Automation NOTEBOOK®

Your guide to practical products, technologies and applications

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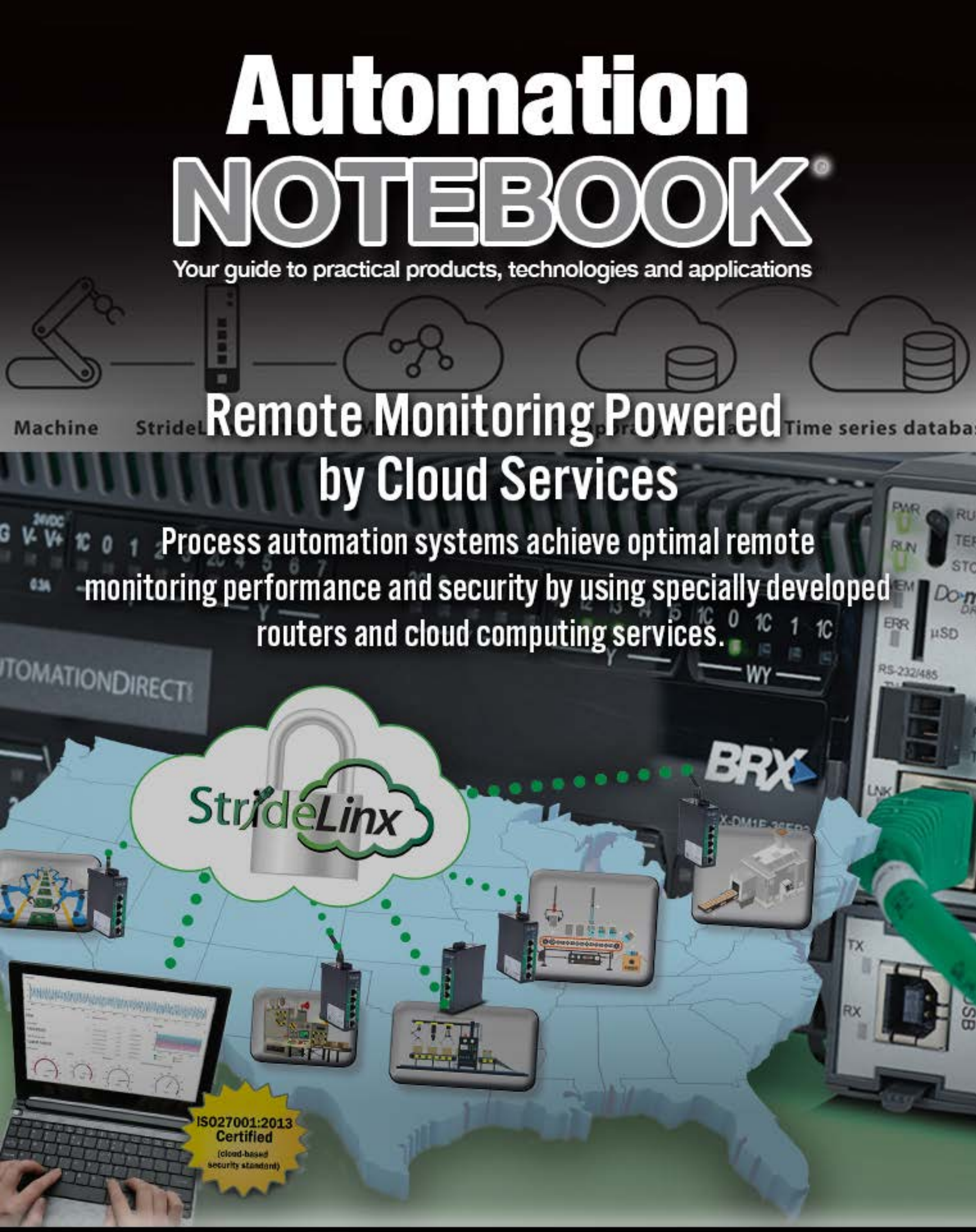

Automation NOTEBOOK®

Your guide to practical products, technologies and applications

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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.

It's never that easy". As a homeowner, I've learned that this is one of the truest statements ever spoken. Something that seems like an easy fix, in the blink of an eye, can become a lot more difficult. Case in point, my son, like most kids his age, is a serious gamer. But his games aren't what I grew up with. They don't have simple plots like defeating an angry ape who has mastered barrel weaponry or helping two friends, Ryu and Ken, travel the world to fight in the streets. These games are very advanced with intense graphics and when playing online, require lots of bandwidth. So much so, that a Wi-Fi connection doesn't really cut it. Which leads to my "easy" project of running an Ethernet cable to his room, through the attic, from the room with the modem two doors down. Since I had already done this for a different room, this would be a piece of cake. My first step was to head into the attic to plan the easiest route for the cable. While in the attic, to get a closer look, I stepped toward the edge of the attic's platform only to realize there was no more platform. The platform's edge was covered with insulation, and I made the wrong assumption. As you may know, sheetrock doesn't offer any support for a 250-ish pound person, and my leg ripped through it like it wasn't even there. Luckily, the rest of me didn't follow through and I got stuck between the rafters. After a short moment of shock, I pulled myself up and realized first, I was lucky to only have minor scratches. Second, that my "easy" $30 job just became a whole lot more and third, that my son was already on the phone ratting me out to my wife. The moral of this story is that you can't plan for the unexpected at home or in the field. But when in the field, if the job takes a turn for the worse and becomes much more difficult, we'll be here to help with low-cost solutions and free technical support.

This issue of NOTEBOOK is full of interesting and educational articles including our Tech Threads, which discuss important VFD safety features and how process pump automation can enhance pump performance. We also have a great Cover Story on the benefits of implementing an end-to-end remote access solution that utilizes cloud technology. The User Solutions show how pneumatics and open-source control were used to turn discarded bottle caps into works of art, and how CLICK PLCs helped to quickly produce sanitizing products used to combat Covid-19. Our Student Spotlight discusses how AutomationDirect components helped Georgia Tech students melt metal with their homemade induction furnace. For information about exciting events happening in and around AutomationDirect, including some recent product awards, take a look at the Business Notes. In this issue, you'll also find information on our newest products, such as Quadritalia modular enclosures, the new CLICK PLUS 2-slot CPUs, Norgren air preparation components, UPS-capable DC power supplies, additional ReeR Mosaic safety controller components, and more. As always, the Break Room is stocked with fun and challenging brainteasers, so give them a try and see how many puzzles you can solve.

CLICK PLUS Serial Communication Option Slot Module and 2-Slot CPUs

CLICK PLUS PLCs combine the simplicity of the original CLICK PLC with advanced features, including Wi-Fi capability, MQTT communication, data logging, and mobile access. The new CLICK PLUS 2-slot CPU offers an additional built-in option module slot for even more PLC I/O customization.

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MurrplastiK Cable Entry Systems

AutomationDirect has added more choices to their offering of Murrplastik cable entry systems. The addition of the KDL/D MONO series cable entry system provides the same benefits as the existing KDL/D series in a round frame form.

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Norgren Excelon Plus Air Prep Components

AutomationDirect has added Norgren Excelon Plus air prep components to its existing lineup of pneumatic air prep products. Norgren, a well-known name for pneumatic components, manufactures products that provide exceptional performance, and their Excelon Plus air prep components are compact, lightweight, and suitable for most industrial applications.

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Quadritalia Modular Enclosures

AutomationDirect has added new Quadritalia modular enclosures to their selection of over 7,000 high-quality enclosures. This new modular enclosure line adds enclosures that can be easily assembled on-site to fit any application while maintaining the required NEMA rating.

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New ReeR MOSAIC Safety Controller Components

AutomationDirect has added new ReeR MOSAIC safety controller components for expanded capability. The Reer MOSAIC (MOdular SAfety Integrated Controller) makes it easy to manage safety systems and sensors. It is modular, expandable, and configurable for managing all safety functions of a single machine or an entire plant.

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New General-Purpose, High-Performance, and Harsh-Duty AC Motors

AutomationDirect has added a host of new motors from Regal Rexnord to its existing portfolio, including two new series of Marathon® motors and Leeson® specialty motors. The new Marathon Globetrotter motors are high-quality 3-phase general-purpose motors that can be controlled by an inverter and are rated up to 200hp.

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New RHINO Power Supplies with Integrated UPS and Power Boost Technology

AutomationDirect has added open frame and panel mount power supplies, with integrated UPS functionality, to their RHINO SELECT series of power supplies. The integrated UPS feature provides seamless battery switchover to keep critical operations running when there is an unexpected loss of power.

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Remote Monitoring Powered by Cloud Services

Process automation systems achieve optimal remote monitoring performance and security by using specially developed routers and cloud computing services.

By Jonathan Griffith, AutomationDirect

Machines, equipment skids, and automation systems used for manufacturing and processing facilities are more connected than ever. Some of the newest equipment may come with cloud-capable controllers, but many users are adding gateways or other devices to make the connection from legacy operations technology (OT) systems to information technology (IT) logging, visualization, and computing resources.

Cloud networks are often the best way to interconnect and manage many data sources for an industrial internet of things (IIoT) implementation, but only if users understand the potential data security risks and take the right steps to address them.

Creating this type of a solution from scratch is a complex undertaking and may not be secure. Fortunately, there are complete solutions available which are tailored to the needs of industrial users who need to connect OT data quickly and easily to IT resources.

This article describes why cloud-capable routers and an associated cloud solution—designed using a comprehensive information security management system (ISMS)—are often the best all-in-one solution for safely and easily setting up remote access, remote monitoring, and alert functionality.

SECURITY, BOTTOM TO TOP

Industrial remote connectivity and monitoring solutions include hardware and software elements on-premises at the production facility and in the cloud, and all the networking functionality in between. A typical solution uses a site-located intelligent router to provide secure remote access with local machines, and has the capability to log and then transmit machine or process data to cloud servers over the internet (Figure 1).

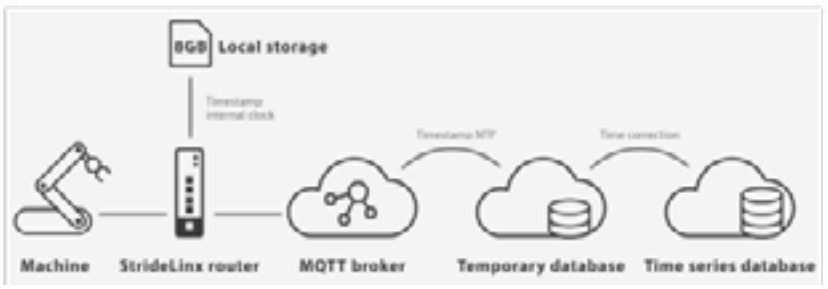

Figure 1: A remote connectivity and monitoring solution must access data at the site, include data logging provisions, and securely transmit that data to cloud servers.

As the following sections will describe, it is a significant endeavor to create a safe, reliable, and trustworthy IIoT solution of this type. Therefore, choosing an off-the-shelf solution providing routers and cloud services is typically the best way to ensure all elements are optimal. To start, the solution should be certified according to the ISO 27001, which addresses information security management, and should provide the following capabilities and functionalities.

Router Security

Most legacy controllers used for processes, equipment, and facilities were never designed for security—and even the few that were, are rarely updated. Therefore, these controllers should never be connected to a company network or the internet directly. Instead, they should reside on a plant network, which in turn must be isolated from the internet using a router with a built-in firewall.

By default, the router firewall should block all traffic between the machine local area network (LAN) and the company/cloud wide area network (WAN) (Figure 2). Of course, to configure remote connectivity on standard routers requires significant understanding of communications and IT networking. This can be a complex task to perform manually, requiring skilled personnel to create and manage these settings.

continued >>

Figure 2: AutomationDirect StrideLinx VPN routers install on-site to access machine data, and seamlessly and securely transmit that data to StrideLinx cloud services.

For this reason, a router which automatically connects to a secure comprehensive cloud-based solution is a better approach. The cloud solution should also provide a health indication of all associated routers, and notifications if a router goes offline for any reason.

There are a few more characteristics needed to ensure cloud-capable routers are securely implemented:

- Secure Connectivity Protocols:

  HTTPS, MQTT over TLS, and secure virtual private network (VPN) connectivity are three of the most popular protocols to establish and maintain secure and encrypted cloud communications for remote monitoring and connections.
- Only outgoing ports:

  Because most IT groups will block incoming internet communications, it is essential for routers to establish secure connections using only outgoing ports, which will be sufficient for most sites.
- Access restrictions:

  Industrial routers must work well with site IT security standards, while addressing the needs of OT users. This means the router should be capable of using a static or automatic DHCP IP address, and it should also accept a hardwired digital input to enable or lockout remote access.
- 2-factor authentication:

  Solutions should include the capability to mandate 2-factor authentication as part of the user management system, as an additional security step to strengthen the account by requiring users to verify their identity using a one-time password method.
- Router failover:

  Site network connections are not always stable, so an industrial router must be capable of using a primary/preferred network, and then performing a failover to a secondary/fallback network as needed. This functionality should be available for Wi-Fi, 4G, and Ethernet networks.
- Local data logging:

  For the same reason router failover is important, the router must also include significant on-board memory to log data offline while a connection is not available, and then transmit the data when the router is back online.

Cloud Security

Some users might consider creating their own cloud server configurations. However, there are many issues which make this type of system complex to develop from scratch. As with the routers, a better choice is to use a commercially available cloud services solution structured for the best availability and security, as well as required performance.

Cloud services providers offer a network of dozens of servers, distributed in ISO 27001 certified data centers located worldwide (Figure 3). Some servers are necessary for data handling roles, while others support VPN connections. The VPN server network is typically distributed across the globe to provide low latency connections, along with redundancy so if one server goes down the others will take over automatically. This is particularly important because VPN connectivity supports HMI and web-based visualization.

Figure 3: The AutomationDirect StrideLinx remote connectivity and monitoring solution is powered by servers distributed in data centers worldwide, to deliver low-latency and provide redundancy for best overall performance.

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Cloud server implementations should also address each of the following aspects:

- Data ownership: Users should ensure the cloud services provider confirms all data is owned by the users, and not by the service provider.
- Kubernetes cluster: This open-source technology is a high-performance way of deploying, scaling, and managing applications, which makes it an ideal platform for offering cloud services.
- Relational database: A redundantly configured relational database cluster is necessary to store information about cloud server devices and users.
- Non-relational database: Events such as alarms and logs should be stored in a non-relational database cluster to optimize required storage resources, and it should be replicated for high availability.
- Time-series database: Process and operational data consists of timestamped values delivered via MQTT, so they require a specific time-series database cluster optimized for quickly accessing and performing computations on large data quantities in an efficient manner.
- Browser and app security: Because the cloud platform is accessed via browsers and apps, there needs to be a way of managing and authenticating administrators and users.
- VPN tunnels: The cloud service should also enable secure VPN tunnel connections in a way such that 3rd party apps can securely access the cloud data. This provides the best end user flexibility to use apps of their choosing.
- Management services: Cloud computing solutions should include centralized monitoring, logging, and analytics to detect anomalies in a timely manner. An independent third-party should periodically scan the cloud services for vulnerabilities and audit the servers. Access control policies should carefully limit which developers can work on servers and software, and software changes should be reviewed by at least one other developer prior to deployment, with a versioning system used to provide backups.

Remote Monitoring Performance and Security

Most processing companies would like to take advantage of remote monitoring, access, and visualization of their automated systems. But for many, it would be difficult to create a comprehensive solution from scratch, especially one that performs under adverse conditions and follows ISO security standards. Even if such a solution could be created in-house, maintenance and upgrades would be very challenging and resource intensive.

By choosing an end-to-end solution with cloud-capable routers and an associated cloud solution developed using the latest standards and technologies, these users can quickly implement a safe, reliable, and trustworthy IIoT platform..

All figures courtesy of AutomationDirect

About the Author

Jonathan Griffith is the Product Manager for Industrial Communications & Power Supplies at AutomationDirect. Prior to joining AutomationDirect in 2015, he worked at ANADIGICS from 2002 to 2014, a Wi-Fi networking company. Jonathan holds three degrees, all from the Georgia Institute of Technology: an MBA, an MSEE and a BSEE.

Business Notes

CLICK PLUS gains notable recognition by winning one major industry award and is a finalist for another.

AutomationDirect's CLICK PLUS PLC is the next generation platform for delivering reliable and familiar functionality for basic control applications, combined with advanced features like Wi-Fi, data logging, and increased security measures. CLICK PLUS has recently won the 2022 Control Engineering Magazine Engineers' Choice Awards for the Control Systems: PLCs, PACs Category. CLICK PLUS is also a Finalist for the Plant Engineering Magazine 2021 Control Systems Product of the Year Award.

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Business Notes

AutomationDirect and FIRST Robotics in 2022

AutomationDirect has been a proud supporter of FIRST robotics for almost 2 decades. The 2022 Digital Animation Award is offered to help encourage students to cultivate skills in design and creation of animation including, but not limited to, storytelling, creativity, use of computer software, and an understanding of different techniques and forms of animation.

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Student Spotlight

EMMA wins Design Competition at Georgia Tech

The Georgia Institute of Technology Engineering Department requires two semesters of design experience, with a course known as "senior design". Students divide themselves into teams of 4-6 students, often comprised of members from within a single department, or students can form interdisciplinary teams. The projects themselves come from three sources: faculty proposed, industry proposed, and student proposed. This year's winning project was a 10 kW induction furnace used to melt metal affectionately named EMMA.

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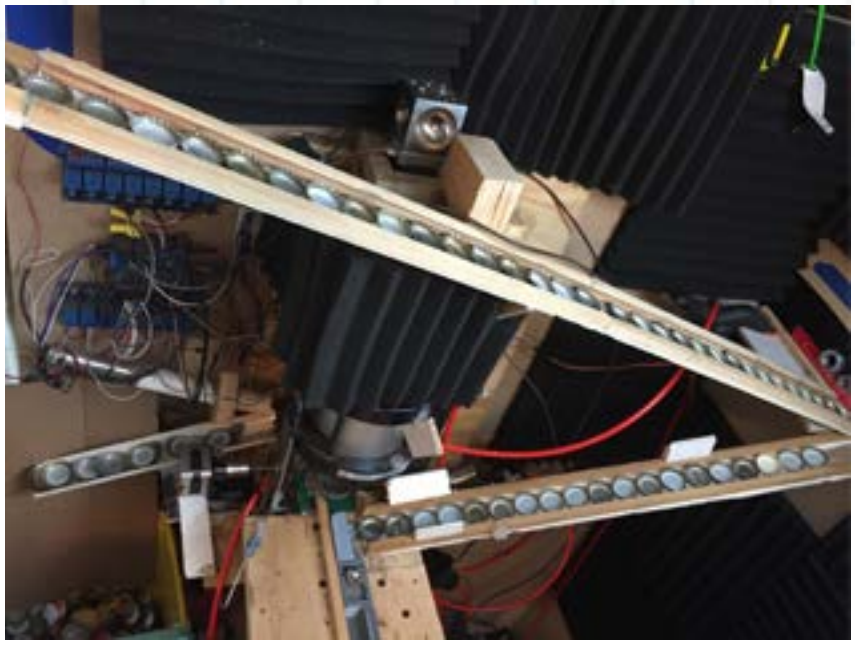
User Solutions



Upcycling with Automation

This innovator found a way to upcycle bottle caps into extraordinary works of art, an activity that helps support local children's charities. By applying practical automation, he has efficiently scaled up production.

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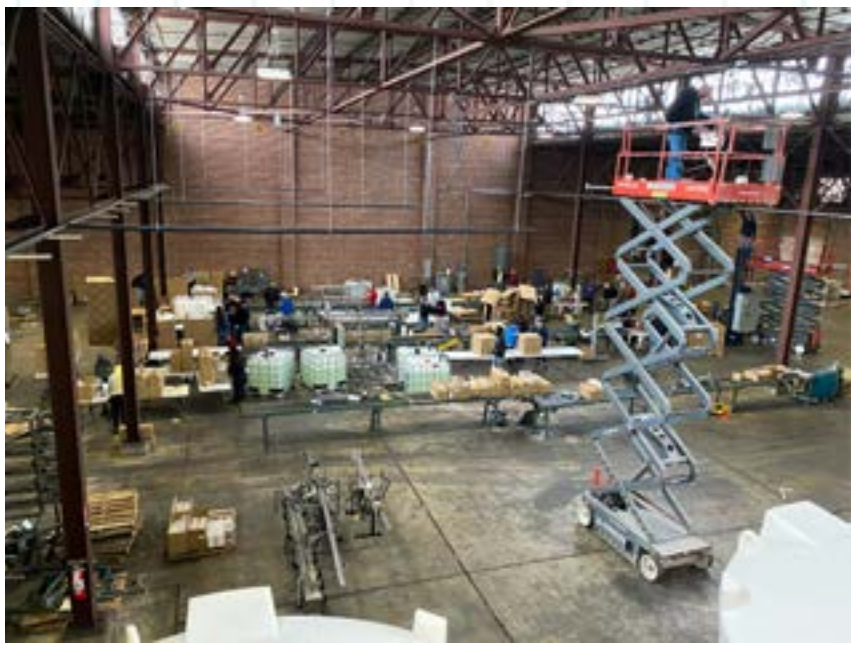
User Solutions



Quick and Clean Automation Implementation

To help meet COVID-prompted needs for sanitizing wipes, an HVAC contractor used their multiple-disciplinary background and AutomationDirect products and support to quickly created automated filling machines.

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Tech Thread

Process Pump Automation Options

Whether pumps are automated with hardwired controls or PLCs, designers can provide enhanced functional and protective features using control and monitoring relays.

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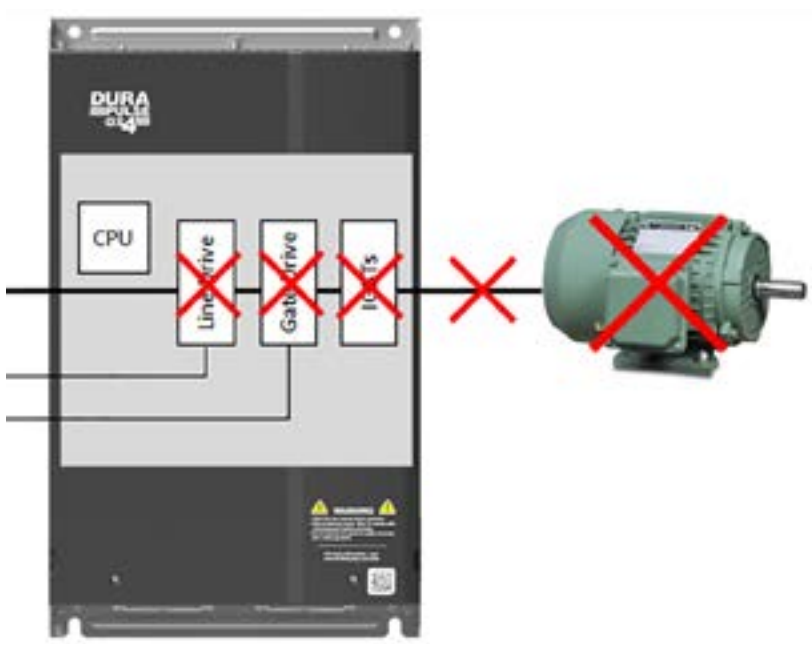
Tech Thread



What is VFD Safe Torque Off, and How Does it Improve Safety?

The safe torque off function built-in to modern VFDs significantly improves the integration of emergency stop (e-stop) electrical interlocks to stop the motor if any unsafe condition is sensed or an operator triggers an e-stop device.

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Brain Teasers

By Chip McDaniel, AutomationDirect

1.) Team Colors

Joe, Bob, Sue, and Robin are members of an FRC robotics team. Their team roles are, not necessarily respectively, President, Treasurer, Electrical Lead, and Mechanical Lead. They wear (again not-necessarily-respectively) red, blue, black and green shirts.

You are told that the President is better at math than Bob, and that Sue and the Electrical Lead often play video games with the team members in black and green shirts. Joe and the Mechanical Lead have lunch with the team member in the green shirt, but that isn't the treasurer, as the treasurer always wears red.

What was the role and shirt color of each team member?

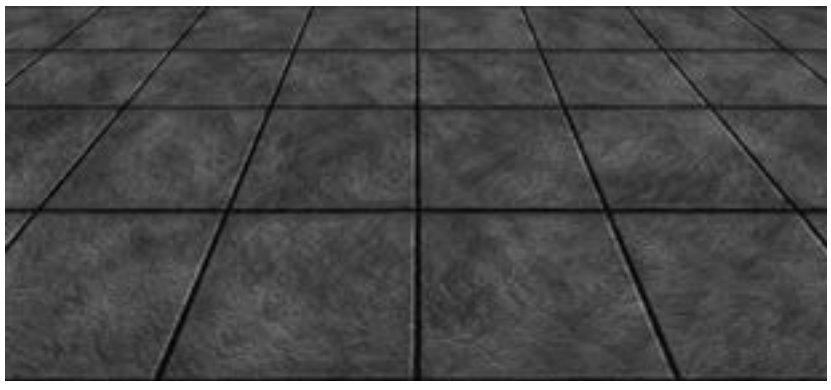
FIRST ROBOTICS COMPETITION

Are you aware of the FIRST Robotics Competition (FRC)? Learn more and get involved with a local team here. Read more about our involvement in THIS issue of Notebook.

2.) Crossing the Line

A certain factory floor is tiled with identical square tiles, and is exactly 72 tiles wide x 90 tiles long. If a line is drawn from one corner of the factory to the opposite diagonal corner – how many of the tiles does that line cross?

What would the answer be if the floor measured 2982 x 3822 titles? Or, in other words – can you find the general solution to the problem for any size room?



3.) Liar's Club

The annual Liars Club Dinner is (again) planned for May, but none of the members know which night the event will be held. That doesn't stop some of the members from making the following claims at the March meeting: The first member stands to speak and claims that the date will be an odd number. A second member states that the date is a perfect cube, while the third member to speak reports that the date is not a perfect square. After the meeting, the president confides to the board that the meeting will be in the first week of the month. But the membership director (who is always having trouble collecting dues from deadbeat members) insists that the date must be later in the month than the date on which the event was held the previous year. That date is known to have been the 17th.

It was subsequently discovered that only one of the members was telling the truth. What is the date of the event?

All puzzles credit E. R. Emmet (1909-1980)

Brain Teaser Answers

By Chip McDaniel, AutomationDirect

1.) Zig or Zag

From the setup of the puzzle we can rule out several colors and roles:

- President can't be Bob
- Sue not the Electrical Lead
- Joe not Mechanical Lead
- Neither Sue nor Electrical Lead wears Black or Green
- Neither Joe nor Mechanical Lead wears Green
- The Treasurer wears Red, and therefore no other team role wears red

It may help to fill in a chart with that known information:

	Red	Blue	Black	Green	President	Treasurer	Electrical	Mechanical
Sue			x	x			x	
Bob					x			
Joe				x				x
Robin								
President	x							
Treasurer	TRUE	x	x	x				
Electrical	x		x	x				
Mechanical	x			x				

Then we can deduce (and continue filling in the chart):

We can fully complete the roles and colors (bottom left quadrant of the chart)

- The President must wear Green (as no one else wears Green), and also rule out blue and black for Pres…
- Therefore the Mechanical Lead must wear Black, and rule out blue for Elec
- Therefore the Electrical Lead must wear Blue

Then, because we know:

- Bob is not the president…
- The President wears green…
- Yet Sue and Joe don't wear Green…

THEN therefore Robin must be the President

Now:

- We know Sue doesn't wear black…
- But that the Mechanical Lead DOES wear Black…
- And that Joe nor Robin is the Mechanical Lead…

Therefore Bob must be the Mechanical Lead

That leaves the only possible role for Sue to be the Treasurer.

And therefore Joe must be the Electrical Lead.

So the roles and colors are:

Sue: Red: Treasurer

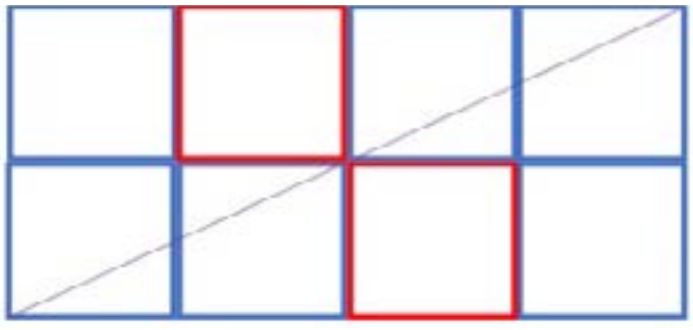
Bob: Black: Mechanical Lead

Joe: Blue: Electrical Lead

Robin: Green: President

2.) Crossing the Lines

A picture may help:



In this simple case we can see that the line crosses four of the tiles on a 2 x 4 grid.

The line crosses all four(4) columns of tiles from right to left - once and only once – and both(2) of the rows of tiles from top to bottom - once and only once. But note that in the center of the grid – the line goes directly through the intersection of four tiles and only crosses the blue tiles.

So if we know how many "exact intersection" crossings there are, then the general formula will be pretty easy to determine:

- Total tiles crossed = number of rows + number of columns – the number of exact intersections

So, the trick becomes how to calculate the intersections. This number is the Greatest Common Factor(GCF) of the two numbers (width and length).

The greatest common factor of 2 and 4 is 2.

So, for our simple example above with 4 tiles wide x 2 tiles long – the number of tiles crossed is = 2 + 4 – 2 = 4 tiles.

The greatest common factor of 72 and 90 is 9.

So, with 72 tiles wide x 90 tiles long – the number of tiles crossed in the original problem statement is = 72 + 90 – 9 = 153 tiles.

And the extra credit: the CFG of 2982 and 3822 is 42, so the number of tiles crosses is 2982 + 3822 – 42 = 6762 tiles.

Continued on next page.

Brain Teaser Answers

By Chip McDaniel, AutomationDirect

3.) Liar's Club

It may help to make a chart. We are looking for the only row with a single true statement. The dinner was held on the 4th.

It may help to make a chart. We are looking for the only row with a single true statement. The dinner was held on the 4th.

	Odd	Is a Cube	Not a Square	In first two weeks	Later than Last Year	# True
1	T	T	F	T	F	3
2	F	F	T	T	F	2
3	T	F	T	T	F	3
4	F	F	F	T	F	1
5	T	F	T	T	F	3
6	F	F	T	T	F	2
7	T	F	T	T	F	3
8	F	T	T	T	F	3
9	T	F	F	T	F	2
10	F	F	T	T	F	2
11	T	F	T	T	F	3
12	F	F	T	T	F	2
13	T	F	T	T	F	3
14	F	F	T	T	F	2
15	T	F	T	F	F	2
16	F	F	F	F	F	0
17	T	F	T	F	F	2
18	F	F	T	F	T	2
19	T	F	T	F	T	3
20	F	F	T	F	T	2
21	T	F	T	F	T	3
22	F	F	T	F	T	2
23	T	F	T	F	T	3
24	F	F	T	F	T	2
25	F	F	F	F	F	2
26	F	F	T	F	T	2
27	T	T	T	F	T	4
28	F	F	T	F	T	2
29	T	F	T	F	T	3
30	F	F	T	F	T	2
31	T	F	T	F	T	3