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Automation

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Special Issue

 AUTOMATIONDIRECT.com

June 15, 2004

Welcome to the premier issue of Automation Notebook by AutomationDirect. We are expanding our current newsletter into a quarterly publication delivering even more information of interest to our readers. Inside you will find topics on what's new here at AutomationDirect, as well as product information and application stories. We have guest columnists reporting on industry technology, business news, and hot topics that appear on our own website technical forum.

If you would like to pass along subscription information to a co-worker, please refer to the back of the magazine for details. We look forward to your feedback and hope that you will communicate any comments to editor@automationnotebook.com.

Best Regards,

Tina Crowe
Publisher



Technology Brief

HMI and Connectivity

Feature Story

“Learn it on the Web!”

Your guide to practical products, technologies and applications

Automation NOTEBOOKTM

Summer 2004

Inaugural issue

Cover Story

Which control choice is right for you?

PLC/PC/Custom



New Product Focus

AC drive and motor lines
up to 100 hp offer big savings
when purchased together

Technology Brief

HMI and Connectivity

Feature Story

"Learn it on the Web!"

Automation NOTEBOOK™

Your guide to practical products, technologies and applications

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Editor's Note

Hello and welcome to the inaugural issue of AutomationDirect's magazine publication, Automation Notebook, your guide to practical products, technologies and applications. We have outgrown our newsletter, The Insider, so you will be receiving this magazine in its place. In this issue you will find informative articles, technical columns, insider news, and a bit of wit and humor.

Having been a part of AutomationDirect since 1995, I just have to tell you how excited I am about what has happened the past nine years. Some of you may remember back to our earlier days when we were PLCDirect. That's when our offering consisted of PLCs and a few operator interface panels. Then in 1999, after listening to what our customers were asking, we expanded our offering to include a vast array of industrial control products, opened our ecommerce store and became who we are today, AutomationDirect.

This year we are celebrating our 10 year anniversary and want to extend our appreciation to all of our dedicated customers who helped AutomationDirect get here.

I hope you will enjoy our magazine and be sure to send us any comments or suggestions you may have.

Keri Schieber

Keri Schieber

Managing Editor

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AUTOMATIONDIRECT is committed to bringing you the best automation products at prices that won't break your budget, backed by superior technical support and highly efficient business operations. It all adds up to the best value in automation today.

1 Award winning products
 AUTOMATIONDIRECT offers over 5,000 industrial automation products for your electrical control system, including PLCs, operator interfaces, AC drives, sensors, motor controls, pushbuttons, connection systems, enclosures and more. We have won **Editors' Choice Awards** from Control Engineering magazine for products such as our DL06 micro PLC.

2 Best prices every day
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3 Voted #1 for customer service
 AUTOMATIONDIRECT has been voted **#1 in service** again. For a **third year in a row**, our service was voted #1 in the latest Control Design magazine Reader's Choice survey.

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 We can take your order as late as 4 p.m. EST and ship it the same day. (For in-stock orders with approved credit. Does not include some enclosures, AC drives over 40 hp and larger motors.)

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New Product Focus

what's New



New AC drive and motor lines up to 100 hp offer big savings when purchased together

by Jennifer Gerborg
Senior Editor

AutomationDirect recently released the custom-built *DURAPULSE™* drives line, and announced a partnership with Marathon Electric® to offer a wide range of Marathon's vector and inverter-duty motors. These new drives and motors are available up to 100 hp and, when purchased in approved combinations, feature some of the lowest prices in the industry.

The new *DURAPULSE™* series of sensorless vector AC drives builds on the simplicity and flexibility of AutomationDirect's GS1 and GS2 series drives. *DURAPULSE™* drives are available in 1 to 100 hp models and offer sensorless vector and autotuning, as well as optional encoder feedback for closed-loop speed control.

Also featured are automatic torque and slip compensation, an internal dynamic braking circuit for models under 20 hp and programmable jog speed. *DURAPULSE™* drives provide three analog inputs (0-10 VDC, -10 to +10 VDC or 4-20 mA), 16 preset speeds, 11 programmable digital inputs, four programmable outputs (three digital and one relay) and one analog output. Default values were carefully selected so the drives run "out of the box" for most applications, with default values set for the U.S. industrial market.

DURAPULSE™ series drives have a removable keypad for programming parameters. The keypad features real language parameter groupings, can store up to four different application programs for any *DURAPULSE™* model and can be remotely mounted for easy access to data and parameters. Configuration settings are a superset of the GS series, so programming for the same parameters is identical across all drive lines. The digital keypad includes a two line x 16 character LCD display, five status LED indicators, and nine function keys. The keypad is designed with defaults for the North American customer and



allows you to configure the drive, set the speed, start and stop the drive, and monitor critical parameters for your application.

Open serial communications are available with a standard RS-485 MODBUS serial interface, which offers communications up to 38.4 K baud. An Ethernet option, available through the use of AutomationDirect's GS-EDRV Ethernet module, allows access parameters via MODBUS TCP/IP or a built-in Web server. The Ethernet option can be combined with AutomationDirect's KEPDirect EBC I/O server to connect the drives to any OPC client.

For PC-based drive configuration and maintenance, the GSoft Windows-based programming package, available for \$50, can be used with the *DURAPULSE™* drives. GSoft features a drive setup wizard, PID tuning screens and a schematic view of the drive with external connections that can visually lead the user through drive setup. The schematic view can be printed, which will give a hard copy of the completed drive setup with parameters, which can then be posted near the equipment installation.

DURAPULSE™ drives are UL and CE listed and come with a two-year replacement warranty. Prices range from \$289 to \$3,999.

The Marathon Electric motor lines have been carefully selected to be performance-matched with the *DURAPULSE™* and GS series AC drives. The offering includes models ranging from 1/4 hp to 100 hp, that feature dual 230/460 VAC voltages and a base speed of 1800 RPM. Models are available from several different lines: The microMAX™ motors (1/4 to 10 hp) are ideal replacements for PMDC (permanent magnet DC) systems, since no brushes or commutator changes are needed. The motors also



offer dual mounting options, C-face rigid base and C-face round body, cooler running and lighter weight design, allowing an easy transition from PMDC. The microMAX™ motors also feature top-mounted conduit boxes for easy wiring and installation. They range in price from \$99 to \$789.

Black Max® motors are designed for inverter or vector applications where up to a 1000:1 constant torque speed range is required. They are available from 1/4 to 30 hp. They feature Class F MAX GUARD insulation system, constant torque operation from 0 to base speed on vector drive and constant horsepower operation to twice the base RPM. Black Max® motors with DYNAPAR HS35 encoders are also available, in sizes from 1/4 to 30 hp. Black Max motors are priced from \$149 to \$2,369. Blue Max® 2000 vector-duty motors (40 to 100 hp) are designed for inverter or vector applications and also feature the Class H MAX GUARD insulation system. They offer constant horsepower operation to 1.5 times base RPM, as well as constant torque operation from 0 to base speed on vector drive, including TEFC (on V/Hz drives, TEFC motors are limited to 20:1 constant torque). Blue Max® motors range in price from \$2,999 to \$5,069.

Blue Chip XRI® inverter-duty motors are available from 40 to 100 hp and meet NEMA Premium® efficiencies. They feature 10:1 variable torque and 20:1 constant torque on VFD with 1.0 service factor. Blue Chip® motors offer Class F insulation and continuous duty at 40° C ambient. Blue Chip® motors range in price from \$1,819 to \$4,059.

All Marathon motors carry a 3-year warranty and meet all UL, CSA and NEMA requirements.

For users interested in purchasing performance-matched drive/motor combinations, significant discounts are available, making these packages some of the most cost-effective in the industry. For more information, contact AutomationDirect at 800-633-0405 or visit online at: www.automationdirect.com.

Product Snapshots

Press Releases



AutomationDirect now offers wire duct and accessories



Cumming, GA --- April 15, 2004 --- AutomationDirect® has added a line of wire duct and associated accessories. Rigid PVC wire duct features a wide finger design that provides greater rigidity and larger slot width. A non-slip flush cover (included) holds 10-12% more wires than traditional designs. Rigid wire duct is available in 2 meter lengths in dimensions from .5 x .625 to 6 x 4-inch, grey or white models, in packages of 1-24. Individual piece prices start at \$9. Flexible wire duct is ideal for wiring to cabinet doors, from control panels, and for electrical equipment. It can be easily bent and twisted without breaking and allows individual wires to be added or removed for applications that require frequent access to wiring. Flexible wire duct is available in grey or white and in 20 inch lengths in dimensions from .5 x .5 to 1.5 x 1.5 inches. Packages of 20, 36, 42, or 64 pieces are available, with prices starting at \$134.25. Completing the line are replacement wire duct covers and associated accessories, including duct separators, wire retainers, identification tags, mounting inserts, rivets and rivet tools, spiral wrap and braided sleeving.

AutomationDirect teams up with Cirronet to offer wireless modems

Cumming, GA --- April 15, 2004 --- AutomationDirect® and Cirronet™ Inc. have teamed up to offer Cirronet's wireless modems. A variety of wireless serial and Ethernet modems are available, along with associated antenna, cable, adapter and power plug



accessories. The new line of modems was designed specifically for the industrial automation market and employs Frequency Hopping Spread Spectrum (FHSS) radio transmission technology.

Two series of modems are available: The CR-HN series are versatile, 2.4 GHz FHSS serial radio modems. CR-HN radios are ideal for SCADA applications (as remote modems in multipoint configurations) and are a cost-effective solution for point-to-point installations. A DIN-rail mounted Serial Adapter Box, one of the major components of the CR-HN series, resides in the control panel while the NEMA 4X radio module is mounted externally to the control panel to achieve the best line-of-sight link to the other radio antennas in the system. For most

purposes, the CR-HN radio module incorporates an integral 6dB antenna, creating a "single piece" modem. CR-HN modems start at \$595.

CR-SE series Ethernet radios are based on the same patented technology as the CR-HN serial radios. CR-SE series are low-cost, 2.4 GHz FHSS wireless data modems. They provide long-range, high-speed wireless connectivity among Ethernet devices in industrial settings. CR-SE radios have exceptional multipath fade rejection, as well as immunity to jamming. Typical CR-SE applications include wireless industrial automation and data collection, network bridging, PLC networking and SCADA. CR-SE radios can function as



a high-speed bridge to a distant Ethernet network node, or a CR-SE radio base station can be connected to multiple remote CR-SE radios to build a wireless Ethernet network. The higher gain antennas increase the range up to five plus miles. All CR-SE models enable long-range connectivity far beyond cabled Ethernet maximums. CR-SE modems start at \$1,195.

Wireless data modems for networking hard-to-reach PLCs and remote devices

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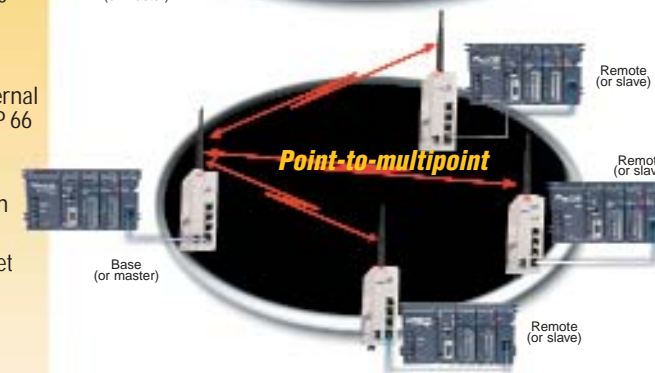


**CR-HN Series
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starting at \$595**

**CR-SE Series
Ethernet Radio Modem
starting at \$1,195**

AUTOMATIONDIRECT CR Series feature:

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- Frequency Skip feature that prevents interference with/from any co-located 802.11 wireless LANs
- Wide operating temperature range from -30 degrees Celcius to +70 Celcius
- Reliable data throughput using Cirronet's patented FHSS technology; assures reliable performance even in high-multipath and noisy RF environments. CRC error checking and ARQ (automatic repeat-request) schemes for auto-retransmission of bad packets assures errorless data reception
- Rugged packaging well suited to varied operating conditions; external radios are housed in NEMA 4X/IP 66 enclosures ideal for outdoor and harsh environments
- Long range with high speed (up to 1.23 Mbps total over-the-air bandwidth in point-to-point and multipoint applications), up to 1.5 miles (farther with high gain antenna)
- Easy-to-understand configuration tools for quick setup
- Fully programmable setup to meet specific site and performance requirements
- UL 2279 listed and CE marked



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AUTOMATIONDIRECT

Cover Story

PLC/PC/Custom

PLC, PC, or Custom- Which control choice is right for you?

by Paul Ruland,
AutomationDirect Product Manager

Choices and change are the only constants in control system technologies today. Current industrial controller products can no longer be classified by the internal design architecture they possess. More often than not, any type of modern controller uses some portion of Commercial Off The Shelf (COTS) technology in its CPU, operating system, memory, or data storage components.

Previously, the lines that separated Programmable Logic Controllers (PLCs), PC, and custom control systems were easily identified. With the movement toward embracing commercial technology in the heart of controller products, how do control system choices affect OEMs, end users, and the system integrators that serve both? Can choosing between PLCs, PC, and custom control systems make or break a project or an OEM's new machine design?

Are PLCs still the one?

In the last five to seven years, smaller PLCs have been introduced with significantly improved capabilities previously found only in larger PLCs. This recent increase in PLC features has been most noticeable in the nano and micro class of controllers, with such features as analog I/O, auto-tune PID, floating point math, motion control, multiple serial ports, and Ethernet and Internet connectivity, as well as several choices of device level networking and remote I/O options. PLC customers benefit greatly from this increased performance. For many applications, a much lower-cost micro or nano PLC will do the job that larger and more expensive PLCs did previously, and they can be installed in a much smaller panel for additional savings. Increased performance and added features in micro and nano PLCs

make the amount of local I/O the only significant lacking quality in comparison to larger PLCs.



DL205 Micro-modular PLC with Ethernet Communications

Industrial Technologies Solutions (ITS), a systems integrator in Columbus, OH, was faced with a project on a short timeline and with multiple repeat systems required. The application was to retrofit several automatic riveting machines with a more accurate and reliable control system, as well as increase operator diagnostics when compared to the 12-year old original CNC controller. ITS chose the DL205 micro-modular PLC with a D2-260 CPU and an H2-CTRIO high-speed counter pulse/output module, along with a 15-inch EZTouch panel for the operator interface. Brian Engle, ITS Design Engineer says, "The DL205 system provided the necessary motion control interface to the servo drives, along with enough CPU memory to facilitate extensive operator diagnostics and recipe management functions, all at an unbeatable price. We received the complete PLC system in days and were able to install, fully program, and debug the first machine, then deploy the same system and program to additional machines all within our four week time period."

There's no doubt the days of "control-only" PLCs are numbered. The modern PLC, incorporating many PC capabilities, including Ethernet interfaces and TCP/IP based protocols, multiple serial ports, removable memory cartridges and even integrated LCD screens, has now moved the PLC into the role of "Control and Information Center". Software is also making significant contributions to the evolution of PLCs with the availability of more

intuitive instruction sets, graphical configuration of I/O and networked devices, and extended diagnostics and alarming capabilities, enabling HMIs and other data publishing devices to become more integrated into the PLC architecture. Advancements in small footprint microprocessors and the acceptance of flash ROM memory have allowed the introduction of a new breed of specialty module. These modules, best suited for specific applications such as high-speed counting or motion control, are being designed as low-cost "microprocessors", capable of executing local logic asynchronous to the PLC CPU scan, yet providing an improved cohesiveness between software and hardware through the benefits of Microsoft Windows-based point-and-click configuration utilities. With all these advancements in PLC computing technology and network connectivity, PLCs should quickly shed the stigma of being a "silent black box".

PC control: when the data is as important as the control

Data handling capability within a control system is one of the top emerging requirements for new industrial control applications. With the economic pressures on manufacturers to be more productive and efficient with less resources and personnel, real-time statistical data is essential for making optimal process or machine adjustment decisions. PC control can often satisfy both the need for fast sophisticated data handling, along with process or sequential functions for control.

Today, PC control can provide almost all the capabilities PLC or Custom Control solutions can, along with additional data handling and extended connectivity into enterprise systems. The strengths of PC control are mainly in the areas of database connectivity, complex math functions, data storage, networked and fieldbus support, and alternate programming choices. Most PC control packages are far superior in exchanging data with SQL and ODBC enterprise systems. This benefits

many customers who base their manufacturing scheduling on ERP (Enterprise Resource Planning) applications and who require the control system to respond to data changes in real time. Additionally, PC control systems often have one tag database for all control, HMI, motion, vision, and networked I/O functions, so any changes or additions to the tag database are instantly updated and available for all control system functions. Finally, PC control offers many alternate programming choices beyond the traditional ladder and function blocks for PLCs or the embedded VB, C or assembly language for custom control systems. Flowchart programming is very popular because of the adaptability of common system design flowcharts, which are included in many system proposals to describe sequence of operation and can easily be transferred into the actual control program.



PC-Control with Entivity Studio Software - courtesy of Sorrento Electronics

One example of PC control meeting customer needs is a material handling application by Sorrento Electronics, that loads tanker trucks and rail cars with bulk products such as gasoline, chemicals, asphalt and fertilizer. The system manages transactions, inventory and credit for metered and weighed product at distribution centers worldwide. Sorrento chose PC-based control, using Entivity Studio software combined with DL205 Ethernet I/O, because of the

software's flexibility and I/O networking abilities, as well as the integrated, easy-to-use HMI. According to Ladislao Kalmare, Sorrento's design engineer, the major benefit of using Studio was its flowchart programming. "Since we develop flowcharts as part of our normal programming process, we had no trouble adopting Studio's flowchart programming and we didn't need to take time to translate the flowcharts to a programming language. We chose the DL205 Ethernet I/O hardware because it was the only one that had a high-speed counter module at the time," says Kalmare.

Although it may appear that PC control is the silver bullet for all control needs, under many circumstances it may come at a slight premium in price. But, if an application meets the requirements for PC control and a PC is already an essential component in the system, the

benefits of PC control may also result in a cost savings.

Custom control: special needs for special applications

Embedded or custom control designs are still the most popular for industrial control OEM machine applications in terms of the number of unit placements. This is both because the definition of a custom controller is all-encompassing and subjective, and

custom controllers are most often used in high volume system applications. The cost benefits of engineering a custom Printed Circuit Board (PCB) with CPU, communications and onboard I/O often are not realized in any application below several hundred units, and sometimes only above several thousand units.

Custom control applications implemented by AutomationDirect customers usually involve a specialized Single Board Controller (SBC) or a custom industrial hardened PC controller with a deterministic operating system running an application developed in C/C++/C# or another high-level language. These systems are often applied to high-speed discrete control applications for material handling or motion control. One of the biggest decisions in developing custom control applications is whether the I/O will be integrated into the SBC design, or whether it will be networked. Several customers have chosen networked I/O for cost reasons in low to medium volume applications. Ethernet is typically used because of its ability to be distributed closer to connected devices, and because of the advanced capabilities available in Ethernet SDK (Software Development Kit) tools, which allow for custom protocols to be easily developed.

What's next?

The future of control system choices will continue to be interesting to say the least. Prices will continue to fall, and customers will truly benefit when it comes to selecting best-in-class products that provide interoperability. This should eliminate basing a control system buying decision on one control architecture, or one network protocol available from only one specific vendor, who may have desired features and prices for some products, but deficient features and artificially inflated prices for others. Although many suppliers will be faced with significant market and technology challenges, customer-driven suppliers will find ways to either offer great value-added services and solutions, or low-overhead, best-value products shipped the same day. In the end, the customer is the winner.

Business Notes

Goings on in the Automation Industry



From Conference Board.org

The Institute for Supply Management publishes a monthly survey of purchasing and supply managers regarding the activity in the manufacturing sector. According to their index, the manufacturing sector was recovering through March and this survey is likely to show more of the same results for April and May. "With both investment growth and inventory rebuilding, a drop off in ordering is unlikely."

Automation Systems Integrators strive to thrive

With many manufacturing and process facilities reducing their in-house engineering staff, outsourcing automation project design and implementation is more necessary, and there is more competition for those service dollars. One trend has been for large controls suppliers to expand their integration services to bid on projects they might not otherwise have considered in the past. This move has put those suppliers in direct competition with systems integrators that may have been their loyal hardware and software customers for years. (See March 2003 Control magazine, "SIs in the Crosshairs" by Dan Hebert.) Alliances of independent integrators have formed to assist their members in remaining competitive against a growing number of participants in the integration business.

The Control and Information System Integrators Association (CSIA) is the largest organization in North America for independent control system integrators (see www.controls.org). Similar to a professional society, CSIA has sought to help improve integrators' performance in all aspects of business and project management. The CSIA's Best Practices and Benchmarks Program developed performance standards and industry benchmarks, set measurement criteria and established procedures for self-evaluation. A CSIA certification assures customers of a high level of service from any member company.

Another approach has been to connect formerly unrelated integrators to create a quasi-national service group. Automation Alliance Group is a group of ten CSIA members located throughout the nation that offer a wide range of competencies in various industries (www.automationalliance.net). By combining their knowledge and purchasing power, they can offer customers a well-engineered, cost-effective solution while providing local service. (See April 2004 Control Engineering magazine, "Why System Integrators Consolidate" by Vance VanDoren.)

While there are trends toward mergers and alliances, there are still hundreds of local and regional integrators whose success may increasingly depend on maintaining strong ties with their best customers, expanding the range of services they can offer to keep their business captive. If a customer knows their integrator is truly acting as a business partner with the user's best interests in mind, the relationship is much more likely to remain impervious to competing service providers.

Control Engineering magazine launches new online Resource Center

Oakbrook, IL - To help engineering professionals improve productivity and reduce costs, Control Engineering magazine has launched its new online Resource Center. The Web-based center allows subscribers to customize data for their specific control, automation and instrumentation needs. The Resource Center's main components include searchable databases such as customer service from which users can gauge readers' satisfaction with specific vendors and products, product and industry research studies, how-to articles about specific applications, tutorials, and white papers, training references and eBooks. Visit the site at <http://resource.controleng.com>.

User Solutions

Application Stories

Control system combines off-the-shelf components with Terminator I/O for complex turbine generator applications

by Ernesto Colon,
Vice President and Start Up/Controls
Engineer for TDS



"TDS uses Automation Direct's Terminator I/O field I/O modules in their TurboNet DASH 1 system."

Turbine Diagnostics Systems (TDS) is a power generation field service company that provides industrial, utility, independent power producers, and municipality power generation systems for turbine generator applications. The company's TurboNet DASH 1® Control System is a complete DCS-structured turbine generator control system, developed to meet the needs of customers looking for a stable, "crash-free" system for turbine control. "Our Linux and LYNX OS operating platforms make our system much more stable than Windows-based systems, and offers a reliable, real-time operating environment," says John Todd, TurboNet Programmer for TDS.

The system includes a complete control panel, an Human Machine Interface (HMI) station, an optional Engineering Work Station (EWS), and Historian systems, supplying balance of plant and turbine controls in one

package. The system is easily adaptable to various size steam, mechanical drive, and gas turbine control applications, and, because of its compact design, is also suitable for retrofits and upgrades.

The TurboNet DASH 1 Control System hardware architecture incorporates off-the-shelf, readily available computer components (with the exception of three specialized I/O modules) to reduce ownership and maintenance costs. The power supplies are available in a redundant configuration using industry standard components, the control panel and HMI station are based on industry standard, x86 compatible microprocessors, and all monitors are industry standard LCD displays.

"The off-the-shelf-price of our components makes the TurboNet extremely cost effective for maintenance. The customer can afford to have a complete set of spare parts in stock," explains Brian Walsh, Senior Designer for TDS.

TDS uses Terminator field I/O modules from AutomationDirect, and has developed a protocol to communicate with redundant control processors via the Terminator I/O's Ethernet network interface. TDS uses all of the standard Terminator I/O modules and has developed low-density termination boards that, interposed between the I/O modules and the field I/O, provide suppression and fuse protection as required, as well as standard contact relays operated by the output modules. With three nodes of Terminator I/O modules, each individually powered and with separate Ethernet interfaces, the system is able to handle triple redundant field I/O. The hot-swappable I/O modules allow non-critical or critical redundant I/O to be changed online.

The control system scans the I/O and performs the control processing at a 20ms scan rate. The "hot standby" processor monitors the broadcast of the primary processor every 20ms and takes control after two failed primary

broadcasts in 50ms, allowing it to be in service on the third scan. The control processors interface with the HMI via the main data highway to provide data for monitoring and alarming, and to receive operator initiated control commands.

To handle the complexity of turbine generator control, TDS developed three specialized I/O modules in cooperation with AutomationDirect and their technology partner HOST Engineering that seamlessly interface into the standard Terminator bases and Ethernet network interfaces. These specialized I/O modules (an overspeed module, servo loop control module and a vibration module) are used for the control and protection of the turbine generator interfacing with devices typical of turbine generator industry standards.

Utilizing a high-speed Internet connection, the TurboNet DASH 1 control system can be accessed for control and maintenance from remote locations. Operators can perform control operations and access any historical data collected. Engineers can implement program changes, as well as monitor and troubleshoot the system online.

About Ernesto Colon

Ernesto Colon is the Vice President and Start Up/Controls Engineer for TDS. He obtained his B.S.M.E from Purdue University, and his experience includes time as a Field Engineer for GE. Colon designed and wrote the code for the TurboNet Dash 1 control system. For more information on TDS and the TurboNet DASH 1 control system, visit the company's Web site at:

<http://www.turbinedoctor.com>.

A Milestone Year



1994 Headquarters

This year marks the 10th anniversary of AutomationDirect. Even if you've been a longtime customer, you may not know the story behind the company, so here's a brief history: Tim Hohmann, founder and company captain of PLCDirect, established the company in January 1994 as the first entity within the Koyo Seiko group to concentrate on the small and micro PLC market. At its inception, PLCDirect consisted of a handful of people working out of a tiny leased building. The first catalog consisted of 200 pages featuring about 200 products. For the first five years, the company focused on practical ways to deliver quality PLCs to customers at typically half the price of competitors.



1994 1995 1996 1997 1998 1999 2001 2002

In 1996, the company moved into a new facility, and completed an expansion in March 1998. In April 1999, PLCDirect changed their name to AutomationDirect, added a host of electrical control products and launched an e-commerce site, www.automationdirect.com. By 2002, the catalog grew to over 1,300 pages featuring over 3,500 name brand and private label products.

AutomationDirect has frequently been on the cutting edge of technology. As PLCDirect, it was the first to offer Microsoft Windows-based PLC programming software with their DirectSOFT line. In 1998, the company became the first to offer a Microsoft Windows CE-based Programmable Logic Controller, the WinPLC™. And, in 1999, AutomationDirect's e-commerce store was the first to offer a full range of factory automation products available for purchase online.

Now, ten years after the inception of the company, the 2004 catalog features over 5,000 industrial control products, from PLCs to sensors, operator interfaces, enclosures, drives, motor controls, communication products, and more.

We extend a special thank you to all of our loyal customers who have made it possible for us to celebrate this 10 year milestone.

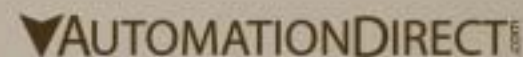
2004 Headquarters



2004 Catalog Available

If you are a current customer, you should have received our 2004 Volume 9 catalog. Over 1,500 new products have been added to the lineup, including radio modems, AC motors, a new line of sensorless vector AC drives, and new additions to many existing product lines, such as enclosures, sensors and relays.

If you haven't received your new catalog and would like to request one, call us at 800-633-0405 or order one online at <http://www.automationdirect.com/adc/CatalogRequest/CatalogRequest>

AUTOMATIONDIRECT®

Feature Story

Web Seminars

"Learn it on the Web!"

by Shane Crider,
AutomationDirect Online
Training Coordinator

The economy of the past three years has caused many businesses to exercise tighter control on their expenditures in areas such as travel to trade shows and expenses for training seminars or conferences. This comes at a time when it is more critical than ever for engineering and plant personnel to stay abreast of new products and technologies available for improving manufacturing processes. Concurrently, the Internet has become the number one source of information for those technical personnel with access to it. Its immediacy and abundance of accessible resources can accelerate the learning and purchasing processes for specifiers of automation equipment, which ultimately saves their company time and money.

One resource that is gaining widespread acceptance is Web-based training supplied by manufacturers and industry organizations such as the Instrumentation, Systems and Automation Society (ISA). The benefits of Web training include eliminating traveling time and expense to offsite locations, lower or no attendance fees, and the near-immediate availability of relevant topics, which reduces scheduling conflicts.

Web seminar technology

Most seminars are presented through a Web seminar hosting service to which the presenter has subscribed. Live Webcasts or seminars are events scheduled for a specific date and time, for which participants must register to obtain a "seat". Seminars may be free or can cost hundreds of dollars for more in-depth technical topics. These presentations are viewed from your PC, and typically require executable software needed to display the event (usually free to download from the Web seminar hosting service) and a separate telephone line or a sound card and computer speakers for the audio. After registering for an event, you receive the Internet URL address for the seminar site and a telephone number to access the audio portion. Once logged and dialed in, you can view and hear the presentation, and can ask questions via the phone line or a chat option in the seminar window. The presentation can be a simple series of slides, or may utilize animation or streaming video. Typical seminars last from 15 minutes to one hour, including questions and answers from the audience.

Seminars may also be available from the provider's site on an immediate basis by viewing a pre-recorded version streamed to your local PC. The benefit here is that you can view it when convenient, and as many times as desired. Of course, there is no real-time interaction with the "presenter" and any questions you have must be handled via an email or a phone call.

Types of Web seminars

Online seminars lend themselves best to technology briefs, product overviews, or a more detailed focus on one aspect of a topic. They can present material that might otherwise take an engineer days to gather, organize and study. Industry organizations tend to offer seminars on technical basics or emerging technologies and issues. According to www.isa.org, the Web site for the ISA, more than 12,000 manufacturing personnel participated in ISA Web seminars in 2003. The 90-minute seminars have covered a variety of technical topics and are led by ISA subject matter experts. Examples of topics include "Cyber Security Risk Assessment for Automation Systems", "Overview of FOUNDATION Fieldbus Technology", and "Boiler Control Fundamentals".

At www.manufacturing.net, the umbrella Web site for the Reed Business Group's collection of manufacturing-related publications (including Control Engineering, Modern Materials Handling and Plant Engineering), live Webcasts are broadcast periodically on topics such as "Radio Frequency Identification Systems: What You Need to Know to Get Started" and "Your Road Map for Project Management Success". These seminars are also archived for viewing at the user's convenience.

Supplier sites typically offer seminars that focus on product line overviews or application solutions using their products. For example, National Instruments, a large test and measurement equipment manufacturer, has an extensive schedule of seminars and interactive tutorials with titles such as "Essential Software Technologies for Automated Test" and



Figure 1 Results of key phrase search

"Automating Analog and Digital Measurements using LabVIEW 7.1". Emerson Process Management operates www.PlantWebUniversity.com, at which over 40 courses are available. The brief seminars cover topics such as selecting process automation networks, planning and implementing a fieldbus project, and streamlining maintenance. AutomationDirect's live Web seminars on automation



Figure 2 Schedule on AutomationDirect's Web Seminar site

products such as Ethernet-enabled PLCs, operator interfaces and data collection software offer the opportunity to get a product and application overview, as well as ask questions of the product manager or technical support specialist in attendance.

Finding the seminar you need

If there is a technical or product topic for which you hope to find a Web seminar available, you may have to do a little digging on the Internet to find it. Entering the key phrase "industrial automation seminars online" into the Search box at www.msn.com returns a listing of relevant sites (Figure 1), although not necessarily every possibility available. If you want to learn about a new technology, an industry site or professional organization site will have offerings on broad topics. For example, if you want to learn about Profibus, one of the open digital communications systems being used as a control and I/O network on the factory floor, you might go to www.profibus.com, where their "Training" section describes the online eLearning courses available on the bus' technical specifications and operation. At the www.automationtechies.com Web site, their "Resources and Tools" section offers links to training offered by equipment suppliers, training organizations and professional societies. If you have specific product research in mind, your best bet is to go to the supplier's Web site and search for "Web Seminars" or "Training". From the home page of www.automationdirect.com, clicking the "Web Seminars" link brings you to their training site, with a listing of upcoming live seminars, as well as access to pre-recorded presentations (Figure 2).

If an online seminar is not available on your desired subject, many of the same organizations mentioned in this article also offer CD-based training and regional in-person workshops that, while requiring a little more time and expense, can provide a more in-depth presentation as well as hands-on interaction.

Conclusion

Web seminars have greatly increased the speed with which engineers can gain knowledge on topics or issues that arise on the job. From learning about a new technology that may apply to a manufacturing process to choosing the best products to implement that process, online learning has become an important tool in improving an engineer's ability to make the best decisions that contribute to their company's success.

AutomationDirect offers both live and recorded seminars on a range of product and technology topics. Most live presentations last from 40 minutes to one hour, followed by a question and answer period with the product expert. See a typical schedule (below) or visit the event site at <http://automationdirectevents.webex.com> to see a full listing of seminars.

Web Seminar Schedule

for AutomationDirect

June 2004

6/16/2004 2PM
Promis-e Draw AutoCAD Schematic Software

6/24/2004 2PM
PC-based Control with Entivity's Think & Do Software

6/30/2004 2PM
Dataworx PLC Data Logging Software

July 2004

7/21/2004 2PM
DirectSOFT PLC Programming Software

Pre-recorded Seminars Available

Ethernet Communications with PLCs and HMI
PC-based Control with Entivity's Think & Do Software

Technology Brief

HMI Mobility



HMI's and PC Control: upwardly mobile with upscale connections

by Wayne Labs
Guest Writer

Remember when you had to be an artist to design HMI faceplates that resembled your process? Remember configuring your HMI software by filling in cryptic addresses and values, something resembling the Microsoft® Windows™ registry? Remember when your HMI was a dedicated system that only connected to a single process? Or when it was cool to analyze your trend data off line?

HMI today

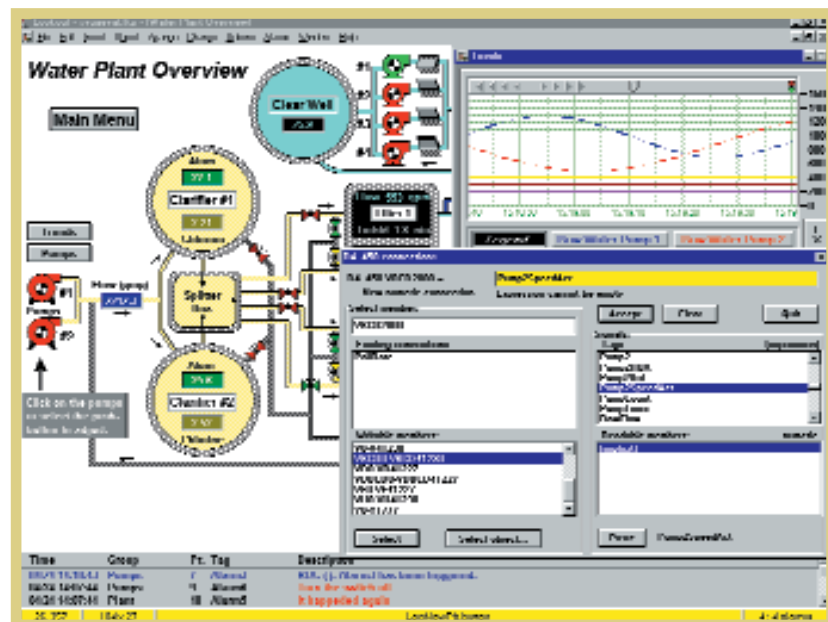
Times have changed. Today's HMI or PC control application doesn't interface to just one PLC in real time; it connects to several PLCs or motion/process controllers and hosts a real-time application embedded in the same machine, whatever the application demands. It monitors your process variables and keeps your process "in the window" at all times. Besides off-line trending, it does real-time trending, SPC, fault-monitoring, and much more. And while you watch your process on one screen, you can monitor it from a variety of multiplexed touch screen panels or remote screen terminals.

What makes all this possible? First are the features you've been asking HMI or PC control software vendors for all along. Second is TCP/IP networking. The days of Windows-based (dynamic data exchange) DDE over NetBIOS-

based proprietary networks are gone. TCP/IP, the transport medium of UNIX networks and the Internet, has become the number-one way of making your HMI process data available to you on any screen, anywhere in the enterprise, whether wired or wireless. Not only at the LAN/WAN level has TCP/IP become the norm, but it has become the key transport medium of choice for device-level networks as well.

For features to maintain maximum control over your process, to achieve consistent product quality and to

and sliders (often ActiveX controls) that allow operator input with the appropriate interface (touchscreen, mouse, tablet, etc.). The trend today is to use names (e.g., Liquor #1 Level) to connect these symbols or objects to real-world I/O points or calculated values in the system. Some HMIs let you create, copy and paste an object on other control screens. If you need to make a change to that object (e.g., it now represents Pump_2 instead of Pump_1), the HMI allows an automatic global change to all the Pump_1 objects in your application.



PC Control software with advanced HMI functions

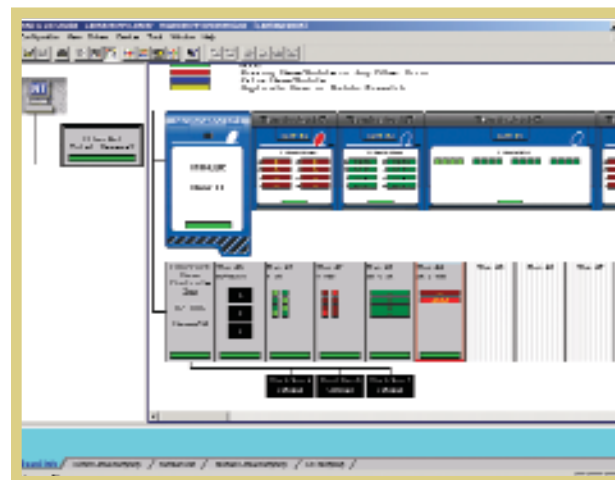
communicate your data to the enterprise, you'll need to look beyond the basic HMI software that may have come with your hardware.

Let's start with crafting your faceplate or control screen. Today most HMI or PC control provides a respectable library of scalable automation shapes or objects. You shouldn't have to draw anything, unless you enjoy fine-tuning your symbols. But these symbols aren't just "art." Instead they've become system objects capable of taking on process variables, changing in size or color to represent changes in pressure, flow, speed, level, etc. Today's libraries include clickable and touchable buttons

The HMI or PC control tag database provides an easy, tabular way of entering I/O points, engineering units, and/or process variables without writing "code." You can fill in I/O names and addresses, and with some HMI products, the software discovers the I/O you've connected to it, and generates an I/O network diagram. All you have to do is add in your real-world names to the tables, and the software takes care of the rest (address, data types, etc.) as you design your HMI panels.

Don't forget other tools that come in handy for the creation of your application. Flowcharts help you program motion and PID functions into your

system. Tree views (similar to Windows Explorer) show your system components at a glance. If your system allows



Entivity's software automatically identifies connected I/O

direct control as well, a unified or common development environment, such as those often provided in suites or studios, goes a long way toward simplifying programming. A run-time window makes it easy to check the results of your work, and simulation flowcharts let you test your system. The software should allow both historical and real-time trending as trending, charting and alarming modules allow you to keep tabs on your process. With some HMI or PC control products, you can purchase these modules separately, spending only what you need. Look for additional ActiveX®-based controls and module plug-ins (often third-party) that extend the usefulness of your HMI application.

Driving away drivers

If you speak to HMI product managers or R&D engineers, they'll tell you that too many man-years have been spent developing driver software for every known PLC, loop controller, vision system, etc., thus decreasing the amount of time and money available to develop new HMI features and functions. One way around this is to use Windows-based OLE for Process Control (OPC) clients and servers as the software communications medium. Think of OPC as a Windows

PostScript® printer driver or TWAIN driver. With these drivers in place, you can connect any PostScript printer or scanner (respectively) to your computer without the need for proprietary drivers. Look for OPC support (clients) in the HMI or PC control application that you purchase. Look for OPC support (servers) in any hardware that you buy. Chances are that if you can't find direct OPC support for a PLC or loop controller,

a third-party vendor such as Kepware (www.kepware.com) provides it. OPC support has even moved into the UNIX/Linux community, making it possible through Ethernet and TCP/IP to view your HMI virtually anywhere on any platform.

Networking and new functionality

In addition to OPC, many HMIs or PC control packages support Windows DCOM, Windows .NET and



DNA, SQL databases and sometimes DDE (older technology). With the new technologies, your HMI is no longer an island. It becomes a warehouse of information that can be viewed around the world and throughout your enterprise, where it's needed.

However, with this capability comes a few caveats. The first, of course, is security. If your system is no longer

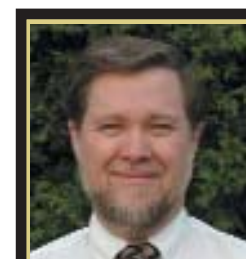
standalone, but networked, you need to be concerned. In addition to checking out firewalls and routers, make sure your HMI supports more than one level of password protection, and don't forget to use complex passwords.

If you're planning to use your HMI around the world, you may need to have local language support. With some HMIs, this is as easy as clicking a button to convert your HMI to Italian or French, complete with engineering unit changes if necessary. And the good news is, you won't have to redesign your faceplates.

Connecting with the enterprise

If you're connecting to the enterprise, you'll want your HMI or PC control application to be compatible with SQL-based databases and other systems such as Oracle® and IBM's DB2 products. You may want to scale up to a multiprocessor, distributed system. You may want to have alarms generate email messages, faxes, phone calls, pages, or multimedia displays.

We've just hit the high points here. Before you commit to a product, do some comparison shopping, get trial copies, and talk to system integrators and other users.



About Wayne Labs

Wayne Labs served as senior technical editor for 18 years with Control

Solutions International magazine (formerly Instrumentation & Control Systems) where he covered sensors, control system hardware and software, wireless and networking, embedded systems, HMI, and enterprise systems. His monthly column, "Software Upload/Download," discussed software issues including open source, security, applications, and networks. Before becoming an editor, Labs worked as a field engineer in wireless systems with GE.

Tech Thread

A Beginner's Guide to RLL Plus Programming

Jumping on the "stage" wagon

by Richard Palmer, AutomationDirect

The Technical Support Team at AutomationDirect receives a large number of calls on RLL Plus (Relay Ladder Logic Plus) programming, also known as "Stage" programming. Most of the callers want to understand how and when it should be used. The short answer to the "when" question is that it depends on the process that is being controlled. The "how" question will be answered later.

Stage is an advanced style of programming that is suitable for a moderately experienced programmer. A thorough knowledge of how the PLC scans the program is necessary to avoid complications. However, it is not a "different" language than RLL. It uses the same instruction set and is scanned in much the same way with a few exceptions.

RLL Plus or "Stage" programming is well suited to a process that has clearly defined "steps" or stages that will occur multiple times during the process. It is not suited for processes that are linear, and have poorly defined "steps". For example, making a batch of cookie dough might be a good use for Stage programming, while baking the cookies would not be, since baking only has one step (i.e., cooking the dough).

A good example to illustrate the use of Stage programming is a machine that mixes bread dough. A bread dough machine has several unique "steps" to create the final product. Some of those steps will be done more than one time throughout the process. As you can see in Figure 1, small portions of the standard RLL program are needed multiple times. For example, the mixer will be turned on and off many times throughout the program. It will always need the same alarms and safeties each time it operates. While you could

minimize the amount of ladder by paralleling contacts, it does make a program harder to read. By placing the startup, safety, alarm, and shutdown for the mixer all in one stage, you can enable the same code many times in the program and cut down on your programming time (Figure 2).

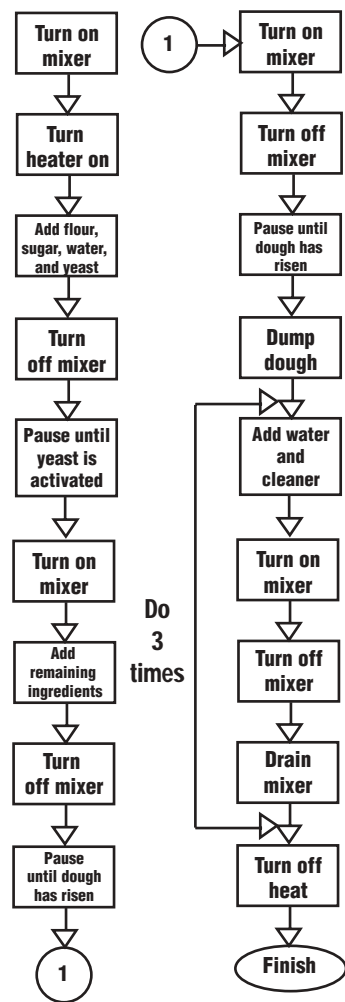


Figure 1 Flowchart example using standard RLL Programming

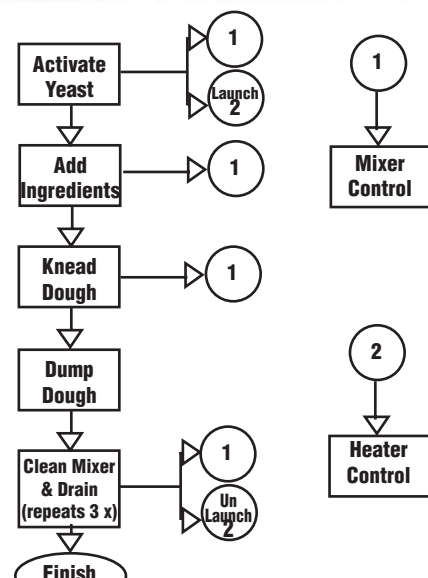


Figure 2 Flowchart example using stage programming

Stages are not like subroutines. They are scanned just as if they are regular ladder logic. The closest thing to a stage is a Master Control Relay. If the MCR is on, then the power rail is processed. If the MCR is off, then the power rail is skipped. Stages operate in much the same fashion. If the stage is enabled, the power rail has power and the logic is executed. If it is disabled, then all logic within that stage is skipped (not processed) because the power rail has no power.

There are three main behaviors to Stage programming:

- 1) When the stage bit is on, the corresponding stage is scanned and logic within that stage is evaluated and processed.
- 2) When the stage bit is transitioning from on to off, the corresponding stage will be scanned one more time to turn off all outputs that are currently on.
- 3) When the stage bit is off, the corresponding stage is not scanned and therefore no logic in that stage is evaluated or processed.

There are some caveats to be aware of with stage programming that concern turning stages on and off. These are detailed in AutomationDirect PLC user manuals, which can be purchased separately or downloaded from www.automationdirect.com.

Stage programming can save PLC memory and improve scan time by reducing the number of repeated sequences and by scanning only the stages that are active. These are two more good reasons to think about using stage programming, but they are not good reasons to use stage if the process is not suited for it.

Stage programming and standard RLL logic style programming can be intermixed by placing standard RLL at the beginning of the program, but usually there is no need to do this. A proper stage program will start with one or more initial stages and have numerous stages that will be turned on and off throughout the program cycle.

There are two ways to activate a stage: with a "Jump" instruction or by setting the stage bit. The Jump instruction deactivates the current stage while activating the specified stage. It does not jump over other code.

Setting the stage bit will activate the specified stage while leaving the current stage running as well. By using Set instructions you can have many stages active at one time.

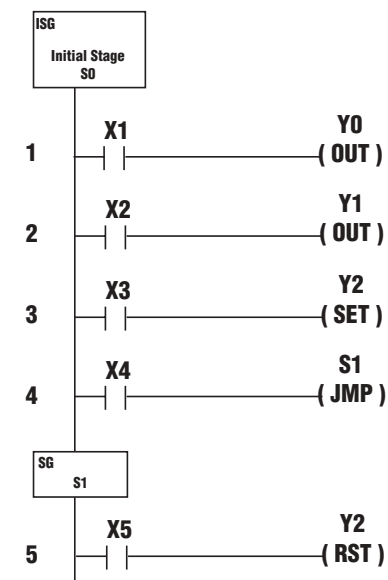
The Reset instruction works in much the same manner as the Set instruction. You can reset one stage or a whole group of stages at one time using the Reset instruction.

When exiting a stage, whether by jumping out of it or by resetting the stage bit, the stage will always finish scanning before turning the power rail off. When jumping out of the current stage, the current stage will be scanned one more time after the current scan is completed. This behavior can cause problems with some processes if it is not accounted for.

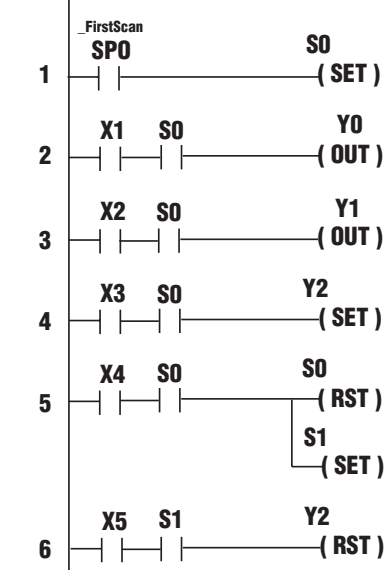
A stage is turned off by jumping out of it or by resetting it. All outputs, timers and counters, unless set, will be turned off. The simple explanation is that turning off a stage turns off the power rail. If there is no power, then the instructions are turned off. Timers and Out instructions, for example, rely on the power rail to maintain their state. Once power is removed, they turn off. This happens with other instructions as well.

The following examples show Stage programming and how Stage would look if using Standard RLL:

When ISG S0 is on, all ladder in the stage is active. When jumping to S1 (Stage 1), outputs Y0 & Y1 will turn off. Since output Y2 is SET, it will remain on until the RESET is activated in Stage 1.



This is one way to explain how stage works by using standard RLL. You would need an MCR (S0 or S1) in each rung.



Stage programming can certainly help organize a program, but it isn't always useful for every program. The key to help determine if Stage programming should be considered is, "Can this program be broken down into logical steps?" If you can answer "Yes" to that question, then learning Stage programming might help save you some time, both in program development and in execution speed.

Technical Review

A How-To Article

Connecting 3-wire sinking and sourcing devices to PLC input modules

by Keri Schieber, Managing Editor

When connecting a 3-wire field device to your PLC system, it is important to have a solid understanding of sinking (NPN) and sourcing (PNP) concepts.

First, sinking and sourcing are only associated with DC circuits. DC circuits can conduct current in one direction only. This means that it is possible to connect the external supply and field device to an I/O point with current trying to flow in the wrong direction. By understanding sinking and sourcing concepts, the supply and field devices can be connected correctly every time.

Be sure to pay close attention to what field device you are using. If a field device is a sinking (NPN) device, then the I/O module must have a sourcing input. There are some I/O modules that are sink/source I/O circuits. This means that the circuitry will allow current to flow in either direction. When using a sink/source I/O module, you should wire all I/O points with a shared common as only sinking or only sourcing.

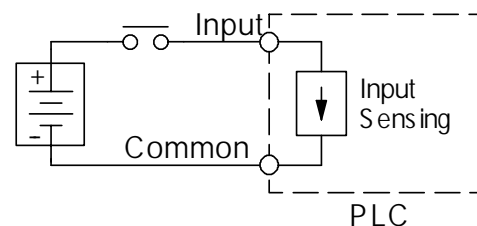
In the figures shown to the right, you will notice that the sinking PLC input module is connected so the input provides a path to supply common (-). So, starting at the PLC input terminal, follow through the input sensing circuit, exit at the common terminal, and connect the supply (-) to the common terminal. By adding the switch between the supply source (+) and the PLC input, the circuit is completed. Current flows in the direction of the arrow when the switch is closed.

NOTE:

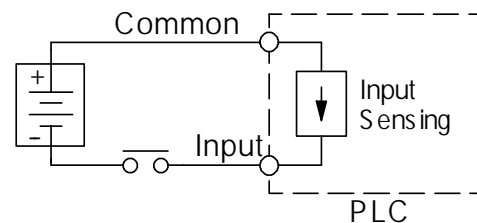
Sinking provides a path to supply common (-).

Sourcing supplies a path to supply source (+).

Sinking PLC Input Module



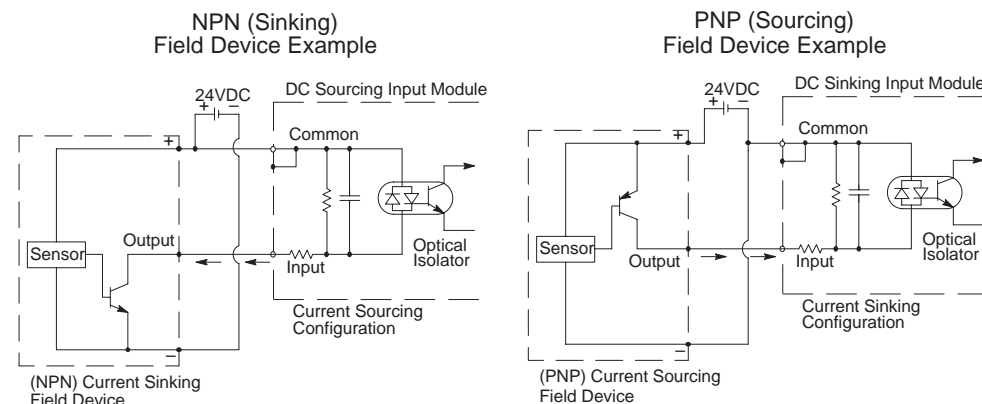
Sourcing PLC Input Module



Three-wire devices work in the same manner. The difference is that the 3-wire device has a supply source (+), supply common (-) and signal (output). In the diagrams below, for a PNP (sourcing) field device, the supply common (-) is connected to the field device common (-). The supply source (+) passes through the field device output into the PLC input (sinking), through the input sensing circuit, out the common terminal and to the supply common (-).

By following these guidelines, you should have a working circuit every time.

Field device examples - 3 wire connections



FYI

Conquering Challenging Applications

Decimal Point Manipulation Challenge

by Doug Bell, Interconnecting Automation

I think we've all been confronted with a challenging application at one time or another. In this particular instance, I was contacted by a customer asking for help with an application using a floating-point number that needed four decimal places. Even though the fourth decimal place was not being used, it had to have a value in it in order to make an ASCII string work properly to a remote device. The other part of the challenge was that the ASCII string would not work if there were more than four decimal places. The customer did not want to have to go through the stored ASCII to find the decimal point and to determine if there were more or less than four digits after it.

My challenge was to find an easy way to check whether or not a value was in the fourth position, add one if needed, and drop any decimal places greater than four. I was able to accomplish this in three rungs of logic using a CPU that using real math and bit-of-word programming instructions.

The first step was to take the real number with decimal places and make it a whole number by multiplying by a factor of 10,000 (real). Once I had a whole number, I converted it to a binary number to discard any extra decimal places. Then I converted it to a 32-bit binary coded decimal number (BCD). The purpose of using a BCD number is that I could look at the least significant nibble (LSN) of the word. The LSN represents the fourth digit in my decimal number.

Using the real number 26.37501, the conversion to BCD bit pattern would look as follows:

32-bit word (two 16-bit words V5000 & V5001)

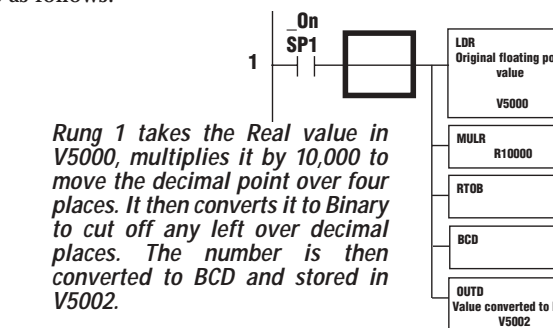
V5000				V5001			
0	0	2	6	3	7	5	0
bits 12-16	bits 8-11	bits 4-7	bits 0-3	bits 12-16	bits 8-11	bits 4-7	bits 0-3
0000	0000	0010	0110	0011	0111	0101	0000
							LSN

Remember, I only multiplied by 10,000, therefore the fifth decimal place (1) was not converted to BCD.

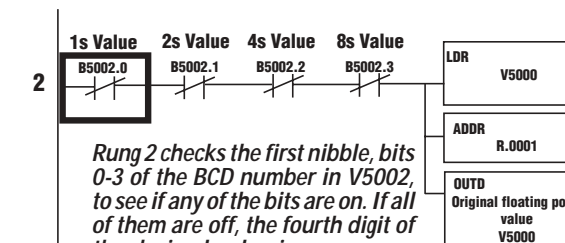
The next step was to look at the status of the four bits that make up the LSN (bits 0-3). If the status of each bit was null (off), I needed to add a value of .0001 to the real number.

The last step was to make sure there were no more than four decimal places in the number. So by multiplying by 10,000 (real), converting to a binary number (no decimal places), and then back to a real number, there would be four decimal places.

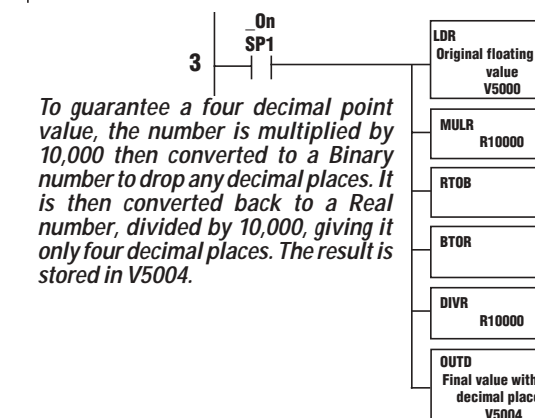
Now the real number will be 26.3751. The ladder would be as follows:



Rung 1 takes the Real value in V5000, multiplies it by 10,000 to move the decimal point over four places. It then converts it to Binary to cut off any left over decimal places. The number is then converted to BCD and stored in V5002.



Rung 2 checks the first nibble, bits 0-3 of the BCD number in V5002, to see if any of the bits are on. If all of them are off, the fourth digit of the decimal value is a zero, so a value of .0001 must be added.



To guarantee a four decimal point value, the number is multiplied by 10,000 then converted to a Binary number to drop any decimal places. It is then converted back to a Real number, divided by 10,000, giving it only four decimal places. The result is stored in V5004.

About Doug Bell

Doug Bell, cofounder and owner of InterConnecting Automation Inc., conducts training classes on AutomationDirect PLCs. Doug started his career as an electronics technician on the factory floor at Crown Cork & Seal, one of the world's premier suppliers of cans and closure systems. From there he established a very successful consulting firm that designed and implemented control systems including programming and start up. Doug offers prescheduled training classes in select cities or at customer sites (on request) throughout the U.S., using custom-built training units for hands-on experience. For more information, visit his web site at: www.interconnectingautomation.com.

The Break Room

Humorous stories and Brainteasers



8 Years Later

by an Anonymous Employee

When a memo was delivered into my "in-box" requesting office humor for the premiere edition of Automation Notebook, numerous events immediately entered my mind. I thought about an unsuspecting team member's SUV that was filled with three lawn size garbage bags of paper confetti as retribution for a recent prank he had planned. The paper filled the top of the vehicle from front to back. I also recall that day when a few fellows used a leaf-blower attached to a box of shredded paper to "decorate" the office of our human resources director – once again an opportunity to recycle all that shredded paper.

The funniest and least-known prank, however, involves the men's locker room in our company gym. During Karate class a rather bright and outspoken fellow decided to poke fun at the tumbling ability of a few of us, I mean – others – in the class. Women in general are better at tumbling, and we were no exception. We were outperforming the fellows five to one on this one exercise. Although I do not recall all of the words exchanged during that week, I do recall that we decided to play a prank on our outspoken co-worker and to this day, I'm not sure who even knows that we succeeded. Well, sort of succeeded, that is. This nameless fellow always showered after the class, which gave us an idea. The next morning (early) we entered the empty men's

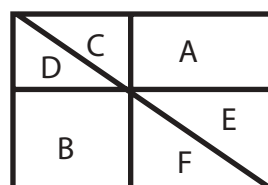
locker room and proceeded to remove the shower head from the bath stall. I quickly packed it with Beef Bouillon cubes and carefully reconnected the shower head while the others stood watch. We could hardly wait until lunch for our class. Afterwards, we anxiously awaited the response and odor that we expected to emit from the locker room. Well, let's just say that the odor of beef-stew was "simmering" throughout the gym area. We laughed to ourselves in silence because we knew he had to be in there, showering as he usually did, and I began to recite in my mind what fun I could have with this one today. Multiple comments crossed my mind and we started laughing as we began to share them with each other. The next moment though I felt my body temperature drop, as he emerged from the door – DRY! He didn't shower that day! "He didn't shower today?" I said it aloud to the others. I felt my heart quiver a bit - "Who else could it be, and who IS in the shower?"

After eight years, we must apologize to our company president for that less-than-enjoyable shower he took that day. The beef-bath wasn't intended for you Mr. Hohmann, but I hope it's safe to admit it now. By the way – we love the bottled water that we've had ever since, but I imagine that the tap water is not as bad as it once was thought to be.

Brainteasers

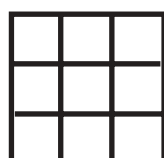
1. Which rectangular area is larger?

A line is drawn from the top left corner to bottom right corner of the outermost rectangle. Area A and B are two rectangles. Which area is larger?



2. Logic box with letters

Place the letters A to I into the 3 x 3 box. E is to the right of C. A is to the right of G which is above B, which is to the left of F. I is above D which is to the left of G.



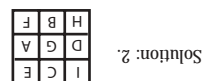
ABCDEFGHI

3. What numbers are A and C?

$$A \times C \times AC = CCC$$

A and C are single digit numbers. To make the equation as shown, what numbers should A and C be?

Solution: 3. $3 \times 7 \times 37 = 777$
A = 3 and C = 7



Solutions: 1. Since the diagonal line intersects the junction of all the rectangles, areas C and D are equal, as well as areas E and F. Therefore area A and area B are equal.

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- Keypad cables in 1, 3 and 5 meter lengths
- Four and eight-port communication boards

Durability guaranteed

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Built-in keypad is easy to use

The digital keypad includes a two line x 16 character LCD display, five status LED indicators, and nine function keys. The keypad is designed with defaults for the North American customer and allows you to configure the drive, set the speed, start and stop the drive, and monitor critical parameters for your application. The internal memory stores up to four complete programs that can be transferred to any *DURAPULSE* drive.

DURAPulse AC Inverters

Hp	230 VAC		460 VAC	
	Part Number	Price (US\$)	Part Number	Price (US\$)
1.0	GS3-21P0	\$289	GS3-41P0	\$389
2.0	GS3-22P0	\$339	GS3-42P0	\$419
3.0	GS3-23P0	\$399	GS3-43P0	\$449
5.0	GS3-25P0	\$459	GS3-45P0	\$499
7.5	GS3-27P5	\$649	GS3-47P5	\$700
10	GS3-2010	\$799	GS3-4010	\$849
15	GS3-2015	\$999	GS3-4015	\$1,099
20	GS3-2020	\$1,299	GS3-4020	\$1,299
25	GS3-2025	\$1,499	GS3-4025	\$1,599
30	GS3-2030	\$1,699	GS3-4030	\$1,799
40	GS3-2040	\$2,499	GS3-4040	\$2,299
50	GS3-2050	\$3,099	GS3-4050	\$2,799
60			GS3-4060	\$3,199
75			GS3-4075	\$3,599
100			GS3-4100	\$3,999

DURAPULSE Drives: Head-to-head

	AutomationDirect <i>DURAPULSE</i>	Allen-Bradley 1336F Plus II	Baldor 15H	ADC price vs AB	ADC price vs Baldor
5 hp	\$499	\$1,436	\$1,744	65% Savings!	71% Savings!
Part Number	GS3-45P0	BRF50-AA-EN	ID15H405-E		
10 hp	\$849	\$1,968	\$2,664	57% Savings!	68% Savings!
Part Number	GS3-4010	BRF100-AA-EN	ID15H410-E		
25 hp	\$1,599	\$4,134	\$5,301	61% Savings!	68% Savings!
Part Number	GS3-4025	B025-AA-EN	ID15H425-E0		
50 hp	\$2,799	\$7,231	\$9,629	61% Savings!	71% Savings!
Part Number	GS3-4050	B050-AA-EN	ID15H450-E0		
100 hp	\$3,999	\$11,179	\$15,239	64% Savings!	74% Savings!
Part Number	GS3-4100	B100-AA-EN	ID15H4100-E0		

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