Your guide to practical products, technologies and applications

Automation NOTEBOOK™

Fall 2008 Issue 12

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Educating Future Engineers Requires Teamwork

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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

Every four years, people are drawn to the nearest TV to watch the big event. No, it's not election coverage – it's the Olympic Games. Even those who show little interest in sports are glued to the screen to see how the countries fare.

I've always watched the games to see how many medals each country wins. This year, I watched them from a different perspective. I saw determination, growth, support, and unity. With each win, I witnessed teams demonstrating those qualities. If they did not win, they reevaluated and adjusted where they saw the need.

What I saw in the athletes, I see in AutomationDirect. We are determined to provide top quality products for our customers. We continue to grow by regularly adding new products to help our customers find industrial control solutions from one source. By keeping our customers and our employees informed on our products' features, we provide the support each of us needs. All this combined provides the unity necessary to keep the AutomationDirect machine in motion.

This issue of Automation NOTEBOOK is just another way we keep you informed. Find out about a new automation lab at Northern Illinois University, and how AutomationDirect products clean wastewater. Our guest writer, Brian Elliott, addresses Corona Discharge. Our cover story describes a fascinating new architectural concept underway in Chicago. There is a lot more packed in this issue. So, turn the page and enjoy…

TJ Johns
Senior Editor
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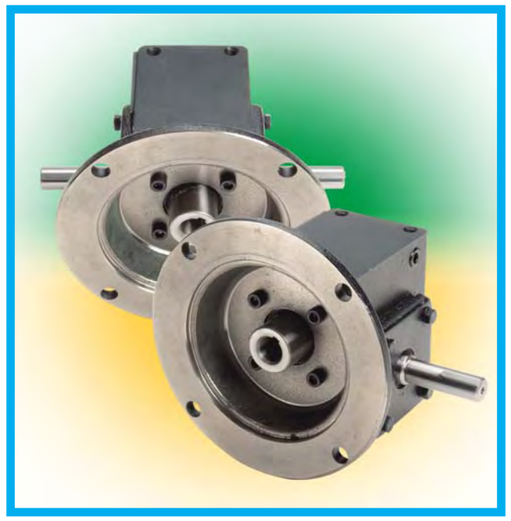
New Product Focus

what's new

IronHorse™ Worm Gearboxes now available from AutomationDirect®



AutomationDirect has expanded its mechanical power transmission product line to include worm gearboxes in four frame sizes and six gear ratios from 5:1 to 60:1. Constructed of cast iron one-piece housings, the worm gearboxes feature a C-flange input and carbon steel shaft with either right-hand or dual shaft output.

Manufactured by one of the world's leading gearbox suppliers, IronHorse worm gearboxes have double-lipped embedded oil seals to prevent leakage. Designed to change drive direction by 90 degrees, IronHorse gearboxes are mountable in any direction, except motor pointing up. The universally interchangeable compact design ensures easy OEM replacement.

The main gear is constructed of an aluminum bronze casting, which is much harder than typically-used phosphor bronze. A one-piece output shaft hub is designed to secure the heavy-duty output shaft bearing, and double bearing sets are on both shaft ends.

IronHorse worm gearboxes are ideal for use with electric motors for reducing output speed, increasing torque, changing drive direction, or running two loads from one motor. Prices start at $130; the full line is available for same-day shipping, and is backed by a one-year warranty. Optional mounting bases are also available, with prices starting at $13. View the complete line of IronHorse gearboxes at: **www.automationdirect.com/worm-gearboxes.**

"You can get everything in life you want if you will just help enough other people get what they want."
– Zig Ziglar,
"Secrets of Closing the Sale", 1984

"Take your life in your own hands and what happens? A terrible thing: no one to blame."
– Erica Jong

"Every artist was first an amateur."
– Ralph Waldo Emerson (1803 - 1882),
Letters and Social Aims: Progress of Culture, 1876

"We are made wise not by the recollection of our past, but by the responsibility for our future."
– George Bernard Shaw

Product Snapshots

Press Releases

View more from 6" C-more Micro-Graphic Panels

AutomationDirect's *C-more* Micro-Graphic panel line now includes six-inch display models. The new touch style graphic/text panels offer a 320x240 pixel graphical display that supports bitmap files. Used in a horizontal orientation, the 6-inch *C-more* Micro supports 40 lines by 80 characters of static text; 53 lines by 60 characters are supported in vertical orientation. Two optional keypad bezels are available for either horizontal or vertical panel mounting. *C-more* 6" Micro-Graphic panels are equipped with drivers to support all *Direct*LOGIC protocols as well as Allen-Bradley DF1 Full duplex, Allen-Bradley DF1 Half duplex, Allen-Bradley PLC5 DF1, AB DH485, Omron Host Link, Omron FINS serial, GE SNPX, Mitsubishi Melsec FX, Siemens PPI, and Entivity Modbus RTU. The *C-more* 6" panels are priced at $299. The free panel configuration software features a built-in project simulator. The latest software can be downloaded at:
http://C-MoreMicro.AutomationDirect.com.

DC Output Modules with Fault Protection

AutomationDirect's line of *Direct*LOGIC option modules includes new fault-protected output modules designed for the DL205 PLCs. The F2-16TDxP 16-channel current output modules, available in sinking and sourcing configurations, feature 16 input points which are automatically assigned as fault status indicators for the corresponding outputs. Equipped with electronic short circuit protection, the modules detect missing external 24VDC, open load, overtemperature, and overcurrent load. The protected output modules also feature user-resettable fault conditions. The modules are priced at $119, are in stock and available for same-day shipping. Find out more at:
www.automationdirect.com/dl205.

AutomationDirect offers Think & Do 8.0

AutomationDirect® has released Think & Do™ version 8.0, the cornerstone of its PC Control product offering. The latest version supports development, deployment and operation of high-value automated control systems for material handling and manufacturing. The intuitive and open-architecture environment readily integrates with hardware and software components from virtually all major suppliers.

Major components of Think & Do 8.0 include ProjectCenter to create various projects, FlowView for creating control logic in easy-to-use and read control flowcharts, ScreenView for creating and editing HMI screens, I/OView for configuring project I/O, and the AppTracker feature provides a fast, graphical debugging tool.

Think & Do version 8.0 is priced at $1,895 (PC-TD8-USB). A demo mode of Think & Do 8.0 is available for up to 40 hours use within a 30-day time period at no cost.

Two one-year subscription extended support products are also available. Learn more at:
www.automationdirect.com/software.

Cover Story

Creative Horizons

A New Twist on Skyscraper Design

by Keith Schmitz,
Guest Writer

Over the past ten years the skyscraper has gone from an engineering marvel of mankind to being a creative marvel of mankind.

Few structures capture the imagination more than the skyscraper. We often know where we've been because of the buildings that punch into the skyline – the Empire State in New York City, the Freedom Tower, the Hancock Center and Sears Tower in Chicago, and the Renaissance Tower in Dallas.

Like all buildings representative of their times, skyscrapers are a dynamic and striking combination of culture and technology. The skyscraper was an invention born out of necessity in the late 1800s. As commerce exploded people poured out of the farms and from far away places to fill American cities. Rather than feed into some vast sprawling metropolis, buildings evolved so people could work and live in a compact, organized fashion.

Technology complied, enabling buildings to sprout out of the streets. Structural steel design (known as the Chicago skeleton as developed by Frank Lloyd Wright's mentor Louis Sullivan) meant that the wall no longer had to bear the weight of the building. Thanks to reinforced concrete, window glass, and elevators, there was nowhere to go but up. Even the development of water pumps and toilets played a role.

Fast-forward to the new Millennium, a time when technology and culture once again bring on a new direction for skyscrapers.

For nearly the past 80 years, seeing a building reach 1,000 feet in the air was enough to impress, but the skyscraper profile was essentially straight, vertical lines. The extent of style for high-rises such as the Empire State and the Chrysler Building in New York or the Wrigley Building and the Tribune Tower in Chicago were gothic gingerbread on the top floors or art deco touches here and there.

The Great Depression and World War II sidetracked skyscraper construction, but when these buildings started to rise again in the 1960s, the style was now ultra rectilinear. By the mid-1980s, according to Karel Vollers, a researcher at Delft University of Technology, "people got bored with the box-shaped buildings."

Vollers observed that architects began to explore using twisted surfaces. According to John Zukowsky, the former architectural curator with the Chicago Art Institute, architecture entered this new phase thanks to two developments. "Changes in computer power – that being computational fluid dynamics – opened up new creative horizons."

"Now every client can have a building that is totally unique and individualistic."

It is one thing to let the mouse wander over the computer screen leaving a trail of parabolic shapes. The real trick is making those forms functional and capable of holding up the weight of a building, providing efficient heating and cooling and withstanding effects such as high winds.

At the same time, Zukowsky credits the development of new materials for bringing these ideas to life. "Carbon fiber materials and new composites have found their way into architecture from other areas such as aerospace research." "As a result," Zukowsky notes, "people began experimenting."

At the start of the 21st century nowhere has this experimenting been more evident than in the architecture and design of a skyscraper. Just as the Internet has lit a match to creativity, enabling ideas to spread around the world at the speed of light, inventive skyscraper designs are being seen on every continent, lining the Hong Kong Harbor and popping out of the sands of Dubai.

Antony Wood, the executive director of the Council and Tall Buildings and the Urban Habitat, sees the possibility that along with breaking away from the standard orthogonal box, tall buildings will be responsive to the environmental challenges of today's world.

"The Gherkin"

High-rise buildings are assuming shapes not dreamt of thirty years ago and employing designs which include "green" themes to minimize energy consumption and maximize some solar alternatives. One of the most unusual is the 30 St. Mary building in downtown London, with its profile earning it the nickname "The Gherkin."

Erected between 2000 and 2003, the 591 ft, 41-story high office building's distinct form has landed it roles in a number of movies and television programs. Among its energy-saving features are windows in the lightwells that open automatically to augment the air conditioning system with natural ventilation that save energy for up to 40% of the year.

Gaps in each floor create six shafts that serve as a natural ventilation system for the entire building, creating a double-glazing effect. Air is sandwiched between the two layers of glazing and insulates the spaces inside. These gaps also form atria to allow for gardens and social spaces for the tenants.

Usually double-glazing in residential houses is limited to avoid the inefficient convection of heat, but the St. Mary Tower exploits this effect. The shafts pull warm air out of the building during the summer and warm the building in the winter using passive solar heating. The shafts also allow sunlight to pass through the building, making the work environment more pleasing, and keeping lighting costs down.

The building's fully triangulated perimeter structure makes the building sufficiently stiff to reduce wind-excited sways without any extra reinforcements.

"Thinking out of the Box"

In Mississauga, outside of Toronto, Ontatio, Yale-educated Yansong Ma, founder of the Beijing-based firm MAD Studio, has offered up the twisting, curving design of the two Absolute World Towers. The 56 and 50 story condominium projects are under construction and will open in late 2009.

Ma won a worldwide competition held by the developer and he did it around a design philosophy. "I thought that maybe the high-rise could look closer to nature."

The locals dubbed the first tower the Marilyn Monroe Building thanks to the contours of the building, which gets thinner in the middle as it rises. The lines of the Absolute World towers are focused on the horizontal plane as comprised by the balconies that wrap around each floor. The floor levels are slightly offset from the floor above and below it, enabling the overall look to be curvy as the building rises and making the views from each unit different.

The support system, mechanicals, service lines and elevator shafts are in the center of the building, but not visible as each floor wraps around it.

The Absolute World project is an example where computer capabilities played a large role in its design. "We used complex software to design the building," recalls Ma.

With each floor having a different design, the computer program enabled Ma to provide individual plans for each one.

Building with a Twist

Mr. Santiago Calatrava is an architect who is not bound by boxes and who, as he told an audience at the Art Institute of Chicago, sees buildings as a machine and the body as a machine and so combines them both. He did that quite literally for a building named the HSB Turning Torso in Malmo, Sweden, completed in 2005.

Architecture became sculpture because the building is based on a sculpture – the Twisting Torso, created by Calatrava. The former CEO of the HSB cooperative in Malmo saw the sculpture and asked Calatrava to design a building around that same concept. At 54 stories this is currently the tallest building in Scandinavia, a place typically not known for skyscrapers.

The Twisting Torso uses nine segments of five-story pentagons that twist as it rises; the topmost segment is twisted ninety degrees clockwise with respect to the ground floor. Each floor consists of an irregular pentagonal shape rotating around the vertical core, which is supported by an exterior steel framework. The two bottom segments are intended as office space and the upper floors house 149 luxury apartments.

Each floor is rotated to create the characteristic twist of the building. The facade is made of curved aluminum panels, with windows leaning either inwards or outwards, in order to follow the twist of the building. An exoskeleton around the building's front face is made of tapered white steel tubes.

Following the concrete perimeter column, the exoskeleton's single upright is fixed to the tower between each module with horizontal and inclined tubes. These tubes reach back to steel

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The architectural design of the St. Mary Tower contrasts sharply with the more traditional buildings in London, yet has many natural touches throughout the building.
Photo courtesy of: *Nigel Young / Foster + Partners*

Cover Story cont.

Creative Horizons cont.

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anchors embedded in shear walls at the building's back corners. While the spine column takes perimeter vertical loads, the exoskeleton around it provides wind resistance and dampens the building's vibrations.

Calatrava is following up with a more spectacular example of twisted architecture in Chicago, the birthplace of the skyscraper, with this year seeing the construction of the Chicago Spire. This building will be located on the bank of the Chicago River before it enters the harbor.

For the first time since the 1970s another building in the city will exceed the height of the tallest buildings in Chicago. At 2,000 ft. high, the Chicago Spire will be the tallest building in the world exclusively for residential use, offering 1,194 homes and over 1,400 parking spaces for the residents and their guests. The base to height ratio is ten to one (versus six to one for the Hancock Center), making it the most slender supertall building in the world.

Calatrava has designed the Chicago Spire with seven sides, with each floor rotated an average of 2.44 degrees between floor plates. When the top floor is reached, it will have rotated 360 degrees from the bottom floor.

The Spire is being built with water on three sides on a very small lot measuring just 2.2 acres. "For the Chicago Spire," according to Kim Metcalf, the spokesperson for Shelbourne Development, the developer of the project, "wind is a huge challenge." The way Calatrava deals with this is part of his creative process, taking his design inspiration from the columns of smoke rising from the Native American campfires lit along the banks of the Chicago River.

As wind hits the building, like the column of smoke, it is redirected and spirals upward to eventually dissipate. The design was tested in a Newfoundland wind laboratory and, according to Metcalf, "the design proved right on the money."

The Chicago Spire strives to meet Antony Wood's charge for tall buildings to be part of the green revolution and is seeking to attain a LEED gold certification, "possibly working higher than that," maintains Metcalf. Built on an old manufacturing site, the building's seven-floor underground parking structure is designed to reduce

In a city of skyscrapers, which are among the tallest in the world, those buildings will be dwarfed by the distinctive Chicago Spire designed by Santiago Calatrava.
Rendering courtesy of: *Shelbourne Development/Santiago Calatrava*

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Cover Story cont.

creative Horizons cont.

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The Chicago Skyline with the Spire represented in place.
Rendering courtesy of: *Shelbourne Development/Santiago Calatrava*

environmental impact and heat gain, plus will have one floor exclusively for bicycles. Because of the tightness of the construction site, the garage is being built from the top down.

Though the Chicago Spire will dominate the cityscape, it will be very much part of the environment by including:

- A system to recycle rainwater for landscaping and cooling the building. The Chicago River will be used for cooling as well.
- Ornithologically-sensitive glass to protect migratory birds.
- An intelligent building and energy management system to provide efficient use of resources while optimizing comfort, contributing to an HVAC system that will be 15% more efficient than current energy regulations.
- Fresh air circulated into every unit, every 30 minutes.
- A unique waste removal system – once trash is dumped into the chute, metals, plastics and other recyclables land in the storage units completely separated.
- An elevator system running on reusable energy and comprised of 17 elevator shafts, which will be longest in the world.

Curious about the price to live in the Chicago Spire? A 534 sq. ft. unit starts at $750,000. For the panoramic view of four states and the curvature of the Earth, from the two penthouses which occupy the entire 141st and 142nd floors – a cool $40 million. Well over 30% of the units have been purchased, which will open in 2012.

Up until recently, engineering capabilities enabled designers and builders simply to go higher when it came to skyscrapers. Now thanks to new technology, the sky's the limit when it comes to creativity.

Keith Schmitz Bio

Keith Schmitz is a business-to-business and technology writer based in Milwaukee, WI. He has written on a range of topics including electronics, HVAC applications, use of lean/SixSigma/TRIZ techniques, and hydraulics.

Industries he has been involved with include supply chain and material handling, manufacturing, mining, construction and medical.

Tech Thread

code writing guidelines

Designing a PLC Ladder Program

By Richard Palmer,
AutomationDirect

Thinking back on my first Computer Programming course, the instructor was adamant about flow charting, documenting, and using good tools to design the program. I was 18 at the time and thought, "Anyone can write a good program and documentation isn't needed. Write it correctly and it's done."

It didn't take long to see just how naïve I was about those assumptions. Software programming of any sort is rarely static. Customers always want something different -- daily production numbers, cast off count, hourly averages, and the list goes on and on. Not to mention that debugging is difficult enough without trying to guess what a function does with no documentation to clarify the logic.

I have debugged many programs over the years, both mine and other people's work. Some are wonderfully documented and a pleasure to debug. Others are just as wonderful in a completely different way. We have all seen those.

Below are some ideas to help spark your creativity while writing and documenting a PLC program.

A good place to start is by outlining your code. The outline consists of the major program segments and what will go in them. It is a rough guide of how to lay out any Stages or subroutines as well as calling out the main parts of the program.

1.) Power on sequence
(resets, analog card setup, comm. Port setup)
2.) Map inputs to internal registers
(X's, Analog, etc)
3.) Motor start sequence
4.) Do pick and place
a. Sub tasks as needed
5.) Error checking
6.) Shutdown sequence
7.) Output mapping
(Y's, analog, PID, etc)

Figure 1

Error Checking

Don't forget to lay out a guide for the error checking section as well as any alarming and shutdowns that need to occur. Error checking is one of the most ignored sections of a program. A good program should be checking switches that go out-of-range for longer than they should, indirect addressing pointers that stray outside their bounds, as well as checking analog signals for validity. There is much more that should go into a good error checking routine, but these examples should help you consider the types of things that you should include.

Memory Map

Design a map for the variable memory. When troubleshooting, it is invaluable to have a guide to the memory layout. Instead of assigning memory registers as you need them with no forethought, try laying out a simple idea of how the memory can work for you. Relate bit addresses to timer addresses and counter addresses to preset addresses. This doesn't mean they have to be identical, but perhaps C100 goes with T0 and CTA100 goes with V4100. Relating addressing makes troubleshooting go much more smoothly as you can remember the relationship without stopping to look it up.

Tag Names

Most software packages offer the use of tag names. Make your tag names descriptive, such as "Exhaust. Valve101. Unload.bit". By creating a descriptive name it tells us exactly how the tag is used. "Bit" tells us it is a discrete value on/off. "Unload" tells us that it is unloading whatever the valve is tied to. "Valve101" tells us which part of the valve train we are referring to. "Exhaust" tells us it is part of the exhaust valves.

With a PLC that supports un-typed memory such as the *Direct*LOGIC line of PLCs, it's important to note what the memory location contains; such as a unsigned integer, 16 bit BCD word, floating point data, or whatever is in the register. If you use the nickname tag to identify the memory address, when you go to import your PLC program tags into the HMI database you will automatically know which tags need to be changed to a different data type with no confusion, regardless of which data type is in the PLC register.

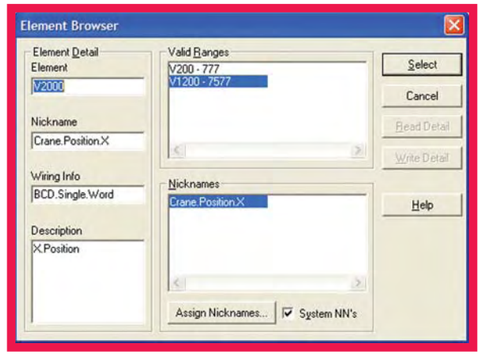


Figure 2

Code Structure

Before starting the actual coding, ask yourself a few questions to help focus your thoughts on how you will write the code.

1.) Does it make sense?

Sure, I can use indirect addressing and save some coding time, but does it make sense to do so? It may save time now, but how about debugging? How much time will it cost me then? Will the person maintaining the machine understand what I did?

2.) Is this something that I will understand in a year?

The sad answer to this question is often "no". If it's difficult to understand now, think of what it will be like when you come back after being away for a while. Take the time to rewrite it into something that anyone can understand. You will be glad later when it is installed and running.

3.) Is saving time or memory space important?

I can write this elegant little chunk of code that takes the place of 100 rungs of ladder. But just because I can, doesn't always mean I should. If memory space is not limited, the more straightforward approach might be better.

Writing code with an audience in mind is more difficult in the beginning, but it pays off when the plant manager doesn't call you at 3 a.m. because the machine is down and no one can understand what you programmed last year.

Documentation

Documentation is important. Program headers should explain what the program does in a broad and general way. This should be at the top of your program. Section headers should explain what each section does; program and hardware setup, input mapping, startup, run, shutdown, alarming, output mapping, etc. Line comments should explain each line that does something unique. Document your constants that you compare against. Thinking "What?", "Why?", and "When?" will help with commenting the rungs. (Figure 3)

To sum it all up, you really can't have too much documentation. However, you have to achieve a balance between time invested and readability. Some documentation is better than none, and documenting the details will make your job easier in the long run.

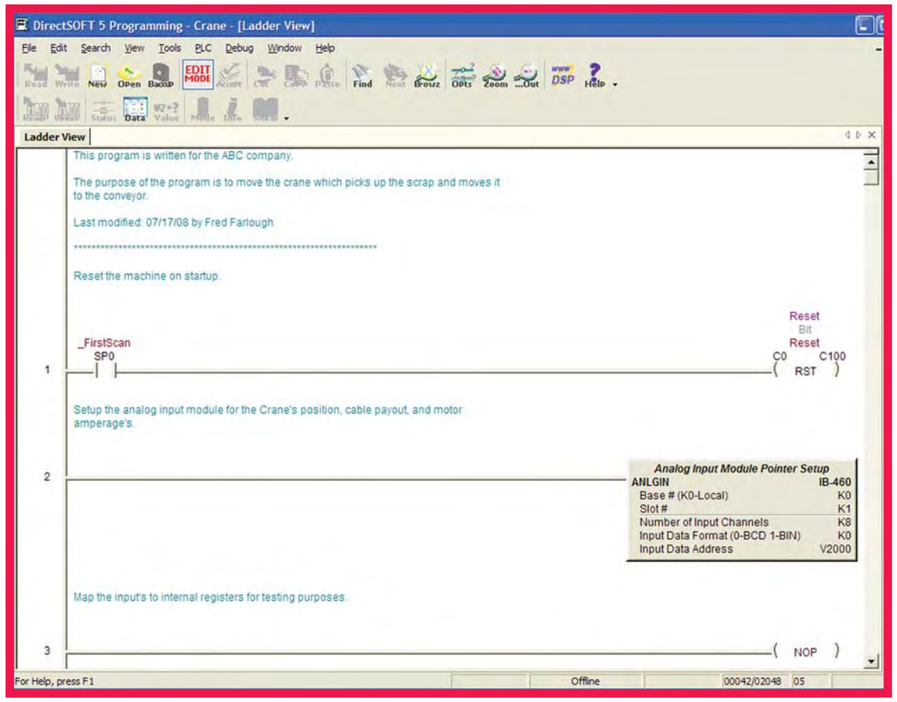


Figure 3

Feature Story

New Automation Lab

Educating Future Engineers Requires Teamwork

By Cliff Mirman, Ph.D.
Professor and Chair,
Department of Technology
Northern Illinois University

The goal of any technology or engineering educational program is to educate its students utilizing techniques built upon sound theoretical principles. But, how does one teach college level students to utilize automation components like robots, PLC's, and sensors?

PLC programming area of Automation Lab
Courtesy of: Dr. Cliff Mirman

The field of automation is constantly changing and educators need to maintain pace with these changes in the classroom, in order to produce well-qualified graduates. The real solution to this complex situation is through innovative Industry/Education partnerships.

The teaching of advanced hands-on concepts requires complex laboratories and equipment. As the level of state funding decreases in higher education and technology usage increases, universities are looking towards new avenues to develop experiential learning facilities. This is especially true in the area of Technology, which is heavily dependent upon maintaining laboratories which keep pace with industry changes.

As the name Technology implies, students must enter the workforce with the hands-on laboratory skills that are needed in industry. The Northern Illinois University Department of Technology has the same set of challenges in developing and/or modernizing laboratories in the automation areas; the biggest challenge is finding the needed funding.

Through a large alumni and industrial support base, the department has made strides in modernizing laboratory facilities in the manufacturing and electrical areas.

During the past five years, Automation Direct has provided equipment, including PLCs, to the department. However, the company made an even bigger commitment to the students. AutomationDirect recognized that if students use their equipment in the course of instruction, they will be more inclined to use this equipment at their companies upon graduation. This understanding has proven to be true over and over again with NIU graduates.

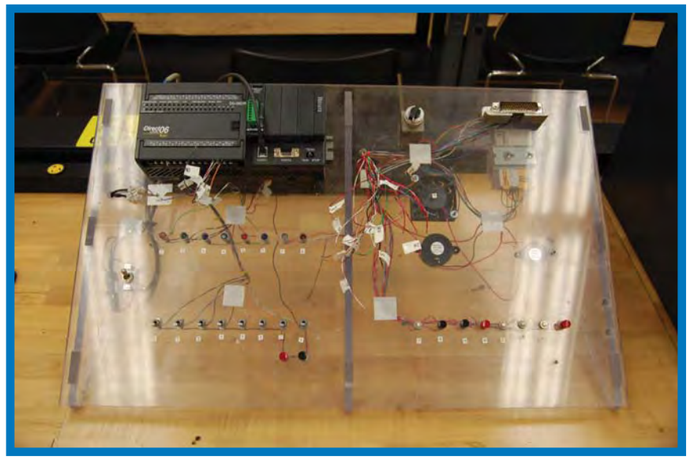
In 2008, AutomationDirect partnered with NIU's Department of Technology to help fund a well-equipped automation laboratory. In return for the support from the company, the Northern Illinois University Department of Technology named the lab the AutomationDirect Automation Laboratory. Through funding and equipment provided by AutomationDirect, the NIU Department of Technology can now keep this important laboratory current in equipment and process.

This laboratory supports the departmental Programmable Logic Controller (PLC) course and the Automation course. The PLC course teaches students basic and advanced concepts and applications for PLC programming. In addition, the students learn to integrate various components with the PLC, such as sensors, switches, and output devices, as shown below.

Robotics and integration area of Automation Lab
Courtesy of: Dr. Cliff Mirman

This laboratory is also used to teach the departmental automation course, where students learn basic concepts of robotics, vision, and pneumatic control, as well as integration of the components learned in the PLC course.

As a final project, student teams design automation systems which will sort parts, using the integration of vision, PLCs, sensors, and pneumatics. This level of experimental interaction produces Manufacturing Engineering Technology graduates who excel in industry.



DL06 PLC Trainers in Automation Lab
Courtesy of: Dr. Cliff Mirman

In addition to student instruction, AutomationDirect and the NIU Department of Technology are exploring new ways to best use this laboratory to assist the company. The Department faculty will use the facility for industry training courses on the AutomationDirect PLC products. Through the gracious assistance from AutomationDirect, the school will have a very strong laboratory facility in which the next generation of manufacturing engineering technologists will be educated.

NIU Website: **www.ceet.niu.edu/tech**

Department of Technology
Still Gym
Northern Illinois University
Courtesy of: Joan Welty

Department of Technology at NIU

The Department of Technology has been the cornerstone of technical education at Northern Illinois University for over 80 years. Over the years, the department has evolved from vocational education to an organization which supports the needs of industry and the region. The department is a component of the College of Engineering and Engineering Technology, which currently has approximately 1,500 students. The Technology Department has over 400 students across Electrical Engineering Technology (EET), Manufacturing Engineering Technology (MET), and Industrial Management and Technology programs. The level of industry interaction and the growing laboratory facilities have assisted in gaining the Department accreditations from the National Association of Industrial Technologists (NAIT) and the Accreditation Board for Engineering and Technology (ABET). The majority of NIU Technology graduates obtain employment in the manufacturing or electronics areas, either implementing new technology or supporting current processes.

Business Notes

Customer Feedback

New features for AutomationDirect Customer Forum

By Joan Welty
AutomationDirect, Director of Marketing

Since its introduction in 1999 as part of the primary Web site , the AutomationDirect Customer Forum (**http://forum.automationdirect.com**) has emerged as a valuable resource for automation professionals to explore application ideas, share knowledge, and solve problems. There have been over 5,000 threads containing over 24,000 posts on topics ranging from PLC programming to motion integration. Feedback from the forum has also played a direct role in the development of new and enhanced products.

AutomationDirect recently moved the forum to a much more modern and robust software platform. In the transition, we were able to preserve and import all user accounts and posts from the old forum, and the look and feel should be familiar to anyone who has visited the forum in the past.

Customers who have experience with other popular industry forums will probably recognize several of the new features:

- Attachments - participants can now share everything from screenshots to programs. Sometimes a simple picture says it all.
- Thread and forum subscriptions - receive notification if a thread you're watching is updated.
- Messaging - communicate privately with other participants.
- Customization - view by threads or topics. Add avatars, conduct polls, and have much more control over how you use the forum.

We welcome all feedback and suggestions for future improvements to the forum. If you have an idea – just post it!

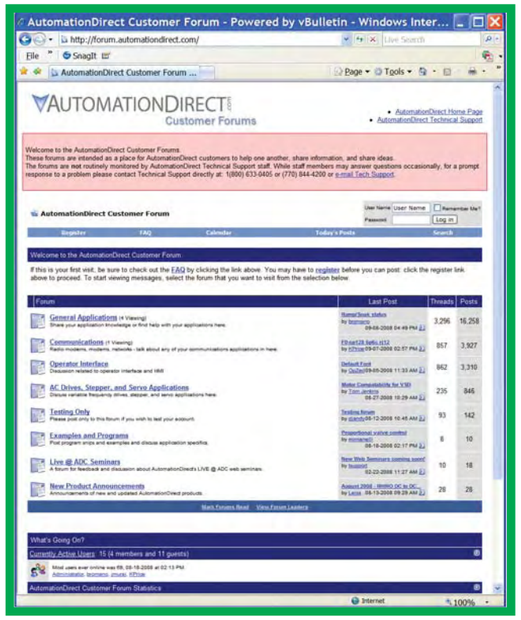
In addition to the Customer Forum, there are many other online resources available from AutomationDirect that that support specific products as well as offer general industry information. These include:

http://support.automationdirect.com
Contains FAQs, demo programs, firmware and software updates/downloads, product manuals (PDF downloads), example programs, application stories

www.automationnotebook.com
AutomationDirect's online technical magazine (also available for FREE hard copy subscription)

http://learn.automationdirect.com
Online streaming tutorial site offering training and information on a wide range of automation products. [Flash plug-in required]

www.automationtalk.com
Live and pre-recorded seminars on AutomationDirect hardware and software products, from product overviews to PLC programming



New Customer Forum from AutomationDirect

Tech Brief
Electrical Wiring

Corona Discharge and High Voltage Leaks

Corona discharge happens when a conductor is forced to carry more electrons than it can accommodate. In these instances, the electrons jump to the air where they flow to any neutralizing charge that they may find. Near the conductor, the electrons have sufficient energies to ionize the air and force it to glow or, in other words, produce a corona.

The most common cause of electron concentration is sharp points on the conductor. The electrons concentrate at the diminishing point and eventually are forced off the conductor. As an example, the sharp tip of the conductor on the left hand side of **figure 1** will have a great deal of leakage at high voltage and will, most likely, glow with a low purple light. On the other hand, the conductor on the right, with its rounded tip, will have very little leakage and will stand off much higher voltages.

Solder joints are always a trouble spot in high voltage circuits. In one instance I designed and constructed a 10,000 volt DC power supply for an industrial flash unit. When I energized the circuit, it was outputting only 2000 volts. As I probed the circuit, it was clear that the voltage got progressively lower as I worked through from the transformer secondary to the output of the supply. This was puzzling. Without any other ideas, I turned off the lights and was surprised to see that the entire circuit was glowing brightly from numerous corona discharge sites. I turned on the lights, de-energized the circuit and carefully applied high voltage silicone rubber to all of the soldered and bolted joints. The next morning I re-energized the circuit and it produced its full 10,000 volt output. As it turned out, the solder and bolted joints were leaking 80% of the power supply's voltage to air! **Figure 2** shows an example of a poor high voltage solder joint and the use of high voltage silicon rubber to suppress leakage.

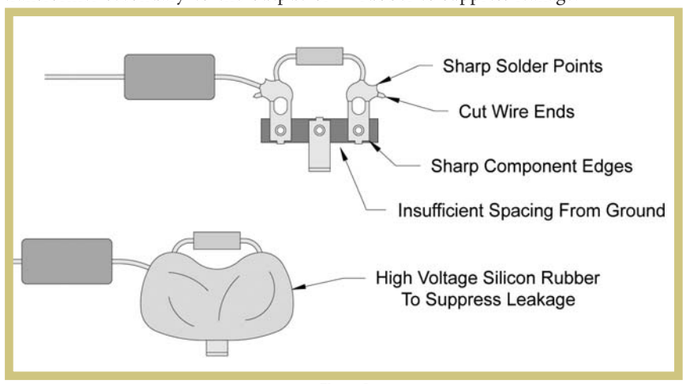


Figure 2

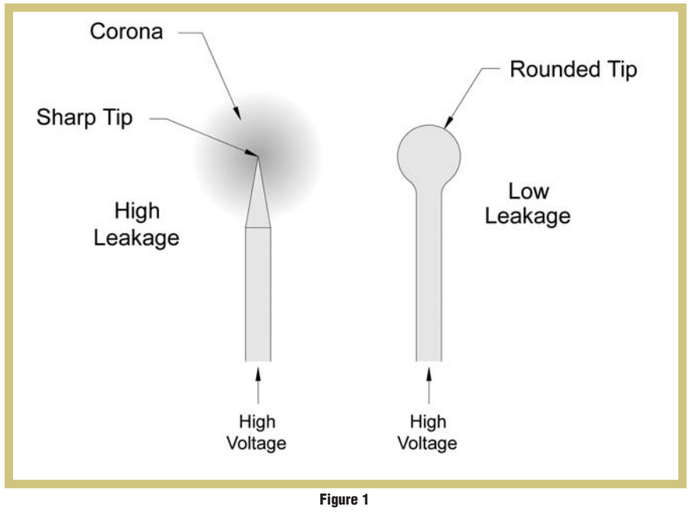


Figure 1

The slow build-up of dirt can also produce high voltage leaks. This is particularly problematic with equipment that is forced to operate in dirty and dusty environments. High performance cabinet filtration will help mitigate the effects of dirt built-up. Figure 3 shows how an exposed stand off insulator can be protected from dirt build-up by using a protective boot. In this case, the leakage would be from the terminals to the grounded case. If the case is floating, the leakage would be between the terminals, forming a bypass of the component.

Carbon paths, as shown in **figure 4**, are insidious problems that build over time. There are two principal ways that carbon paths develop. The first occurs during uncontrolled arcing. The arc produces a great deal of heat and burns the surface of the insulator, forming carbon. If the arc has enough energy and the insulator is sufficiently burned, a permanent short can be produced. Glass or ceramic insulators with a glazed surface resist this type of damage, while phonolic and plastic insulators are particularly susceptible.

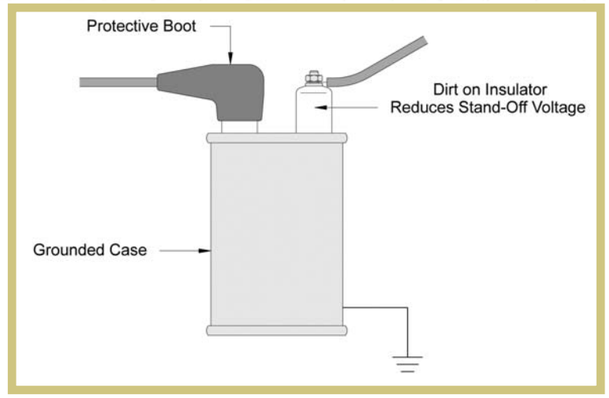


Figure 3

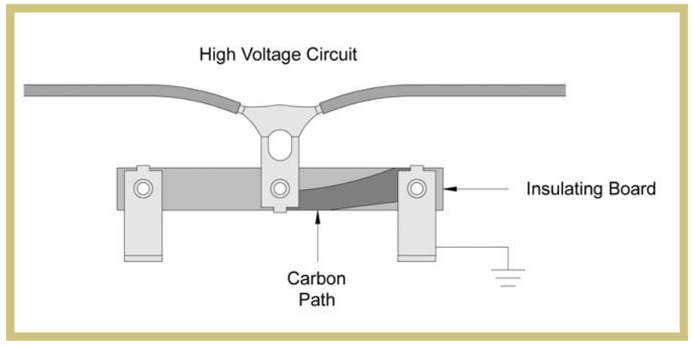


Figure 4

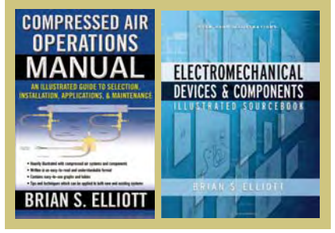
The second process that forms carbon paths is the slow carbonizing of dirt deposits. As dirt builds on the insulator, small micro-arcs accrue and produce localized carbon sites. As time progresses, the carbon builds until its leak rate is detrimental to the circuit's continued operation.

In addition to the above methods, heat shrink tubing, especially the marine grade variety, will significantly help in reducing corona discharge and the formation of carbon paths. Even though it is usually considered unprofessional, in a pinch, even ordinary electrical tape does a pretty good job dealing with these troublesome situations. I also stress circuit cleanliness. Preventing dust and dirt buildup will dramatically reduce the formation of carbon paths. All it takes is a quick blast of dry compressed air and/or regular replacement of the cabinet filters.

I have found that heat shrink and boots will dramatically reduce corona discharge and carbon path formation; however, potting the joint in silicon glue stops discharge and the formation of paths altogether. In my experience, it can be pretty tough, or even impossible, to get into a finished circuit to apply heat shrink, boots or tape. For that reason, and because of the convenience of the long nose tip supplied with a tube of silicon rubber, I usually lean towards the glue solution. I will readily admit that caulking the joints of an electronic assembly doesn't look that great, but it provides exceptionally good performance in this regard.

Brian Elliott Bio

Brian Elliott is currently V.P. of Engineering and Manufacturing at Air Options, Inc. During the course of his long career, he has worked in various industrial, technical and scientific fields ranging from automated manufacturing to high energy physics. He has authored two books, "The Compressed Air Operations Manual" (ISBN 0-07-147526-5) and "Electromechanical Devices and Components" (ISBN-10 0-07-147752-7), both are published by the McGraw-Hill Book Company. Both books are available through book retailers worldwide.



User Solutions

Environment Compliance Equipment

AutomationDirect Products Help the Environment

By Andrew C Hyatt
Environmental Compliance Equipment

Treating waste water generated in industrial plants requires an efficient, easy-to-use process which yields minimal by-product; it must be reliable and durable too. Environmental Compliance Equipment, in Palm City, Florida, designs systems to meet these requirements. One such system is marketed as ClearFlow.

ClearFlow systems can be integrated in almost any facility that generates waste water in the process of providing a product to consumers. For example, when the ink was washed from the lithograph printing press used to print this magazine, an ink/water waste resulted. The ClearFlow system can treat the water, making it clean enough to be discharged; remaining solids become non-hazardous material.

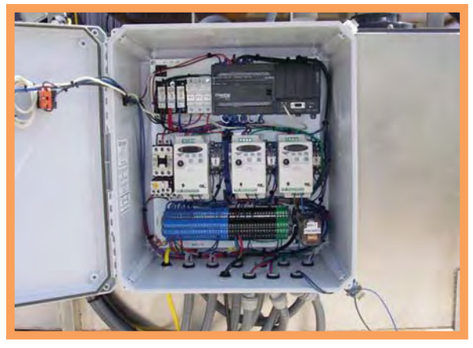
The automation side of the ClearFlow system allows operators variable functionality, quick and easy access, and reliability. By choosing AutomationDirect products, Environmental Compliance Equipment acquired the tools needed to meet the goal.

The ClearFlow system processes waste water in a batch cycle; one volume of waste water is completed before repeating the process. The number of batches is measured hourly so the value of this process – and machine – lies in its efficiency to treat many batches each hour.

Because each waste stream may vary, the DL06 PLC was selected for its versatility and ability to adapt to each client's needs. The DL06 also provides the ability to add expansion modules to take on such challenges as pH control, temperature monitoring, Total Dissolved Solids (TDS), and Total Suspended Solids (TSS), all of which require discrete I/O interfaces from separate controllers.

Versatility of the DL06 allows the system to be incorporated into the plants' internal control system for monitoring output, alarms and general function of the system.

As mentioned earlier, the batch has to be treated quickly and efficiently. During each batch, the system performs sequential tasks to treat the waste water.



The tasks are as follows:

- Fill the system with waste water and mix; adjust pH if required.
- Separate solids from the waste water by adding a special Clayfloc flocculent and allow separated (flocced) solids to settle.
- Next, pump the combined mixture to a filter to separate solids from clean water. Monitor TDS or TSS if required.
- When the filter becomes clogged or unable to pass water, it is indexed forward to supply clean filter paper.
- Once complete, the system is emptied and another batch begins.

Each step is controlled using a timer or speed measurements, or a combination of both. Using the DL06 PLC with GS1 and GS2 A/C drives provides flexibility in performing these tasks. This allows the system to be efficient enough to use only the amount of consumables necessary to treat the waste water, generate as little byproduct as possible, and reduce operating costs.

Employing the *C-more* Micro touch screen panels provides ease of use and accessibility, which meets another design criterion. The *C-more* Micro gives operators access to all facets of system operation.

The HMI allows operators to manipulate each sequence timer in the DL06, optimizing the system for maximum throughput, while also providing information about the system's conditions, alarm indicators (when consumables are exhausted), and if/when the system has been disabled. Another

Continued, p. 26 >>

Tech Review

operator interface compatibility

C-more HMI with Enhanced Allen-Bradley PLC Driver Support

By Greg Philbrook
HMI and Communications Product Manager, AutomationDirect

With the growing popularity of the *C-more* Operator Interface line offered by AutomationDirect, we have had many requests to add PLC protocol drivers. More details for the following can also be found on the AutomationDirect Technical Support web site. Look for document number AN-EA-004 on the Technical Notes page.

Compatible Allen-Bradley PLCs

C-more supports five Allen-Bradley PLC drivers: DF1 Full Duplex, DF1 Half Duplex, DH485, EtherNet/IP Client driver and EtherNet/IP Server driver (generic).

The compatibility matrix below illustrates the many choices available to connect Allen-Bradley PLCs to the *C-More* HMI.

Which Protocol Should I Use?

C-more® Allen-Bradley® Support	DF1 Full Duplex	DF1 Half Duplex	DH485	Generic EtherNet/IP Server (UO Messaging)	EtherNet/IP Client	EtherNet/IP Tag-Based Client	Tag-Based DF1 Full Duplex	Tag-Based DF1 Half Duplex
SLC™ 5/01, 5/02			Yes					
SLC™ 5/03	Yes	Yes	Yes		Yes[1,3]			
SLC™ 5/04	Yes	Yes	Yes[2]		Yes[1,3]			
SLC™ 5/05 (Series A OS501 FRN5 & Higher)	Yes	Yes	Yes[2]		Yes[1]			
MicroLogix™ 1000, 1200, 1500	Yes	Yes	Yes[2]		Yes[1,2]			
MicroLogix™ 1100	Yes	Yes	Yes[2]		Yes[1]			
PLC-5	Yes							
ControlLogix®				Yes[1]		Yes	Yes	Yes
CompactLogix®				Yes[1]		Yes	Yes	Yes
FlexLogix				Yes[1]		Yes	Yes	Yes

1 Ethernet available on full featured C-more™ panels only. -R units do not support Ethernet
2 AIC module from Allen-Bradley® required for this connection
3 NET - ENI module from Allen-Bradley® required for this connection

These drivers allow customers with different PLC brandsto standardize on the *C-more* HMI product.

The latest group of drivers supports the Allen-Bradley family of PLCs. The new Ethernet drivers allow simple connectivity of multiple *C-more* panels and/or multiple Allen-Bradley PLCs.

We also added ControlLogix Ethernet/IP Tag Messaging support. This new feature helps increase productivity by reducing the time often required to map your PLC tag database into another device. This time saving feature allows you to import the RSLogix 5000 L5K file directly, or with just a few clicks of the mouse you can directly enter your ControlLogix or CompactLogix tags from the PLC into a *C-more* database. No mapping or translation is required.

Since these protocols are widely used with *C-more* HMI, we have developed some tips on when and how to use these new drivers with *C-more* panels. To explain this, we will use common Allen-Bradley terminology.

These descriptions of the five available protocols can assist you in choosing the best one for your application.

DF1 Full Duplex: This driver is used for point-to-point serial connections. If you are connecting only one *C-more* panel and one Allen-Bradley PLC, this is the most economical method.

DF1 Half Duplex: This is an economical method for connecting one *C-more* panel to multiple PLCs. Note that since Allen-Bradley PLCs do not use RS-422 or RS-485 for serial connection, an RS-232 to RS-422/485 converter (such as the FA-ISOCON) is required for each PLC.

Generic EtherNet/IP Server: This driver is atypical in that the messaging is initiated by the PLC instead of *C-more*. The *C-more* panel is treated basically like a Remote I/O drop. It contains a block of Input Words and Output Words and the PLC either reads or writes this data back and forth. The PLC tags are not directly referenced, as in the EtherNet/IP Client driver. This rare method is sometimes preferred by customers for unique applications.

EtherNet/IP Client: This driver is the more typical method of reading and writing data back and forth from the PLC. The *C-more* panel directly references the PLC tags and initiates the messages going back and forth. If your application involves using multiple *C-more* panels and/or multiple PLCs, this is the best method for accomplishing this.

DH485: This driver is mostly for legacy systems where it is necessary to add a *C-more* panel to an existing network. It is possible with DH485 to have multiple *C-more* panels and multiple PLCs on the same network but the performance levels are much lower than EtherNet/IP. DH485 is not as robust as DF1 or EtherNet/IP.

Supported Data Types

The earlier Allen-Bradley SLC, MicroLogix, and PLC5 support what can be referred to as legacy memory mapping. This mapping is based on fixed file types, whereas the newer Control/Compact/FlexLogix PLCs use what is referred to as a variable tag based memory map. The *C-more* HMI supports both types of mapping.

Compatible Data Type Chart for SLC, MicroLogix, and PLC5

	SLC	Micro Logix	PLC5
I = Input	X*	X	X
O = Output	X*	X	X
S = Status	X	X	X
B = Binary	X	X	X
T = Timer	X	X	X
C = Counter	X	X	X
R = Control	X	X	X
N = Integer	X	X	X
F = Float	X	X	X
L = Long**		X	
ST = String**	X	X	

* I/O access not supported for SLC5/01 and 5/02

** **NOTE:** As of version 2.10, Long and String data types are not yet supported. They should be available by Q3, 2008. Refer to the release notes of the *C-more* software on our Web site to see when these data types will be supported.

Control/Compact/FlexLogix Tag support

Logix Memory Type	C-more Tag Data Type	Description
DINT	Signed int 32	Memory area with a value of 32 bit 2s compliment integer -2,147,483,648 to 2,147,483,647
INT	Signed int 16	Memory area with a value of 16 bit 2s compliment integer -32,768 to 32,767
SINT	Ascii String	Memory area with a value of 8 bit used primarily as a character byte location up to 128 characters
BOOL	Discrete	Memory area with a value of 1 bit representing 0 as False and 1 as True
REAL	Floating PT 32	Memory area with a value of 32 bit floating point -1.1754944e-38 to 3.4028237 e38
STRING	Ascii String	Memory area with a characteer array up to 82 characters

There are different terms used to describe the different data types in the Allen Bradley Logix PLCs. The table below describes how the Allen-Bradley data types are used in the *C-more* programming software.

Tag Types

The *C-more* HMI supports all the tag and memory types used in the Logix PLCs. Each has different characteristics that will determine how it is used in your HMI project.

Atomic Data: Atomic data types are the base data type unit from which all other complex data types are built. The Atomic data types are: BOOL, SINT, INT, DINT and REAL. The syntax for the Atomic data types is simply the tag name itself (no precursors or delimiters). An example would be: Tank1_Level.

All Atomic data types are addressable in the *C-more* programming software and are importable via the L5K file.

Pre-Defined Data: Pre-defined data types are complex data types that are made up of one or more Atomic data types, User-defined data types or Arrays. They are commonly called "structures" in other programming languages such as C. The Pre-defined data types already exist in RS Logix 5000 with every new project that is created. One of the most common Pre-defined data types is the TIMER data type.

A TIMER data type comprises these members:

TIMER:

PRE (preset member that is a DINT atomic data type)

.ACC (accumulated member that is a DINT atomic data type)

.EN (enabled member that is a BOOL atomic data type)

.TT (timer timing member that is a BOOL atomic data type)

.DN (done member that is a BOOL atomic data type)

.FS (first scan member that is a BOOL atomic data type)

.LS (last scan member that is a BOOL atomic data type)

.OV (over member that is a BOOL atomic data type)

.ER (error member that is a BOOL atomic data type)

So if you create a TIMER called Cycle in the PLC, you will have these tags:
Cycle.PRE, Cycle.ACC, Cycle.EN, Cycle.TT, Cycle.DN, Cycle.FS, Cycle.LS, Cycle.OV and Cycle.ER.

There are hundreds of Predefined data types available in the RS Logix 5000 software.

All Predefined data types are addressable in the *C-more* programming software. The Pre-defined data types can be imported via the L5K file, however the configuration file "L5KPreDefine.txt" must be modified for this purpose. For more details, refer to application document AN-EA-004 on the AutomationDirect Tech Notes web page.

Array Data: An array is basically a data structure of a sequential set of the same data type. Each element is accessed by an index number. Arrays can be created from Atomic data types or complex data types (Pre-defined or User-defined).

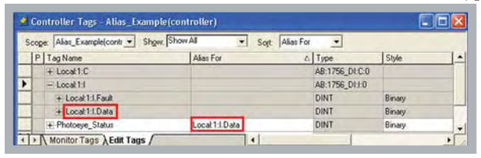
All Array Tags are addressable in the *C-more* programming software. Array Tags can be imported via the L5K file. You may choose to limit the number of imported elements by adjusting the "Import Array Element Count Limit" field in the *C-more* programming software import window.

User Defined: User-defined data types are complex data types that are created by the user. They are very much like the Pre-defined structures but the user may choose which data type members the User-defined data type is composed of. It is a very efficient way to organize data in the PLC.

Here is an example of a User-defined data type:

DataType_A:

DintMember (which is a DINT member of this User-defined data type)



Continued, p. 26>>

Tech Review cont.

operator interface compatibility cont.

Continued from, p. 25

IntArray[10] (which is a INT array of this User-defined data type)

BoolArray[32] (which is a BOOL array of this User-defined data type)

If a Tag called "Example1" was added using the "DataType_A" data type, the RS Logix5000 software would create these tags:
Example1.DintMember
Example1.IntArray[0]–
Example1.IntArray[9]
Example1.BoolArray[0] –
Example1.BoolArray[31]

All User-defined data types are addressable in the ***C-more*** programming software. User-defined data types are also importable via L5K file depending upon the members of the user-defined data type. Refer to application document AN-EA-004 on the AutomationDirect Tech Notes web page and see section 5.a. for details.

I/O Tag Data: I/O Tags are created automatically when an I/O module is added to the configuration. They are typically members of a complex data type. The complex data types differ based upon the module being configured and the various configuration options that the user has selected.

These data types are not directly importable into ***C-more*** via the L5K file but must be imported using the standard ***C-more*** Tag importation. There is a macro function available to help make I/O tags importation easier. I/O tags can also be manually entered.

Aliasing: Aliasing is a method to 'de-reference' the user tag from the memory location in the PLC. It could be said that Tag names themselves do this very thing but Aliasing creates another abstraction layer from tags such as I/O tags that can and will change very often. Aliasing is very useful for HMIs, where the data point is needed but the constant hassle of changing the name can become tedious. An example of an Alias in the RS Logix 5000 software is shown below:

There are several Alias import options available in ***C-more***. In the following example, "Photoeye_Status" is an Alias to the I/O tag "Local:1:I.Data".

Here is an explanation of these options:

"Do not import Aliases" = This means, simply, that the ***C-more*** programming software will not import any Alias tag names.

"Import all Aliases & Tags" = This means that the ***C-more*** programming software will import everything that it can. If there are many Alias tags in the project, this method will result in duplicate tag references since you will have imported the base tag itself, as well as the Alias of that tag.

"Import only Aliases" = This option will only import those Tags that have Aliases.

"Import Aliases & Tags that do not have Aliases" = This option will import Alias tags but not the base tag that the Alias refers to and it will import tags that do not have Aliases.

Unfortunately, only importation of Aliases to BOOL I/O tags can be done with this method because the memory size for all other I/O data types cannot be derived from the L5K file. To import Aliases of all non-BOOL I/O tags, use the method outlined in section 5.b. of the application document AN-EA-004 on the AutomationDirect Tech Notes web page.

Program Scope Tags: Tags can be in two locations in the PLC: Controller Scope (globally accessible anywhere) or Program Scope (only available within that program).

Program Scope tags can be accessed via ***C-more*** HMI but they require additional syntax in front of the tag name. To access a Program Scope tag, you must enter "PROGRAM:program name.tag" name where PROGRAM is static text to identify that a Program Scope tag is following.

Next Issue…

In the next issue, Part 2 will cover importing and exporting the tag database, and how to optimize communications between ***C-more*** and the Allen-Bradley PLCs.

For the complete discussion (covering Parts 1 and 2), go to **http://support.automationdirect.com** and select the link to Technical and Application notes. Select the ***C-more*** link and download document AN-EA-004 (Using ***C-more*** HMI with Allen Bradley PLCs).

User Solutions cont.

environmental compliance equipment

Continued from, p. 22

important feature of this interface is that it allows manual operation of each function using the touchscreen.

The reliability and low cost of the AutomationDirect products were major factors in choosing them for the ClearFlow treatment system.
www.ecequip.com

Andrew Hyatt Bio:

Andrew Hyatt is a Managing Member of Environmental Compliance Equipment, a waste water treatment equipment manufacturer and distribution company with offices and manufacturing facility in Jupiter, Florida and an office in Palm City, Florida. Mr. Hyatt has over 16 years of experience in the waste water treatment industry, specializing in industrial waste water and vehicle wash water treatment.

Environmental Compliance Equipment Manufacturing as a whole provides experience in a variety of water treatment technologies, indoor air systems, marina wash water and sewage operations as well as consulting and private label design and manufacturing of specialized equipment. ECE has a world wide distribution system to provide equipment to industry.

The Break Room

Brainteasers

BrainTeasers

1.) Tank you very much

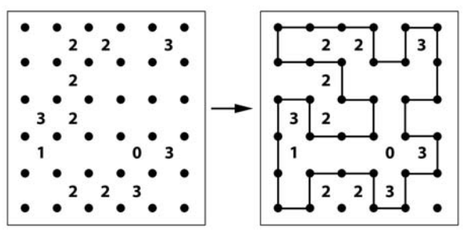
In a factory far, far away – a tank is filled 1/3 full with an unidentified liquid, and another tank of the same size is filled ¼ full with the same non-hazardous fluid. Both tanks are then topped off with water and mixed thoroughly. The resulting mixtures are pumped into a larger vessel and mixed together, before being returned to the original tanks. What is the resulting ratio of the unknown liquid to the water in each of the tanks?

2.) Slither Link

(also known as Fences and Puzzle-Loop) is a type of logic puzzle with simple rules and challenging solutions.

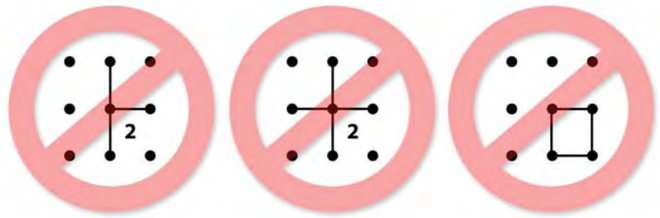
The rules are simple. You draw lines between the dots to form a single route (or 'loop') without crossings or branches. The numbers in each square indicate how many lines will be drawn about that square. A square with no number can have any number of lines bounding it. You can use logic to solve these puzzles, guessing should not be required.

Here is a simple Slither Link with the solution shown on the right:

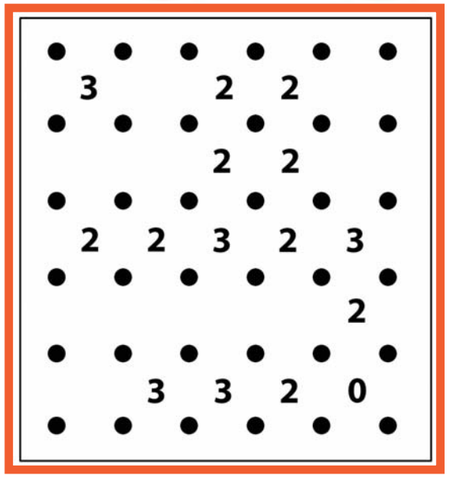


Puzzles courtesy **www.puzzle-loop.com**

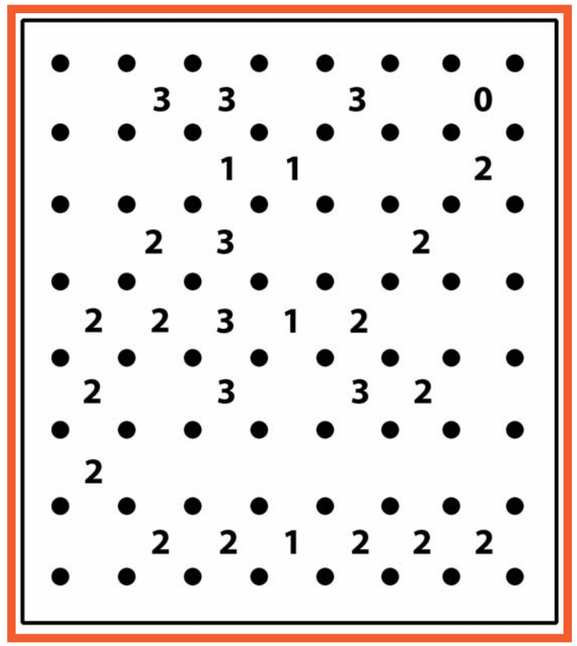
For more Slither Link puzzles (including much harder ones) and/or more tips and hints please visit **www.puzzle-loop.com**



Loop Puzzle 1.)



Loop Puzzle 2.)



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

AC Servo Systems

start under $1,000

The ***Sure*Servo family of brushless servo systems** from AutomationDirect is fully digital and offers a rich set of features at dynamite prices. Beginners to experienced users can take advantage of this easy-to-use family for as little as $965* (100W system).

** All components sold separately.*

- **Eight standard systems from 100 W to 3 kW**
- **Use with *Direct*LOGIC PLCs or any other host control**
- **Drives feature on-board indexer and adaptive tuning modes**
- **Free set-up software**
- **2 year warranty**

Agency Approvals for Drives: cULus

Agency Approvals for Systems: CE

Agency Approvals for Motors: UL

SureServo drives accept a wide range of command sources:

- **Built-in motion controller with preset position, velocity or torque select presets with switch inputs and/or the multi-drop Modbus serial interface**
- **Position commands with "pulse/direction" or "count up/down" format**
- **Encoder follower**
- **Analog voltage Velocity or Torque command**

For configuration, tuning and diagnostics, use the drive's integrated keypad/display or take advantage of the free *Sure*Servo Pro™ PC-based software.

CHECK OUT OUR PRICES

Note: All components sold separately.

Servo Systems	AutomationDirect Price/Part Number	VS.	Allen-Bradley Price/Part Number
Digital Servo Drive	$479.00 SVA-2040		$903.45 2098-DSD-005
100W Servo Motor with connectorized Leads	$319.00 SVL-201		$639.35 Y-1003-2-H00AA
Breakout Board Kit for CN1 Control Interface	$89.00 ASD-BM-50A		$192.85 2090-U3BK-D4401
10' Motor Feedback Cable	$49.00 SVC-EFL-010		$144.40 2090-UXNFBY-S03
10' Motor Power Cable	$29.00 SVC-PFL-010		$84.00 2090-XXNPY-16S03
Configuration Software	FREE SV-PRO*		$76.95 2098-UWCPRG
	*SureServo Pro software is FREE when downloaded and is also available for $9 on a CD		
Complete 1-axis 100W System	$965.00		$2,041.00

All prices are U.S. list prices, AutomationDirect prices are April 2008 prices. The Allen-Bradley 100W system consists of part numbers shown in table above with prices from http://shop.rockwellautomation.com 7/20/07.

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