Your guide to practical products, technologies and applications

Automation NOTEBOOK™

Winter 2007 Issue 8

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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

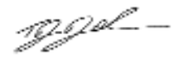
Here we are at the start of a new year. In a way, it's hard to believe we have reached 2007. I can remember as a kid thinking about what my age would be in the year 2000. When I realized I would be 33, I thought, "Man, that's really old!"

Obviously, we're way past that. Now I find myself thinking, "I'm not old at all! I've got a lot of life left in me." I've been blessed with a great wife, three wonderful children, and an exciting job.

At AutomationDirect, we have been blessed in much the same way. I wonder if, 13 years ago, our company founder and affiliates at Koyo Electronics ever dreamed we would grow to this level. Back then, we had a handful of employees - each wearing multiple hats. Now, we're bursting at the seams. Our first catalog was only 200 pages offering 200 products. Today, our catalog has 1,900 pages filled with 6,000 products, and we have no plans of stopping there.

In this edition of Automation NOTEBOOK, evidence of our continuing growth abounds. We have an article featuring System Integrators, OEMs and End Users describing unique ways they're using AutomationDirect products. The technical articles will answer questions about servo drives and choosing the right PLC for your application. There's also an article about the DARPA Challenge for autonomous vehicles, which is scheduled for later this year.

So take your time perusing the pages in this issue. And if you'll excuse me, I need to find my calculator. I wonder how old I'll be when my kids graduate college. Now, turn the page and enjoy…



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AutomationDirect Introduces C-more Micro-Graphic Operator Interfaces

AutomationDirect has released a new line of low-cost operator panels. The *C-more* Micro-Graphic panel is a touch panel with a text panel price, manufactured by our parent company Koyo Electronics, part of the multi-billion dollar JTEKT group.

C-more Micro-Graphic panels are compact operator panels available in touch screen ($189) and non-touch screen ($139) models. The 3.1" easy-to-read LCD monochrome display offers a resolution of 128 x 64 pixels. With 768 KB memory, *C-more* Micro-Graphic panels support up to 999 screens, limited only by project memory usage. In addition, *C-more* Micro-Graphic is equipped with LED backlights with five user-definable colors.

Using the panel with touch display, operators can quickly initiate an action or enter a value. Projects can include bitmap pushbuttons, increment/decrement pushbuttons, and even a pop-up numeric keypad right on the screen. The display panel supports 8 lines by 21 characters of dynamic text, enabling embedded variables, ON/OFF phrases, lookup text, and more. *C-more* Micro-Graphic also supports 10 lines by 32 characters of static text and is capable of reverse video to accentuate text.

C-more Micro-Graphic panels have an alarm function which allows control of backlight color with flashing, function key LED flashing, beep activation, and custom banner alarm displays. In addition to alarm indication the panel can display bar graphs, bitmap buttons, and graphical indicator lights. *C-more* Micro-Graphic panels also include a recipe button object which can transfer up to 99 tag values to PLC destination registers with a single touch.

C-more Micro-Graphic panels connect directly to the 6-pin, modular RJ12 communication port of most *Direct*LOGIC PLCs for both power and communications. If connecting to another brand of PLC, or to a non-RJ12 port on an AutomationDirect PLC, an optional snap-on 24 VDC power adapter is required. Two models are available; the EA-MG-P1 power adapter ($29) or the EA-MG-SP1 model ($49), which is equipped with a 24 VDC power adapter and a 15-pin D-sub RS-232/RS-422/485 serial port.

For applications requiring more advanced data entry, two optional keypad bezels are available. Both bezels are "plug-and-play," with no programming or external power needed. The EA-MG-BZ1 ($59) is an eight-button bezel designed for simple setpoint adjustment and data entry, equipped with Menu, Escape, Clear, Enter, and four arrow buttons. The EA-MG-BZ2 ($79) offers 20 buttons providing the same function keys, plus a numeric keypad.

The *C-more* Micro-Graphic panel configuration software allows the use of bitmap graphics to display images of pushbuttons, switches, and indicators. Simply drag and drop user-defined or standard objects onto the screen construction area, where they can be configured with PLC data tags. A helpful feature of the software is the project simulator, which allows the developer to view and run a project on the PC screen exactly as it would appear on the panel, without being connected to the panel. All functions of the screens can be tested, including touch objects, entering data values and testing the functionality of display objects by changing data tag content. The simulator can save hours of programming and debugging time before ever downloading the project to the panel. The programming software (EA-MG-PGMSW) is available for download online at no cost or a CD can be purchased for $25.

C-more Micro-Graphic panels are UL, cUL, and CE approved, RoHS certified, and are NEMA 4 and 4X indoor rated. For complete details on the *C-more* Micro-Graphic product line, visit www.c-moremicro.com.

Product Snapshots

Press Releases

AutomationDirect offers 575VAC Motors and Drives

Cumming, GA---November 29, 2006

---AutomationDirect announces extensions to their AC drive and motor lines to include 575 VAC models. Marathon Blue Chip XRI® motors improve system reliability while maintaining optimum motor system efficiency and substantial energy savings. Available in 15-100 hp sizes, Blue Chip XRI motors meet NEMA Premium efficiency levels and are an excellent choice for use with compressors, blowers, conveyors, pumps, and in dirty or dusty environments. Prices start at $765.00.

The Black Max® motors' low-inertia design is well-suited for high-performance applications such as machine tools, crane and hoist systems, extruders, conveyors, accumulators, palletizers, packaging, and converting equipment. The new 575 volt models are available in sizes ranging from ½ to 30 hp. Prices start at $185.00.

The 575 volt GS2 variable frequency AC drives are ideal for motor speed control applications, offering dynamic braking, PID, and a removable keypad. The 1-10 hp drives can be configured using either the built-in digital keypad or the standard RS485 serial communications port. GS2 drives are equipped with one programmable analog input, six programmable digital inputs, one programmable analog output, and two programmable relay outputs. The standard keypad allows configuring the AC drive to set speed, start and stop the drive, and monitor specific parameters during operation; 575 volt GS2 AC drives start at $259.00.

More Fuses from AutomationDirect

Cumming, GA---August 30, 2006

---AutomationDirect has extended its line of Edison fuses to include the J, RK1, and RK5 classes of fuses to provide some of the best protection possible for motors, transformers and other inductive and heating loads. These current limiting time-delay fuses are available with either 250 or 600 VAC ratings, depending on type, and are UL and CSA approved. Prices start at $21.25 for a pack of 10.

The fuse line extension also includes small dimension (5mm and 1/4") glass and ceramic fuses which provide fast-acting and time-delay protection for electronic needs including PLC outputs, pilot lights and other control devices. The electronic fuses are available in sizes ranging from 0.0625 to 30 amps; prices start at $1.25 for a pack of 5.

To complement the new line of fuses, AutomationDirect is also expanding its line of fuse holders and fuse blocks.

AutomationDirect introduces Fusible and Non-Fusible Disconnect Switches

Cumming, GA---January 15, 2007

---AutomationDirect announces the addition of 600 VAC/250 VDC heavy-duty fusible and non-fusible disconnects from Ferraz Shawmut to its list of power products. Meeting UL98 standards, the SIRCO and FUSERBLOC series are designed with the latest disconnect technology available, "make and break" power circuits on load, and are UL, CSA, CE and IEC rated. A wide array of handles is available for OSHA padlocking requirements, NEMA configurations, defeater options and NFPA 79 requirements.

The SIRCO switches and accessories, starting at $57, have been tested and approved for use in the most demanding applications, such as "service entrance" and main panel disconnects. These heavy duty switches are available in 30-800 amp ratings; switches up to 400 amps are equipped with visible blade contacts. The available defeatable pistol handles automatically re-latch when the panel door is closed, eliminating the need for tools to reset the latch.

The FUSERBLOC series of fusible disconnects and accessories, starting at $85, use double break contacts per pole, up to 200 amps, isolating the fuse while the switch is in the OFF position. To reduce or eliminate the danger of accidental contact with live, energized parts, these fusible disconnects are supplied with fuse covers and line side shrouding as a standard safety feature. Used with class CC or J fuses, the FUSERBLOC switches provide reliable circuit protection in service entrance or main panel disconnect applications.

Meeting requirements of the NFPA79 standard, these disconnect switches isolate electrical equipment from the supply circuit and have one "OFF" and one "ON" position only.

All disconnect switch contacts work independently of the speed and force of the operator. Switches up to 400 amps use silver-tipped contact technology, providing high on-load break characteristics and longer mechanical and electrical life. Switches over 400 amps use a contact movement technology which provides high short-circuit resistance.

Cover Story

System Integrators

Finding and Selecting a System Integrator

by Joan Welty,
AutomationDirect

Successful automation projects depend on a number of factors, from process definition to system installation. The number of automation vendors, software components, hardware components, and related automation stuff is growing. As the products and product sets have become more complex, more end users are turning to system integrators to help them in product selection, development and implementation, training, and maintenance.

Who's on First

As automation technology advances and continues to broaden in scope and functionality, lines of distinction between system integrators, value-added resellers (VARs), vendors, and OEMs are beginning to blur. In today's marketplace, VARs have become more competitive by adding services that make them look more like a system integrator than a VAR. Some vendors have created in-house consulting and integration units to compete with established integrators.

To establish a common terminology then, the following broad definitions are offered.

OEM - Original Equipment Manufacturer. An OEM in the automation industry has come to mean the manufacturer of a piece of equipment typically installed at end user locations to perform manufacturing or related processes. They may use a vast array of components purchased from automation product manufacturers.

Manufacturer (vendor, supplier). In this article, manufacturer or vendor refers to producers of the automation components used to create control systems. Many of these manufacturers also offer consulting and system integration services. While the vendor may recommend their own equipment and solution, it will be up to the buyer to determine whether the recommendations are valid and objective.

VAR - Value-added Reseller. VARs traditionally are distributors of the automation components, but who may also add their own expertise to help customers solve application problems and design systems.

System Integrator. A system integrator will review and/or document a customer's project requirements and then choose the hardware and software that most closely matches the requirements for that system. In addition to hardware and software, a system integrator may also provide the installation, training, service, and maintenance as required for that particular project. If the project requires a new widget, the system integrator will "integrate" that widget into the selected hardware and software.

System integrators have increasingly broadened their skill sets in recent years in order to satisfy customer demands. Many customers whose project is to do "process reengineering" want a single company responsible for all aspects of the job. Therefore, many integrators have to provide training, project management (including coordinating other vendors) or process reengineering in order to compete with those integrators who already offer a complete start-to-finish package.

System Integrators

System integrators fulfill a need when a company does not have the internal expertise and resources to design and develop a system, and yet the project needs are far greater than a single vendor can accomplish. Many vendors depend on integrators to provide the programming and industry expertise to build applications, integrate hardware components, and handle integration of third-party software programs such as supervisory control and data acquisition (SCADA) or manufacturing execution systems (MES).

A system integrator is a company that is capable of making diverse components work together as a system. While an integrator does not usually add value to the components purchased, the whole system, when assembled, represents a purpose-built system that accomplishes specific work.

The value that a system integrator adds to a project is:

1. The resources and capability to objectively select the right hardware and software for the project
2. The ability to integrate these components into a system that solves specific work requirements
3. The programming resources and experience for system development
4. The capability to also provide process reengineering, system installation, system training, system maintenance, and future product integration

Today's system integrator is no longer only responsible for making hardware/software components work together. They are often responsible for a project from conception to a finished turnkey system.

A system integrator may have vertical industry experience that allows them to understand a project's needs at a more complete level than a vendor or VAR who is not as experienced in that industry. For example, an integrator may specialize in the oil and gas industry and therefore will have a tremendous understanding of an automation project's potential problems, needs, "potholes", and overall direction. Also, with an experienced integrator, the customer is not faced with training the integrator on their industry and the basic processes and terminology. While not mandatory, it is helpful to talk with people who understand your business and speak the same language. Often, an integrator will have completed many projects of a similar nature and this experience could save the customer thousands of hours in time because the integrator has already encountered and solved similar problems.

When is a System Integrator needed?

An end user interested in developing an automation system needs to understand automation technology at a system level, process reengineering, cost justifications, workflow to build the application, and component level programming/integration. Since many customers have an engineering staff appropriate for normal business operations, that expertise may not typically exist within the company. For new, larger projects, these companies may choose to use system integrators instead of increasing their internal headcount.

Another reason why customers may need systems integrators is the decomposition of automation technology from "systems" to "components." Traditional automation systems were complete (but proprietary) systems and the vendor supplied all the necessary system components. Today's automation systems are frequently "open platforms" in which a variety of third-party components can be plugged in, changed, added in later, or developed from scratch. While increasing control system complexity, the "open platform" has allowed users to select the "best of breed" and usually lets them reduce the overall system cost. Knowing and understanding the functionality of the wide range of components may be beyond the resources of many end users and therefore an integrator's knowledge is valuable.

Finding a System Integrator

Once it has been determined that the services of a system integrator are required, the next step is to find integrators that can participate in the project. The easiest method for locating automation system integrators is to begin a dialog with the primary automation vendors. Most vendors are more than willing to

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Top Ten Guidelines for Selecting a System Integrator

1. Determine the relationship level.
   Are you looking for a one-time solution or do you want to build a long-term, multiple projects relationship with the integrator?
2. Use an integrator that has experience in your industry and understands your application.
   Has the integrator completed similar projects? Ask for one or more references for projects that are similar to yours or references in your industry.
3. Have the integrator propose a solution.
   If the integrator has experience in your type of application, allow them to make recommendations, as they may know the proper equipment and standards to get the job done.
4. Ensure the integrator has the skill set and resources to do the job.
   Make sure the integrator can handle all of the necessary responsibilities. Will they do all of the work themselves, or will they have to outsource some of the tasks, and is that acceptable?
5. Choose an integrator that is the right size for the project.
   Ensure that the size of the system integrator, including their technical staff and production capabilities, are adequate for the project. Visit their facility.
6. Check the system integrator's working alliances.
   Does the integrator have strong alliances with software and hardware suppliers? Do they offer the products required for your project? Will they be completely objective when offering solutions?
7. Interview integrator's customers and references.
   Can the integrator give you names and numbers of previous customers with similar applications? Does the integrator have other references?
8. Review samples of the integrator's documentation.
   Does the integrator supply all documentation, such as fabrication and assembly drawings, bill of material, training manuals, etc? Be sure to specify programming source code with full documentation. Determine when complete documentation will be presented.
9. Determine level of support after the project.
   Will the integrator be available by phone, fax, email or other manner? If required, will they be available 24/7?
10. Check financial status and background.
    Be sure to check the financial stability of the integrator. Get a background check or check personal references.

Cover Story

System Integrators Continued

help establish the basic needs of the project and determine whether it is a fit for that company.

Depending on how far along the project is, many vendors will offer consulting support or recommend that a system integrator be brought in initially. Most vendors have a network of system integrators that they normally work with. Automation vendors are a primary source for locating system integrators. For example, on AutomationDirect's Web site, there is a listing of the integrators that have been evaluated and authorized to be part of the SIDirect program(www.automationdirect.com/si).

System integrators can also be contacted directly and brought into the project. If this is the case, they may be more open to choosing the appropriate technology than if brought in by an automation vendor. Finding system integrators depends on geographical location of the project, the size of the project, and the process application. Organizations such as the Control Systems Integrators Association (CSIA) can be resources for finding and evaluating integrators (www.controlsys.org).

Selecting a System Integrator

The primary factor for selecting a system integrator is the size and complexity of the automation project and the internal resources of the company itself. Resources could include both a corporate and local plant engineering group. If neither group has experience in automation technology, then it may be more expedient to bring in a system integrator who can manage the project from beginning to end.

As with any company providing a major system, the potential vendors and system integrators should be researched for business and technical stability. Questions to ask include:

1. Corporate history provided with resumes of key personnel
2. Number of installed automation sites/years of experience
3. Names/contact information for at least two or three reference sites

For some companies that are fairly small, it may be wise to visit the headquarters' offices. As part of this visit, it may also be possible to visit one of their installed accounts. While the level of due diligence can be determined based on many factors, it should be an essential part of the selection process. End users will want to feel confident that the integrator will be in business long-term to support the installation if necessary, and possibly expand it in the future.

Are System Integrators Objective?

System integrators (who have consulting groups) typically claim independence from preconceived solutions and will provide an objective analysis. This is based on their notion that as a system integrator they always "integrate" the appropriate equipment for that project. It should be understood, however, that most integrators work with one or two vendors and the "solution" will inevitably be focused on one of the vendors with whom they have a working relationship. Having these relationships allows the integrator to have a more complete understanding of the product itself, and provide a better overall implementation.

To feel confident that the systems integrator will supply the best overall solution, it is up to the buyer to do their homework, provide detailed project requirements and understand what is being purchased (hardware and software, as well as the system integrator's services). While this may be a generalization, most projects do not fail because of the technology, they fail because the system provider and user do not have the same expectations. Frequent and accurate communication is the key to keeping all participants up to date with the definition and progress of the project.

This article, based on the previously published piece "Finding and Working with Systems Integrators", copyright 1997, is revised and reprinted with permission of Porter-Roth Associates.

"When they discover the center of the universe, a lot of people will be disappointed to discover they are not it."

– Bernard Bailey

"Happiness isn't something you experience; it's something you remember."

– Oscar Levant

Business Notes

Goings-On in the Automation Industry

Technology and industry-focused trade shows still attracting audiences

While it seems that some national industrial trade shows in the U.S. are struggling to attract audiences, some long-standing technology and industry-focused shows are still doing well. Two examples are the International Manufacturing Technology Show (IMTS) and PACK EXPO, both held in Chicago this past fall. Focused on new manufacturing technology, IMTS is one of the largest trade shows in the world. Its popularity reflects the fact that capacity utilization in the U.S. reached 81% last year and manufacturers are looking for new ways to add capacity to keep up with demand. Figures released at IMTS 2006 revealed that overall U.S. manufacturing technology consumption was up 24.4% in 2006, according to a joint statistical study by the Association for Manufacturing Technology (AMT) and the American Machine Tool Distributors' Association (AMTDA). IMTS 2006 final attendance count was 91,985, according to AMT spokesman Robert Gardner, and machinery sales at the show were at record highs.

The PACK EXPO shows focus on the latest developments in packaging technology and showcase exhibitors' state-of-the-art advances in packaging machinery, converting machinery, materials, packages and containers, and components. PACK EXPO continues to attract a large audience; in 2006 it garnered over 71,000 in total attendance.

Newest product Web site offers in-depth PLC information

AutomationDirect has expanded its range of product-focused Web sites to include PLCs. Visitors to www.aboutplcs.com can find in-depth information on the full line of *Direct*LOGIC PLCs, as well as general PLC selection and configuration guides. Much of the information has been available on other AutomationDirect sites, but this site collects all PLC-specific topics in one convenient location. Other product sites available include:

http://c-more.automationdirect.com (touch panels), http://www.c-moremicro.com (small touch/text panels), www.durapulse.com (AC drives) and www.sureservo.com (AC servo systems).

FIRST Robotics Team developing Segway companion product

The Forsyth Alliance, a team of high school students sponsored by AutomationDirect that participates in the FIRST (For the Inspiration and Recognition of Science and Technology) Robotics Competition, is working with an Alpharetta, Georgia Segway distributor to develop a companion product to the Segway, the two-wheeled automated people mover created by Dean Kamen (also founder of the FIRST organization). The new product, conceived by Electric Avenue owner Scott Holloway, is a wagon-like vehicle capable of transporting intermediately heavy loads while automatically following behind a Segway. The students are using the knowledge they gained from designing robots in the FIRST Robotics Competition to create a prototype for Electric Avenue. Their prototype has been dubbed the "Otto-Pallet" in honor of their rookie year robot, Otto Mation, who sported the green smiley face mascot of AutomationDirect. For more information and updates on the Forsyth Alliance and their activities, visit:

www.forsythalliance.com.

Learn.automationdirect.com launches with pre-recorded tutorials

AutomationDirect's new learning site, http://learn.automationdirect.com, launched in November 2006 with pre-recorded tutorials and presentations on a range of topics, including selecting a PLC, HMI and PLC software features and the basics of sensors. Each product section of the site also has a list of links to relevant information on other AutomationDirect sites, including the main store, Automation Notebook and product sites such as aboutplcs.com. Visitors can also provide suggestions for additional tutorial topics.

Feature Story

End User, System Integrator, OEM

Poultry farm utilizes PLC control to increase efficiency

by TJ Johns,
Senior Editor

In the New England town of Monroe, New Hampshire, you'll find picturesque settings filled with family-owned dairy and poultry farms. Situated in the Connecticut River valley at the edge of the White Mountain National Forest is a poultry farm, called Pete and Gerry's Organics, with something to crow about. Pete and Gerry's Organics has found a way to increase efficiency and productivity by using automation to help gather and process eggs.

It all started around 1950, when Les Ward, a retired World War II dive bomber, decided to set up a poultry farm using just a few hundred hens. In the late 1960's his brother-in-law, Rodney Stanton, joined him to manage production for the New England area. The business focus was on quality and freshness.

In 1997, the business was passed down to Rodney's son, Pete Stanton, and Les' son-in-law, Gerry Laflamme.

Continuing the tradition of quality and freshness, Pete and Gerry developed high standards of their own. They wanted totally organic eggs, free from antibiotics, medication, hormones, pesticides, or animal byproducts, to be distributed throughout New England.

Today, after four generations, this small family farm boasts six barns, each over 400 feet long, and nearly 110,000 Hy-line Brown cage-free hens. The hens are a hybrid cross between a Rhode Island Red and a White Leghorn. Each hen is capable of laying up to 320 eggs per year.

A cage-free environment allows the hens to roam freely inside the barn. When they are ready to lay their eggs, the hens climb into red nesting boxes, which tilt back slightly. As each egg is layed, it gently rolls out of the nest and travels on a series of conveyor belts that transport it to the processing facility.

Originally, workers had to start and stop the conveyors manually to control the egg flow. Flow management was difficult, and the process labor intensive; only one barn could be completed at a time. With an average egg production of 80,000-90,000 eggs per day, Pete and Gerry were looking for a way to increase efficiency and minimize human error.

Gerry's son, Jesse Laflamme, joined the family business after graduating from Bates College and serves as co-owner and general operations manager. In efforts to increase both efficiency and productivity, Jesse decided to fully automate the barns and processing building.

With no formal training in industrial controls, Jesse relied on advice from AutomationDirect's technical support team and referenced their product manuals to develop a control system for egg collection and transport. Happy with the overall experience, Jesse states, "The tech support is just fantastic. They are a huge help. If I find a problem on our farm that I have a hunch automation equipment can help us with, I just start reading the books, call up tech support, or look through the catalog and see what products are available, and pretty soon I've got a solution."

Using products from AutomationDirect, Jesse configured PLCs, Marathon motors, GS1 inverters and analog diffuse proximity sensors to control the egg flow.

With the new system, once the egg rolls from the nest onto the gathering conveyor, it is transported to a cross conveyor. Here it begins its journey from the barn to the main transport conveyor, which takes the eggs to the processing building. As the eggs load onto the cross conveyor, proximity sensors send a 0-10 volt signal representing egg volume to a *Direct*LOGIC D0-05DR PLC. An inverter receives a signal from the PLC and adjusts the gathering conveyor's motor speed as the egg flow increases or decreases.

This has helped increase efficiency,

because, according to Jesse, "having this system in all of our barns has allowed us to run all the barns at the same time. Essentially, the barns are controlling their own flow. We're able to blend all the egg production together, which is a big plus."

Jesse also equipped the PLC with a D0-01MC memory cartridge that supports a real time clock. Each barn relies on the PLC to advance the gathering conveyors every 15 minutes during less productive periods to prevent the build-up of eggs.

In each barn, where the cross conveyors join with the main transport conveyor, Jesse uses two analog diffuse proximity sensors to send signals to the PLC. The two signals are averaged and a 0-10 volt signal is sent to an inverter to adjust the cross conveyor speed accordingly.

The speed of the main transport conveyor leading from the barns into the processing facility is controlled by a 3/4 hp motor and GS2 inverter receiving commands from a *Direct*LOGIC D0-06DR PLC .

As the eggs from all six barns enter the processing facility, Jesse enlists the help of the D0-06DR PLC to control an accumulator table fitted with more sensors. Signals from these sensors are sent to the PLC, averaged, and used to control the proper start and stop sequence of the main transport conveyor from the barns.

Within the processing building, equipment output is set based on cases per hour. In the past, the only way to precisely know the production rates was to print out reports and throw in some mathematical calculations during the process. This was very time consuming. Jesse explains, "That's obviously eating away at your actual cases per hour. Even at the end of the day, there's no real report that tells you what your actual cases per hour are, and certainly nothing in real time."

When the machine puts a set number of eggs into a carton, a signal is sent to the PLC. The PLC adds the signals and divides by the case volume. The built-in clock/timer function of the PLC starts when the first eggs are dropped, and continues to run throughout the day. "No matter what happens, unless you manually stop the clock, it's doing the calculations on how many actual cases per hour you're running," he adds. Jesse chose to use an Optimate OP-414 display panel in conjunction with the DL-06DR PLC to display collected data. The display also shows the daily running total and the number of cases per station.

Jesse also uses the DL-06DR PLC with an H0-ECOM Ethernet module for monitoring water consumption. Each barn's control system is networked via Ethernet, where the PLC reads pulses from water meters on individual water lines. Using DataWorx Ethernet data logging software, the information is captured for display in Microsoft Excel worksheets. With this information, Jesse can chart and compare water consumption, which is very important in monitoring the health of the hens.

With the new system in place, the egg gathering no longer needs to be monitored by a human. Initial estimates show labor savings of $70,000–$80,000 per year. This increase in efficiency, and continued company growth, has given employees opportunities to take on other positions and responsibilities.

Jesse continues to search for ways to improve the egg processing at Pete and Gerry's Organics. In the future, he plans to incorporate other methods of PLC control for increasing efficiency, such as water temperature control.

To find out more about Pete and Gerry's Organics, visit:

www.peteandgerrys.com.

Systems integrator brings automation into skydiving

by TJ Johns,
Senior Editor

Thrill seekers around the world are forever looking for the next big adrenaline rush. More of them are finding that thrill through indoor skydiving, which is quickly becoming a way to satisfy the desire for excitement, and yet remove the element of danger.

Indoor skydiving facilities have been in existence globally for several years. However, the controls have been known to be sluggish, undependable, limited in features, and inefficient.

Engineering partners Frank Smith and Bill Alexander of Custom Control Solutions, LLC, in Cumming, GA have developed a newer control system for indoor skydiving tunnels that emphasizes safety and efficiency. The system creates and monitors a smooth air stream which simulates atmospheric properties suitable for skydiving. Frank and Bill have been busy installing systems throughout America, as well as internationally in locations such as Alcantarilla, Spain, Milton Keynes, England, and Moscow.

With its unique architecture, the indoor skydiving structure looks rather unusual. A little over four stories tall, the first floor of the structure consists mainly of open framework, with the exception of a large enclosed bell-like structure at the bottom resembling a space shuttle exhaust. A stairway leads to the second floor which houses the control room, classrooms, and sales center, all surrounding a central circular chamber (the tunnel). Farther up, sitting atop the structure, are four large exhaust fans, designed to pull air up through the central tunnel and exhaust it out the top. This section of the tower houses

Continued, p. 18 >>

C-more micro IT'S A TOUCH PANEL...

non-touch panel
$139
EA1-S3ML-N

touch panel
$189
EA1-S3ML

Screen Colors

AT A TEXT PANEL PRICE C-more micro

Get premium features at best value prices!

The *C-more* micro is a graphical operator interface panel at a text panel price. Choose either the touch or non-touch version depending on your application and budget. Either way, you get advanced features at prices you might be used to paying for more limited text panels:

- **Five backlight colors** that can alert operators to conditions by changing or flashing the color of the screen
- **Five dual-purpose configurable function keys** with individual LEDs
- **Recipes**
- **Alarms**
- **Up to 999 screens** *(dependent on screen complexity)*
- **Protocols supported:**
  - * All AutomationDirect PLCs
  - * Modbus RTU
  - * Allen-Bradley DF1 half/full duplex, PLC5 DF1

Combine these features and more with the free down-loadable programming software* and you have a panel that's flexible, cost-effective, and is perfect for a wide array of applications.

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

Data Entry and Control

For additional data entry and control, select from one of the optional keypad bezels available in a numeric with control buttons keypad or a simple control button keypad.

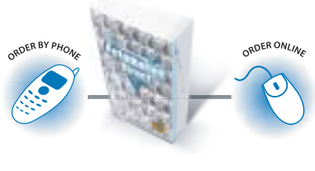
And they're plug and play, no software configuration required!

SPECIFICATIONS

C-more micro

Screen Size	3 inch
Pixel Resolution	128 x 64
Lines of Text (max)	10
Characters per Line	21 dynamic or 32 static
Beeper/Buzzer	Yes
Graphics	Yes
Agency Approvals & Certifications	UL, cUL, CE, RoHS, NEMA 4/4X indoor use
Memory	768 kB
Programming Software Price	FREE download or $25 for CD
Number of Screens	999 Screens Max, limited by memory

For more information, visit:
www.c-moremicro.com



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Feature Story

End User, System Integrator, OEM Continued

four 400 hp fans, each controlled by a dedicated Variable Frequency Drive (VFD) located within the structure below. When the fans run simultaneously, internal wind speeds can reach 178 mph.

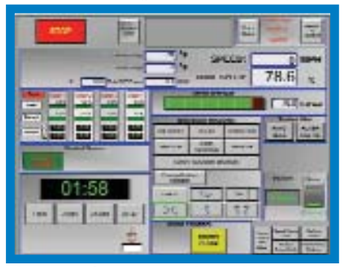
The indoor skydiving tunnels are open to the general public where customers must first attend class and learn how to tunnel sky dive. Experienced skydivers use the facilities to refine existing skills, and teams around the world use them to create and practice in-air routines with relative safety and without time limitations. According to Alexander, in 30 minutes a skydiving team could practice as many as 15 dives, as opposed to the several hours it would take from an airplane.

The new control system features a PC-based control system with Entivity Studio as both the logic engine and the Human Machine Interface (HMI). The master industrial PC communicates to inputs and outputs (I/O) using an Ethernet connection and collects data from the VFDs using RS-485 Modbus communications. The control system provides the operator with a combination of touch-screen and manual flight controls.

Each VFD is built into a packaged configuration which includes an 18-pulse transformer, input reactor, and high-energy surge protection. The VFDs are controlled via analog and digital signals and the control system receives information over the Modbus link on drive status, faults, power consumption, etc.

For increased safety, most tunnels are equipped with photoelectric sensors, located at specific heights, to help maintain airspeed. If the flier exceeds a predetermined level in the flight chamber, the sensors report to the control system and the fan speed is automatically adjusted to bring the flier back down to a safe area within the tunnel.

The control system was designed so the operator has a full overview of system status from one main screen. The main screen is divided into functional areas, which help reduce eye fatigue by



placing information where the operator doesn't have to constantly scan the screen. Setup screens are provided for system configuration such as PID tuning, speed limits, door opening and closing times, etc. The operator controls the flight of the skydiver in the tunnel using a joystick co-located with the control computer.

The control system features Ethernet I/O, enclosures, pushbuttons, switches and terminal blocks from AutomationDirect. The *Direct*LOGIC DL205 hardware platform was chosen for the application based on its wide selection of I/O modules, size, cost and reliability, and ease of integration with Entivity Studio software. A PLC base houses an Ethernet Base Controller (EBC) module in the CPU slot. The program logic is executed in the PC and the I/O rack becomes a transparent extension of the PC itself.

In Milton Keynes, England, the skydiving tunnel uses a different design. The fans are installed horizontally and force recirculated air through outer towers back into the central tunnel.

Friction caused by the recirculation heats the air, so each tower is equipped with an adjustable vent door, allowing exhaust of heated air and intake of outside air to control tunnel air temperatures. Alexander states, "For every liter of air I put out through the exhaust door, it pulls in fresh air." To explain efficiency, he continues, "A four minute flight typically uses less than a dollar of electricity. The efficiency ratio is incredible for the amount of airspeed that's generated."

The combination of Automation Direct I/O, Entivity Software, and VFDs has resulted in a reliable, expandable, and cost-effective control system solution. Since September 2003, the newer control systemhas logged near-perfect up-time. The wind tunnels operate 24 hours a day, 7 days a week, and host scores of tourists and skydiving teams from around the world.

For more information about the skydiving tunnel or other services from Custom Control Solutions, contact Bill Alexander, 3550 North Parkway Suite 300, Cumming, GA 30040. Phone 770-886-3307, fax 770-886-3882 or email billa@ccsolutionsllc.net.

Process analyzer uses WinPLC to monitor cyanide destruction

by ADC Editorial Staff

NEXTChem Process Analyzers, LLC produces chemical process analyzers for industries such as metal treatment, metal finishing, chemical, wastewater, and pulp and paper. The analyzers automate laboratory measurements used for process control. Some of NEXTChem's customers include a large aerospace company who uses the analyzer for measuring caustic cleaner for jet engine parts, and a major steel manufacturer who uses it for measuring sulfuric acid in coke oven scrubbers.

Conductivity and pH sensing are the traditional methods for measuring and controlling chemical processes. However, neither of these methods is capable of providing exact chemical concentrations, which severely handicaps the ability to provide useful process control. Laboratory measurements performed with process analyzers are generally one of two types: titration or standard addition. Titration is a measurement technique that uses a chemical reaction to determine a chemical concentration. Standard addition is a measurement technique that uses the response of an ion selective electrode to determine a chemical concentration. Both of these measurements provide precise information on the chemical process and greatly reduce the amount of time it takes, from hours to only minutes, to report chemical measurements.

One customer of NEXTChem is a medical device maker who uses the analyzer to monitor cyanide destruction. Cyanide is used in a metal plating process at the customer's facility, and the local municipality has a strict limit on the amount of cyanide that can be discharged into sewers. The analyzer is used to confirm that all cyanide is removed from the wastewater before it is discharged into the sewer.

The NEXTChem Basic OMNIChem process analyzer is comprised of AutomationDirect's DL205 PLC system using a WinPLC CPU and H2-SERIO modules, along with digital and analog I/O modules. The WinPLC is programmed with Entivity Studio software. "The Entivity software makes it possible for non-programmers to create very complex programs, and the DL205 system was small, but powerful enough to be used in our analyzers," says Tim Pearson of NEXTChem.

The process begins with a D2-TD2-2 digital output module used to activate pilot solenoids, which send air pressure to sample valves, allowing fresh samples into the analyzer. The H2-SERIO module then sends ASCII commands to a stepper motor controller that activates stepper motors in the analyzer. The stepper motors are connected to pumps that control the proper amount of reagent required for the cyanide analysis.

Next, the cyanide ion selective electrode measures the amount of cyanide present in the sample. This concentration is converted into a voltage signal, which is sent to a voltage-to-current converter. The current signal is brought into an F2-08AD-1 analog input module. The WinPLC performs all the necessary calculations to determine the concentration of cyanide present in the sample. Once determined, a signal that represents the concentration of cyanide is transmitted to a SCADA system

NEXTChem's customers have enjoyed several benefits from the new system, including lower system costs and faster measurement speed. Tim Pearson of NEXTChem says, "The high quality and low cost of parts from AutomationDirect have enabled NEXTChem to move our process analyzers into the next generation of process control. NEXTChem had considered a proprietary controller using C++ programming; however, the ease of programming offered by the WinPLC enabled bringing the product to market six months earlier than anticipated, and at a lower cost."

"Genius is one percent inspiration, ninety-nine percent perspiration."

– Thomas A. Edison

Technology Brief

DARPA Challenge

Team Mojavaton Tackles DARPA's Latest "Urban Challenge"

by Chip McDaniel,
AutomationDirect

The White Knight

The 2007 Urban Challenge, held by DARPA, is the third in a series of races for unmanned vehicles. The Defense Advanced Research Projects Agency (DARPA) is the central research and development organization for the Department of Defense (DOD). DARPA is using the series of races to foster advances in technology for autonomous vehicles to meet DOD internal goals, and due to a congressional mandate. In 2001 the US Congress mandated that, by 2015, one-third of operational ground combat vehicles be unmanned.

The first two Grand Challenges were races across the desert, where vehicles had to overcome fixed obstacles and rugged terrain while navigating a course defined by GPS waypoints. A prize of one million dollars went unclaimed in the 2004 race, with no vehicles completing the course. The prize was increased to two million dollars in 2005, and five teams completed the 132 mile course. Stanford University claimed the first place prize money with the best time of 6 hours and 53 minutes.

On the Road

Team Mojavaton was one of 23 finalist teams in the 2005 event. They had a strong entry; their vehicle, dubbed "The White Knight", actually passed 10 other vehicles. This was an impressive achievement given the race format, which used a staggered start. Unfortunately, the vehicle suffered a mechanical failure in the throttle control, and coasted to a stop in the middle of the road, still on course, with all of the other systems functioning.

On May 1, 2006 DARPA announced a third event, the Urban Challenge, to be held in November 2007. Teams will build an autonomous vehicle able to complete a 60-mile urban course safely in less than 6 hours. The first two Grand Challenges focused on the development of autonomous vehicles operating in an off-road environment with very limited interaction with other vehicles. The Urban Challenge extends this concept to autonomous vehicles that can safely execute missions in a complex urban environment with moving traffic. DARPA's authority to award monetary prizes was questioned late last year, but there have been published reports that there will be prize money comparable to what was awarded in the previous Challenge.

Back Seat Driver

The lights are on, but nobody's home

Challenge vehicles are production cars or trucks modified with computer systems, a variety of sensors, and GPS equipment designed to operate without human intervention. Unlike some robotic vehicles, such as the Mars Pathfinder or the Predator drone aircraft, these are not remote control vehicles. Once the vehicles are switched into autonomous mode, they are completely controlled by onboard computers and sophisticated software.

No one is allowed to ride in the car and humans can only follow and/or watch from a distance. Two radio signals are used for safety, which are the only external controls allowed. One signal pauses the vehicle, and another signal initiates an emergency stop.

Intel Inside®

The Team Mojavaton entry, built on a Nissan Xterra SUV platform, is controlled by an industrial rack-mounted PC powered by an Intel dual-core micro-processor and a fault-tolerant disk array. The PC communicates via RS232, Firewire and Ethernet to several subsystems. These subsystems include LASER range finders (LIDAR), a stereo vision system, GPS navigation system, and a military grade Inertial Navigation Unit (INU). In addition to the custom control software, mostly written in C++, the PC is running Entivity Studio, a PC-based logic controller from AutomationDirect.

Inside view

Entivity Studio allows input from, and control of, devices connected to a DL205 PLC I/O rack. Entivity handles all of the discrete I/O for the vehicle, including required safety features such as the siren, beacon and directional signals. The direction signals are new for this year's Urban Challenge, since Challenge vehicles must obey all traffic laws, including the use of turn signals.

A CTRIO module in the DL205 I/O rack relays velocity data from the car's speedometer to the microprocessor. This is one of three inputs used by the computer to help determine position, direction, and speed. The GPS navigation system can provide extremely accurate position and velocity data when it is in contact with at least three geostationary satellites, but tall buildings and tunnels can obstruct the GPS system. Team Mojavaton uses the velocity data from the speedometer, in conjunction with the Inertial Navigation Unit (INU), to augment the GPS and to determine the position and speed of the car even when GPS data is not available.

Entivity Studio application software also supplies the position commands to four closed-loop stepper systems. The stepper systems are used to control the throttle, steering, and braking, as well as to rotate a suite of sensors on the roof of the car.

You Are Here!

DARPA provides the teams with two types of map data for the vehicle to use in planning its path: the Route Network Definition File (RNDF) and the Mission Data File (MDF).

The RNDF is defined as the overall set of roadways and areas where the vehicles might travel. It also provides information such as waypoints, stop sign locations, road and lane widths, speed limits, checkpoint locations, and parking locations. In addition to the road segments, there are "free travel" zones, where only a perimeter is defined. This route network does not contain any starting point, ending point, or specific path-of-travel information, and it is provided to the teams 24 hours prior to the start of the event.

The MDF is a series of checkpoints that must be visited in sequence by the autonomous vehicle. A checkpoint is a two dimensional point on the earth specified by latitude and longitude. The MDF will be provided to the team only three minutes before the start of the race.

The exact path that a vehicle should travel is not specified by either the RNDF or the MDF. The control system, given the two separate files, is expected to be able to plan a suitable path.

To further challenge the teams, DARPA has warned that the route network may have road segments that are sparsely defined, with missing information such as lane width and speed limits. Road segments provided

Team Mojavaton
Front row, left to right: Walt Rhodes, Mike Hawkins, John Trotter
Back row: Crag Frazier, Phil Miller, Jim Crittenden, Dan Councilman, Karl Castleton, and Steve Stewart.

Continued, p. 22 >>

Technology Brief

DARPA challenge Continued

in the RNDF might even be blocked. The vehicle must be able to interpret and adapt to these "real-world" conditions.

Cross-town Traffic

Jim Crittenden, leader of Team Mojavaton, spoke to Automation Notebook about the challenges that are unique to the urban setting.

"In the 2005 race, our vehicle had to navigate between waypoints and across rugged terrain, but all of the obstacles were stationary. Even when we overtook a vehicle that had started ahead of us, the DARPA officials would pause that vehicle by bringing it to a stop, which allowed us to pass it as yet another stationary object. This year, we'll have to track not only our own position, direction, and speed, but we'll have to be able to track other moving objects as well."

But just how many objects must they be able to track? DARPA has not quantified this particular aspect any further, but has hinted that multiple autonomous vehicles may be on the same course at the same time. DARPA has also announced that there may be additional vehicles on the course being manned with "professional drivers".

Vehicles must demonstrate their ability to deal with oncoming traffic, and interact with other vehicles at stop signs and traffic circles. The vehicles will even be expected to "merge" into traffic, given a reasonable "gap" and taking into account the speed of the traffic flow.

Another obstacle that the teams will face this year is a road block. DARPA has stipulated that the vehicles be capable of a U-turn, but the logistical challenge of a blocked road is much more complex than simply turning around. The vehicle must be able to determine an appropriate re-route based on the available roads and still make it to the next checkpoint in the sequence.

Finally, DARPA plans to challenge the teams with sparse waypoints and reduced accuracy waypoints. In both cases the vehicles will have to use their on-board systems to identify, compensate and adapt to the surroundings.

Second Chance for Mojavaton

Most teams didn't expect DARPA to continue with the Grand Challenge program after the success of the 2005 event, but at least for Team Mojavaton, it's a welcome second chance. Crittenden says enthusiastically, "We had a great vehicle last time out. The component that failed had been a part of the car for over a year and had never given us any trouble, so its failure was unexpected."

He states, "This year we're starting with a proven platform that's mechanically complete and we have all year to perfect the software algorithms. Between the tracking of other vehicles, following the rules of the road, and the DARPA road-blocks, our programmers will be busy in 2007. That's what makes it a challenge"

Good luck, Team Mojavaton!

As we go to press, DARPA has officially restored the prize money. Payouts will be $2,000,000 for first place, the $1,000,000 for second place, and the $500K for third place. Team Mojavaton is very pleased. "I think that $3.5 million in prize money helps to convey the high regard in which our government holds this project and the importance of its success to America." declares Crittenden.

Through the Looking Glass

More information about Team Mojavaton, including video of the Xterra in action, is available at their Web site: http://www.mojavaton.com

Additional information about the Urban Challenge is available at the official DARPA web site:

http://www.darpa.mil/grandchallenge

This includes the complete set of rules; sample RNDF and MDF files, as well as information about the previous Challenges with full results and photos.

"But the fact that some geniuses were laughed at does not imply that all who are laughed at are geniuses. They laughed at Columbus, they laughed at Fulton, they laughed at the Wright brothers. But they also laughed at Bozo the Clown."

– Carl Sagan

Tech Thread

Servos

FAQs for SureServo AC Servo Drives

by Joe Kimbrell,
Motors & Drives Product Manager,
AutomationDirect

Since the release of the *Sure*Servo AC servo drives, we have compiled a list of questions that are frequently asked by our customers. The following are answers to some of those questions.

What power voltages does the *Sure*Servo require?

The *Sure*Servo requires 220 VAC single-phase to power the smaller drives and 3-phase for larger systems. There is a 24 VDC, 500mA power supply built in to the drive for powering the inputs. If using any of the outputs, an external 24 VDC power source is needed.

How do I size and configure my system?

AutomationDirect has teamed with one of the industry's leaders in motor sizing software, CopperHill Technologies. Our VisualSizer-*Sure*Servo software is offered as a free download to help you select the correct servo motor and drive for your application. AutomationDirect also offers *Sure*Servo Pro configuration software as a free download, or it can be purchased on CD. Both software packages can be obtained from the SureServo.com Web site. While our technical support department is ready to help answer any questions regarding the *Sure*Servo product, the answers to most questions can be found in the *Sure*Servo manual, available as a free PDF download at SureServo.com or on the AutomationDirect technical support homepage. Example applications and a step-by-step QuickStart Guide should get most customers' applications up and going quickly.

What modes of operation can the SureServo perform?

*Sure*Servo can perform the following modes:

Analog torque with optional analog or preset velocity limit

Preset torque with optional analog or preset velocity limit

Analog velocity with optional analog or preset torque limit

Preset velocity with optional analog or preset torque limit

Pulse input with pulse and direction, CW/CCW, or quadrature inputs

Position Mode with Internal Indexer. Internal parameters define the accel, speed, decel, and target position of moves. Eight unique moves can be programmed, and can all be modified via Modbus, so the system is extremely flexible. Positioning can be performed in incremental or absolute modes. In Incremental mode, the motor will move a specified distance. In Absolute mode, the motor will move to a pre-defined position.

Dual Control Mode allows the drive to be configured to switch on-the-fly between certain control modes. SureServo can be set for Velocity/Position Mode, Torque/Position Mode, and Velocity/Torque Modes. While in these modes, the drive can be switched from one mode to the other via a digital input signal.

Index Mode is a variation of the internal indexer and allows the servo to use STEP FORWARD/STEP REVERSE logic commands. This is useful when the application has set positions for the motor to travel. A PLC command or simple pushbutton signal tells the servo when to STEP FORWARD to the next position.

Auto Position Mode is another variation of the internal indexer that allows the servo to advance through preset positions triggered by external inputs or by automatically starting the next move after a set "dwell time".

All of these modes are explained in detail in Chapter 6, "Control Modes of Operation and Tuning", of the *Sure*Servo manual.

Does the *Sure*Servo support absolute positioning?

The *Sure*Servo motors do not have an absolute encoder. However, as long as control power, which has a separate input from the main power, is maintained, the drive will keep its actual position updated. If an application is using the internal indexer, re-homing should be unnecessary. A command to go to zero will cause the motor to go to its zero position. If control power is lost, the drive's actual position is reset to zero.

Does the *Sure*Servo offer a mechanical brake?

Yes. Each motor size is available in a brakemotor or a non-brakemotor configuration. The motor cables are the same for both. For example, if there is a 400 watt brakemotor and a 400 watt non-brakemotor, there is only one style of motor power cable and one style of encoder cable for a 400 watt system.

How can I home the *Sure*Servo?

*Sure*Servo allows a lot of flexibility with the homing process. Homing can be initiated by a digital input or started automatically at power-up. The servo can be programmed to home to a home limit switch, motor encoder z-pulse, or an overtravel limit switch used as a home sensor. The motor can stop at the first input or pass the input and return.

How do I communicate with *Sure*Servo?

The *Sure*Servo drive accepts eight digital inputs that can be assigned for various functions such as Home, Reset, Trigger, Command position select, etc. There are five digital outputs such as At position, Home complete, Fault, etc. The outputs can also be configured in Indexing and Auto Position Modes to output a binary code representing Servo current position, Servo ready, Alarm, etc. All modes are explained in Chapter 6 of the *Sure*Servo manual.

*Sure*Servo supports Modbus serial communication. Most parameters can be read from and written to the drive. Detailed examples of using with a *Direct*LOGIC PLC are demonstrated in the *Sure*Servo manual.

The servo also has a high-speed encoder output so a PLC or motion controller can monitor the system. The encoder output is scalable, allowing *Sure*Servo to emulate and replace older systems that use different motor encoder counts. For example, if an older servo system has a motor that operates at 1,000 pulses per revolution, the SureServo encoder output to the old motion controller or PLC could be scaled so that one motor revolution will send 1,000 pulses to the external controller. This is an easy way to upgrade older motion systems without having to reprogram the motion controller.

How do I use a *Sure*Servo in a PLC control system?

The SureServo can be used with all *Direct*LOGIC PLCs. The PLC can issue analog velocity or torque commands to the *Sure*Servo. It can also generate high-speed output pulses using the built-in pulse outputs available on the DC output models of the DL05, DL06, and DL105 PLCs, or by using high speed I/O modules (CTRIO) available for the DL05/06, DL205 and DL405 PLC families. Another way to obtain excellent control is to use the *Sure*Servo's built-in indexer for monitoring. With this feature, the PLC downloads position and speed commands over the serial Modbus link. Then, with a standard digital output, the PLC triggers the *Sure*Servo to move to the set position at the set speed. With this setup, a complete servo and control system can be assembled for less than $1200 when using a DL05 PLC. The *Sure*Servo manual has examples of how to set up the communication between the *Sure*Servo and a *Direct*LOGIC PLC.

How do I troubleshoot my system?

While the *Sure*Servo is a very flexible and full-featured servo drive, the *Sure*Servo system has been designed so that users unfamiliar with servos will have an easy out-of-the-box experience. The *Sure*Servo manual has a step-by-step Quickstart Guide that will have the system up and running in a matter of minutes. The Quickstart Guide gives easy-to-follow steps on how to start up the system using basic configurations.

Do I have to purchase software to program the *Sure*Servo?

You can program the *Sure*Servo two ways: 1) through the free downloadable software, or 2) through the integrated keypad. All parameters are available in the software and on the keypad. We highly recommend the software for its easy, graphical interface and the ability to use the tuning window, if necessary, to help tune the servo. While the software can be downloaded for free, you can purchase a CD version for $9. The communication cable costs $19.

Now that I know all this cool stuff, what do I need to put together a system?

For a *Sure*Servo system you need to purchase the following five items: 1) a servo drive, 2) a servo motor, 3) a motor power cable, 4) a motor feedback cable, and 5) an I/O breakout kit which includes a breakout board and a short cable for I/O wiring to the servo. Complete systems start at less than $1,000. SureServo.com is a great resource for learning more about the product.

What accessories are offered for the *Sure*Servo systems?

The *Sure*Servo system accessories include EMI filters, reactors, regen resistors, and communication cables. These accessories can be found at www.automationdirect.com or www.sureservo.com/accessories.

Where can I find mechanical components for my *Sure*Servo system?

While AutomationDirect doesn't sell gearboxes, belts, couplings, and pulleys at this time, we do provide links to several high-quality manufacturers whose components work with *Sure*Servo motors. Check out www.sureservo.com/mechanical_trans for links to gearboxes with mounting adapters for *Sure*Servo and *Sure*Step, belts, pulleys, couplings, and more.

When do I use a servo instead of a stepper?

The quick, easy, and most common answer is feedback. A servo system keeps track of motor command position and motor actual position. The difference between the command and the actual is called position deviation or positioning error. If the position deviation becomes too large (based on a configurable parameter), the servo will fault and report "position error" to a motion controller, PLC, and/or through the drives' LEDs. One benefit of this arrangement is that if a servo system experiences a disturbance and gets out of position, it can recover and get "back in position". A stepper system is much more basic in its positioning. For each pulse input into the stepper drive, the motor will be commanded to move to the next position. If the motor does not reach this position because the load or commanded speed is too great or the system gets into a bind, there usually is no feedback from the drive to the PLC/motion controller to report that the motor did not get to the correct position. The motor loses torque and the system does not recover or report that anything is wrong. Recent developments in stepper drive technology have led to hybrid steppers that do incorporate feedback. These hybrid technologies blur the line of performance and specification between steppers and servos.

Other reasons to use servos instead of steppers would be torque regulation and using an analog command signal. Typically, steppers run at full torque all the time (some have torque reduction at standstill). Servos can actually run in torque mode (where the actual torque output is based on the incoming command signal). Even when not in torque mode, a servo will output just enough torque to stay in position. Finally, steppers usually require a high-speed pulse train for a command signal. A servo will accept the high-speed pulse train as well as analog speed and analog torque command signals. The *Sure*Servo can also run its own position profile based on preset speeds and preset position setpoints.

What are the sizes offered in the servo drives and motors?

AutomationDirect offers three servo drives that match up with eight sizes of servo motors. The smallest drive (SVA-2040) can handle our 100W, 200W, and 400W low inertia motors. Our midrange drive (SVA-2100) can power our 750W and 1kW low inertia motors and the 1kW medium inertia motor. The highest power drive (SVA-2300) connects to our 2kW and 3kW medium inertia motors. Each size of motor comes in two models: brake and no-brake (a "B" on the end of the part number represents brake). Keep in mind that all our motor power cables have the brake wires incorporated into them. Sureservo.com has specifications and descriptions to help in determining the correct drives, motors and cables to use. Charts for complete systems are found at http://www.sureservo.com/complete_systems.htm.

Technical Review

Selecting a PLC

"Considerations for Choosing a PLC" Worksheet

This worksheet is intended to function as a checklist of the most important areas to consider when researching a PLC. Use the following guidelines for completing the checklist:

Determine whether your system is new or existing: Will your system be installed from scratch or are there existing products already installed that the rest of your system will need to be compatible with?

Why this is important: Certain PLC products are not compatible with others. Making sure your existing products are compatible with any PLC products you are researching will save you time and money.

Define any environmental issues that will effect your application: Are there specific environmental issues that will effect your application such as temperature, dust, vibration, codes specific to your facility, etc.?

Why this is important: Certain environments may affect the operation of a PLC. For example, typical PLCs have an operating temperature of 0 to 60 degrees Celsius. If your application will include any extreme environmental conditions, or you have specific codes at your facility that must be met, you will need to research products that meet those specifications, or design the installation to meet those requirements.

Determine how many discrete and analog devices your system will have: How many discrete and analog devices will you have? Which types, such as AC, DC, 4-20mA or 0-10V, are needed?

Why this is important: The number and type of devices your system will include is directly linked to the amount of I/O that will be necessary for your system. You will need to choose a PLC model that supports your I/O count requirements and has modules that support your signal types.

Determine whether your system will require any specialty features: Will your application require high-speed counting or positioning? What about Ethernet communications or other specialty feature?

Why this is important: Specialty functions are not necessarily available using standard I/O modules. Planning ahead to determine whether or not your application will require any features such as these will help you determine whether or not you will need to purchase additional specialty modules for your system.

Determine the type of CPU you will need: How much memory does your system require? How many devices will your system have, which determines data memory size? How large will your program be, and what types of instructions will your program include, which determines program memory size?

Why this is important: Data memory refers to the amount of memory needed for dynamic data manipulation and storage in the system. For example, counter and timer instructions typically use data memory to store setpoints, current values, and other internal flags. If the application requires historical data retention, such as measured device values over a long period of time, the size of the data tables required may determine the CPU model you choose. Program memory is the amount of memory needed to store the sequence of PLC program instructions that have been programmed to perform the application. Each type of instruction requires a specific amount of program memory, typically defined in a PLC's programming manual. Applications that are basically sequential in nature can rely on the I/O device rule of thumb to estimate program memory; complex applications will be more difficult to judge.

Determine where your I/O will be located: Will your system require only local I/O, or both local and remote I/O locations?

Why this is important: If subsystems will be needed at long distances from the CPU, you will need a PLC model that supports remote I/O. You will also have to determine if the remote distances and speeds supported by the PLC will be adequate for your application.

Determine your communication requirements: Will your system be communicating to other networks or systems?

Why this is important: Network communication ports are not necessarily included with a PLC. Knowing ahead of time whether or not your system will be communicating with other systems will help you choose a CPU that supports your communication requirements, or additional communication modules if necessary.

Determine your programming requirements: Does your application require only traditional programming instructions, or are special instructions necessary?

Why this is important: Certain PLCs may not support every type of instruction. You will need to choose a PLC that supports all instructions that you may need for a specific application. For example, built-in PID functions are much easier to use than writing your own code to perform closed-loop process control.

What now?

Once you have recorded the information on the worksheet and determined your requirements, use this sheet to find a PLC that meets your requirements. With your requirements outlined, it will be much simpler to find a product with the necessary number of I/O points, features, memory, etc. that your application requires.

For information on selecting an AutomationDirect *Direct*LOGIC PLC, see our *Direct*LOGIC PLC Selection Guide located on the AutomationDirect Technical Support Web site.

Considerations for Choosing a PLC

Consideration	Information to Record		Notes
1. Proposed system	____ New system	____ Existing system	(Your choice of PLC manufacturers may be limited by an existing system)
2. Environmental issues	____ Codes/environmental issues to consider	____ No codes or environmental issues to consider	(Codes or environmental issues may affect the choice of PLC)
3. Discrete devices	___ Inputs: ___ AC ___ DC	___ Outputs: ___ AC ___ DC	(Enter quantities and type based on corresponding field devices)
4. Analog devices	___ Inputs: ___ Voltage ___ Current ___ Temperature	___ Outputs: ___ Voltage ___ Current	(Enter quantities and type based on corresponding field devices)
5. Specialty modules or features (application-specific)	___ High speed counter ___ Positioning ___ Servo/stepper ___ BASIC programming	___ Real-time clock ___ Others (list below)	(Specialty modules may have to be considered if needed features are not available on the chosen PLC's CPU)
6. CPU required	___ K program memory	___ K data memory	(Rules of thumb: 10 bytes of program memory for each discrete device and 25 bytes for each analog device)
7. I/O locations	___ Local	___ Remote	(Enter number of physical locations needed for each)
8. Communications requirements	___ ASCII (interface to serial devices like bar code readers, labelers, etc.) ___ PLC to PLC (proprietary among models of same manufacturer) ___ Specific protocols: ___ Ethernet ___ DeviceNet ___ Profibus ___ Modbus RTU		(Communications requirements should be considered if you think your system will be communicating to other systems/networks)
9. Programming requirements	___ Floating point math ___ PID ___ IEC-1131 languages	___ Others (list below)	(Typical instructions like timers, counters, etc. are available in most PLCs; note any other special instructions here)

FYI

Training Tools

Training Tools for AutomationDirect Product Users

by Keri Schieber,
AutomationDirect

As companies continue to increase employee responsibilities and less time is available for away-from-the-office training and seminars, the Internet has become a valuable tool for training and information gathering. With live Web seminars, online classes, video tutorials and many other resources, it's easy to find information on almost any subject you can think of.

At AutomationDirect, we offer a wide array of Internet learning tools such as the Technical Support section of the automationdirect.com site, live and recorded Web seminars, and the new Learn.automationdirect.com site. There are even Web sites devoted to specific products, including *C-more*, *C-more* Micro, *DURA*PULSE and *Sure*Servo, loaded with product information and technical data. These sites are easily accessible by going to the automationdirect.com home page and selecting one of the topics located in the left column.

Technical Support Web Site

A vast amount of information can be found on our Technical Support site, accessed from the home page of our main site, or directly at http://support.automationdirect.com. Major categories include Application Notes, Frequently Asked Questions, Wiring Diagrams, Example Programs, and Software and Firmware Upgrades. A Customer Forum allows anyone to post questions or responses pertaining to AutomationDirect products. The forum has four categories: General Applications, Communications, Operator Interface, and ACDrives/Steppers/Servo Applications. It's a great way to share knowledge, but keep in mind the responses are from all users who log on, not necessarily an authorized AutomationDirect representative.

Application Notes: Application notes are presented in either a PDF, HTML, Flash animation, MS PowerPoint or MS Excel format. Application notes include such topics as "*Direct*LOGIC CPU Communication Port Setup Parameters", "Encoder and PLC Compatibility", "GS Series Drives PID Tuning with GSOFT Software PID Utility", and over 150 other topics.

Frequently Asked Questions: Need an answer to a question on a product? Check out the Frequently Asked Questions (FAQ) section of the Technical Support site, which has nearly 1,000 questions and answers. The FAQs are the result of collecting customers queries from emails and phone calls. All queries are entered into the Technical Support database and the FAQs are generated from there. FAQs are categorized by product type to make it easy to find a topic. A typical FAQ might be "What is the maximum tolerable inrush for relay outputs on the DL06 AC units?" or "Can the contactors/starters be used for DC motors?" and so on. If you think you have a good FAQ and would like to have it posted, send an email to the Tech team.

Wiring Diagrams: If you are looking for information on how to connect communication cables, sensors or other devices, then you need wiring diagrams. Instructions and diagrams can be found in two locations: 1) drill down into the Technical and Application Notes, or 2) select the Cable Wiring Diagrams topic located below the Technical and Application Notes. Cable wiring diagrams are categorized into five sections: PLC Hardware, Operator Interface, Connection Systems, Sensors, and Drives. Typical diagrams include "Connecting Encoders to the D2-CTRINT High-speed Module", "Wiring Diagram and Color Codes for *ZIP*Link Pigtail Cables", and "Wiring Diagram for NPN and PNP Sensors with the D2-16ND3-2 I/O Module". If you can't find what you're looking for in the Cable Wiring Diagrams, try looking in the Application Notes.

Example Programs: Sometimes it's easier to start with a tried-and-true ladder program than to create one from scratch. It can be a time-saver to use one of the example programs from the Tech site. Examples range from a simple program that adjusts the PLC clock to account for Daylight Savings Time, to combining straight velocity and accel/decel profiles in Mode 30 of the D2-CTRINT high-speed module. There are over 30 programs available.

Firmware and Software Upgrades: AutomationDirect ships only the latest versions of firmware and software with their products. But if you have an existing product to which you would like to add a new feature or an improvement, it's easy to upgrade by downloading the latest firmware or software from the Tech site. Be sure to follow all instructions for proper downloading and installation.

There are several more tools available on the Technical Support site. Go to:

http://support.automationdirect.com

for the complete listing.

Web Seminars

AutomationDirect has been hosting Web seminars since 2003. Seminars are available on topics such as communications, PLC programming software, operator panels, sensors and more.

The presentations must be viewed from a PC and attendees must register to reserve a seat for the live seminars. Once registered, they log in at the specified date and time to attend the live broadcast. Most presentations last from 40 minutes to one hour, followed by a question and answer period with a product expert. The seminars are also recorded and made available for viewing at any time. Some of the more recent seminars topics are *C-more* Touch Panels, *C-more* Micro Graphic Panels and *Direct*SOFT5. To view topics which are currently being presented or the list of pre-recorded seminars, go to http://automationdirect.raindance.com.

Learn.automationdirect.com

Learn.automationdirect.com is an online tutorial site offering training and information on a wide range of automation products. Available topics range from "Selecting a PLC" to "Building a Combination Manual Motor Starter". Typically, the presentations are divided into several short sections so the viewer can watch a specific segment without having to view the whole presentation.

Other key features of the site include links to the AutomationDirect.com site and product selectors for choosing the correct product in categories such as touch panels, power supplies, proximity sensors and AC motors.

Below each streaming video window is a banner pertaining to the product group being viewed. The banner has links to additional product information.

Next to the banner are one or more links to Automation NOTEBOOK articles as they relate to each product group.

At the bottom of each page, there are more links to Technical support, forums, upcoming Web seminars and more.

New presentations will be added on an ongoing basis; be sure to check back regularly to see what new topics have been posted.

Hands-on Training Classes across the U.S.

Don't have enough time, or the inclination, to search the Web but still need some in-depth training on AutomationDirect PLCs? Then you'll want to contact Mr. Doug Bell with Interconnecting Automation (ICA).

Doug has been in the industrial automation industry for over 20 years and has been instructing classes on AutomationDirect products for over 10 years. Doug's PLC classes offer introductory and advanced topics, and emphasize hands-on training.

Doug believes there's no better way to learn PLC programming than to dig in and start programming. In his classes you will learn how to configure, specify, program and troubleshoot a PLC control system. Each workstation has an actual PLC with functional inputs and outputs. Programming examples reflect real-world situations that will keep you interested throughout the entire course.

If you prefer do-it-yourself training, Doug offers PLC and analog I/O training kits. The kits include hardware and a choice of VHS or DVD videos.

Another class offered through Interconnecting Automation is PID, instructed by Doug Bell and Cecil Smith. This is an intense class devoted specifically to the PID function.

The most recent course addition is an AC Drives class, instructed by David Cavanaugh. David has an extensive background in gas turbine systems and specializes in eddy-current and adjustable frequency drives and soft starters. In this class you will learn the fundamentals of AC induction motors, study variable frequency drive (VFD) basics and learn how motors operate with VFDs. You will also cover maintenance and troubleshooting techniques.

Not enough time to travel to one of Interconnecting Automation's training courses? No problem, because IA offers onsite training as well.

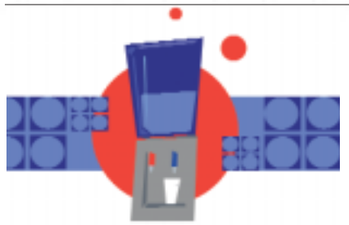
For more information, visit www.interconnectingautomation.com.

"Computers make it easier to do a lot of things, but most of the things they make it easier to do don't need to be done."

– Andy Rooney

The Break Room

stories and Brainteasers



Flag...Christmas tree...Flag

by Keri Schieber
AutomationDirect

AutomationDirect.com Inc., Headquarters Christmas 2006

In 2002, AutomationDirect erected a 100 foot tall stainless steel flag pole to show our support for our country. A 30 foot by 60 foot flag was raised to wave beautifully at all the passersby. Over the years, we've received letters from some of those passersby telling us how inspiring it is to see the flag and our patriotism. We've even had some of them stop by to thank us personally.

The flagpole, which has become a focal point when assembling for holiday celebrations, such as Memorial Day, Fourth of July and Veteran's Day, has found another use as well. During the Christmas season, the flag is carefully stored away, and long strands of Christmas lights are attached to the pole in Maypole fashion. Being in the automation industry, we couldn't let the lights just sit there all aglow. We put our PLCs and other products to use and created a musical light show.

The first few years we used 32 strands of lights, with 3,250 green and 3,250 white incandescent bulbs, with cables and wires totaling over 3 miles in length. When illuminated, they consumed as much as 46,000 watts of power. In fact, the power company had to install an additional power transformer near the tree to handle the demand.

In 2006, we switched to LED bulbs, using 3,250 of each in red, green, white and blue. There are now 64 strands totaling over 7 miles of cables and wires. Since LEDs draw less current, we are using less energy than the previous design. The tree is topped with a man-sized star. Also, some of the outdoor lights located on the building near the tree have been replaced with colored LED lights.

As a final touch, we place a life-size hand painted fiberglass manger scene at the base of the tree each year. Year after year, the manger scene is the subject of many letters of appreciation from our neighbors.

At the annual company Christmas event, employees and their families gather around the flagpole Christmas tree, each holding a battery-illuminated candle. The Christmas tree lights begin to blink, the music begins to play, and the tree comes to life. This past season the show was synchronized to "Carol of the Bells" by Mannheim Steamroller. This annual event adds a special dimension to everyone's holiday season.

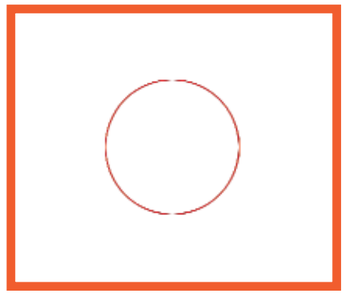
After the New Year arrives, the lights are taken down and the flag is returned to its honorary position, until the next Christmas season.

To view the 2006 musical light show, click on the "MORE" section at:

http://learn.automationdirect.com.

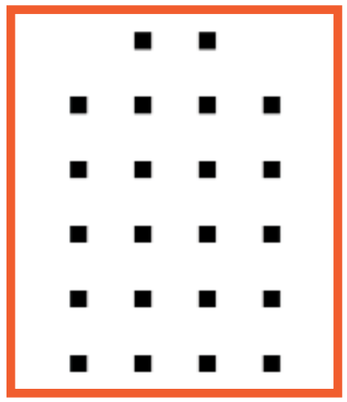
Brainteasers

1. What's the largest US coin that can pass through a hole cut in a piece of paper that is exactly this size without tearing the paper? *This circle can be re-created by cutting a hole the size of a nickel (0.835 inches in diameter) in a piece of paper.*



2. Can you grasp a handkerchief by two opposing corners and tie a single knot in the center without letting go of either end?

3. The machine shop in Puzlandia currently has 22 machine tools on the shop floor arranged as shown below (top view). The shop foreman wants to re-arrange the machines into rows of four to increase the efficiency of the shop. How many rows of four can you provide given that he will only allow you to move six of the machines? He claims he can achieve 19 rows of four. Can you find a way to re-position just six of the machines and get 20 rows of four machines?



Please visit **www.automationnotebook.com** for answers to brainteasers.