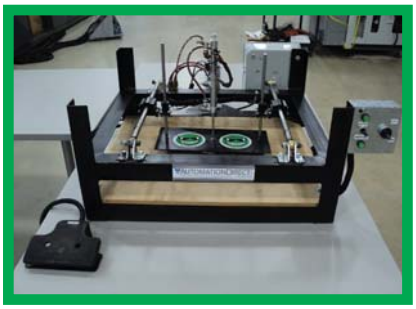




Wiring Diagram for Pad Printing Controls

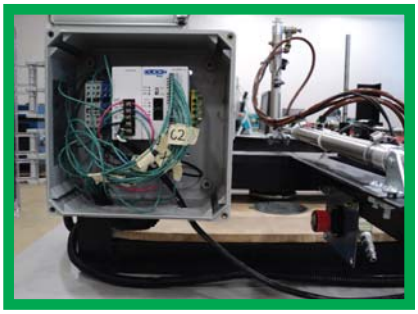
The Frame

Detailed structural analysis helped the students minimize material usage and cost in terms of the structural frame. A 3D model of the machine was created and optimized in Solidworks®, and the students were able to cut the exact shapes and lengths of the various metal elements using the school's extensive shop tools, including a CNC plasma cutter.



NITRA™ Pneumatics

After performing various calculations for load ratios and bore sizes, Sergio and Randle selected a pair of Nitra™ pneumatic cylinders from AutomationDirect to power their two axes of motion: a ¾" bore, double acting rod cylinder with a 10" stroke for the horizontal axis, and a ¾" double acting rod cylinder with a 6" stroke for the vertical axis. Four NITRA position sensors are also used to determine when each cylinder is extended or retracted.



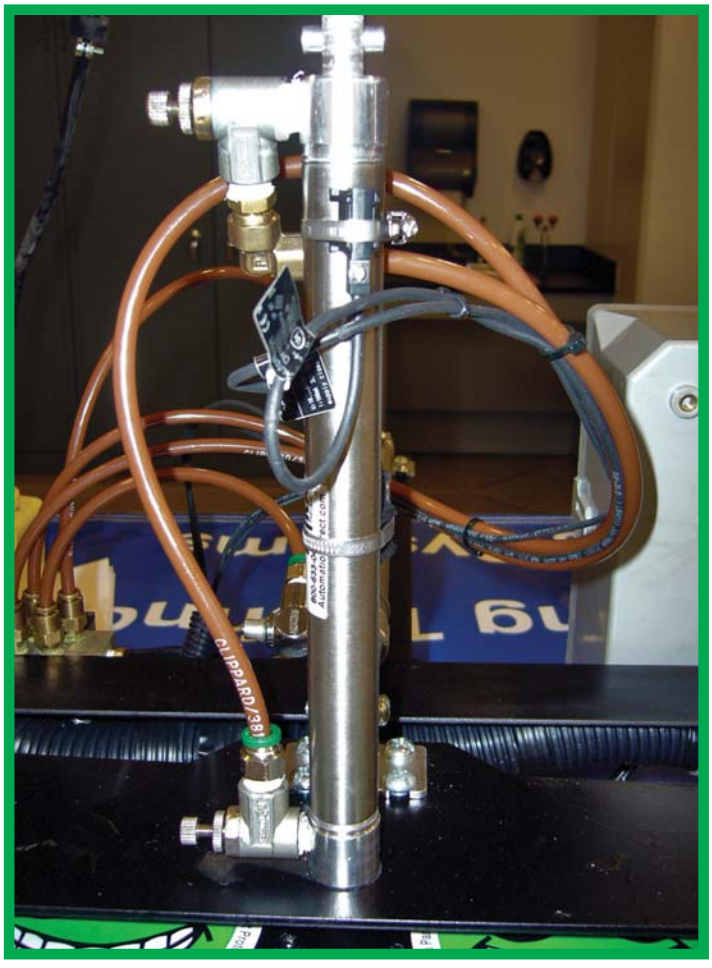
PLC Controller

The students turned once again to AutomationDirect for a cost-effective controller, and selected a CLICK PLC with the C0-00DD2-D CPU to automate their machine. The available I/O included was more than adequate to handle the various pushbutton, switch and position sensor inputs, as well as the outputs that control the pneumatic cylinders. "For $69, it's hard to imagine a lower cost controller for a machine like our pad printer, and the free software was a breeze to learn with our tight production schedule," reports Randle.

Construction & Review

After assembling the components, wiring the electrical, programming the PLC, testing and subsequent refinement, Sergio and Randle presented their project for review by the SPSU Mechatronics faculty, their fellow students, and several invited guests. Everyone was impressed to see the machine printing Smiley logos on anything placed in the machine's target printing area.

The machine also achieved all of the project's stated goals, but Randle and Sergio were quick to point out areas for possible improvement. An application mechanism for ink, touch screen controls (perhaps ***C-more*** Micro), automatic part feeding, and additional safety features top their list. Many of these are indeed features or options for the various commercially available machines. "We have a new-found appreciation for the existing Pad Printing machines that are on the market," admits Sergio. "Building your own version of any complex machine is the only way to fully understand the intricacies of the mechanical and electrical engineering design, and the programming requirements. But hey, that's what our Mechatronics degrees are all about!" It sounds like mission accomplished at the new SPSU Mechatronics Department!



Stepper Motors and Drives

Buy direct and save

Expanded line includes nine stepping motors, three advanced drives, and four power supplies

Agency Approvals for Systems:

CE

Advanced microstepping drives and high-torque stepping motors

*Sure*Step stepping systems provide simple and accurate open-loop control of position and speed for an extremely cost-effective price. The latest advanced drives can accept commands from either traditional high-speed inputs or via a 0-5V analog input. These drives also feature an internal indexer that can accomplish point-to-point moves controlled via ASCII communication.

Bi-polar stepping motors start at $17

- Now available from 61 oz-in to 1,291 oz-in
- Multiple stack lengths in NEMA sizes 17, 23, and 34
- 200 steps per revolution, or 1.8° per full step
- Locking connectors for easy hookup

Advanced microstepping drives start at $199

- Software configurable
- 200 - 51,200 microsteps *(software selectable)*
- High-speed pulse input *(Quadrature, cw/ccw, pulse/direction)*
- Analog velocity mode *(0-5V or potentiometer)*
- Internal indexer *(point-to-point moves via ASCII command)*

Standard microstepping drive also available for $149

CHECK OUT OUR PRICES ON STEPPER SYSTEMS

AutomationDirect VS. Competition

A complete 2-axis SureStep™ Stepping System* for less than just the competition's stepping drives.

Ours includes:

- **Two Microstepping Drives** (STP-DRV-4035)
- **Two Stepper Motors** (STP-MTR-23079)
- **One Power Supply** (STP-PWR-3204)
- **Two Extension Cables** (STP-EXT-020)

$524 Complete 2-axis system!

VS.

$622 (with E-DC) For 2 drives

***Sure*Step® NEMA 23 System Long Stack**

All prices are U.S. published prices. AutomationDirect prices are from October 2011 Price List. Parker prices are from http://buy.compumotor.com 9/2/11. ** All components sold separately*

www.automationdirect.com/stepper-systems

Linear Power Supplies start at $119

- 32V @ 4A, 48V @ 5A, 48V @ 10A, 70V @ 5A
- Onboard input and output fuses included
- Includes 5VDC logic supply for all low voltage signals

www.automationdirect.com

Go online or call to get complete information, request your free catalog, or place an order.

1-800-633-0405

Order Today, Ships Today!*

* See our Web site for details and restrictions.

VOTED #1 Best in SERVICE 11 YEARS 2001 - 2011

AUTOMATIONDIRECT.com

the #1 value in automation

The Break Room

Brainteasers

By Chip McDaniel

BrainTeasers

Queue See

1.) The non-automated assembly line at Widgets"R"Us is notorious for its uneven quality - and its eccentric QC inspectors. After a full day's production the three person Quality Control team evaluated the finished parts. Lisa initially flagged half of all the parts as defective, but on further inspection she cleared 10 of the suspect parts. Tim reviewed all the parts passed by Lisa and flagged one third of them as defective, but then he was able to fix two of them. The last inspector – Sally – flagged one fifth of the remaining parts, but then changed her mind about one of them and cleared it. After these inspections the factory was only able to ship 17 parts for the day. ***What was the total number of parts (good and bad) for the day's production run?***

Roto-Router

2.) A rotary indexing table has nine workstations positioned around its perimeter. The workstations are located at 15°, 40°, 60°, 110°, 135°, 200°, 275°, 325°, & 350° respectively. The motion control system driving the table can be programmed for only two move distances (in degrees), but those moves can each be made in either direction. For accuracy all the moves must originate at the home position (0°). ***What are the two move distances that will allow the table to reach all the workstation positions with the shortest number of total moves?*** (The moves required to return to the home sensor don't count.) For example: moves of 125° and 75° would work and could reach all the workstations with a total of 28 moves - but there is a better solution.

This motion control system could certainly benefit from the flexibility of a ***Sure***Servo™ system from AutomationDirect!

One-Lane Highway

3.) You have N cars that are all traveling the same direction on an infinitely long one-lane highway. Unfortunately - but typically - the drivers would all prefer to go different speeds, but they cannot pass each other. So eventually the cars will group up in one or more clumps.

In terms of N, what is the expected number of clumps of cars?

"Doing nothing is very hard to do ... you never know when you're finished."

– Leslie Nielsen (1926 –)

"There are two types of people--those who come into a room and say, 'Well, here I am!' and those who come in and say, 'Ah, there you are.'"

– Frederick L Collins

"Don't worry about the world coming to an end today. It's already tomorrow in Australia."

– Charles M. Shulz (1992–2000)

Please visit **www.automationnotebook.com** to find the answers to these puzzles.

TECHNOLOGY THAT MAKES YOUR JOB EASIER

more data exchange

EC&M Product of the year 10 Category Winner

www.productivity3000.com/boosters

TOP Productivity Boosters #10

- Speed and power
- Flexible design
- Integrated I/O
- Communications
- Powerful programming
- Advanced instructions
- HELP when you need it
- Extreme HMI
- Helpful diagnostics
- **Data exchange**

VOTED #1 Best in SERVICE 11 YEARS 2001 - 2011

Easy DAQ or SCADA with low-cost I/O and practical software

Use the technology built into the Productivity3000 programmable controller to make your job easier. If you need data collection - from the factory floor, lab, or field - it's a system worth looking at.

One program instruction in the controller connects and passes data to all the common database formats - Microsoft Access, ODBC, and SQL Server. Low-cost server software (DataWorx P3K, starting at $595) makes the data readily available to your upstream application.

The **FREE** Productivity Suite programming software comes with a trial version of DataWorx P3K, so you can experiment with and test your database application with no risk!

For simple data logging, the CPU can write data to a removable mass storage device (USB) on an event or time basis.

Read more, watch free videos, and download the FREE software at:

www.productivity3000.com

AUTOMATIONDIRECT.com

PERFORMANCE + VALUE = PRODUCTIVITY