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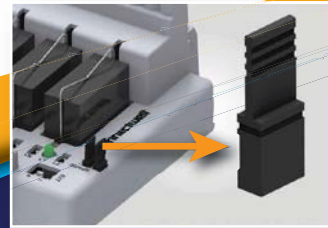


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COVER STORY

10 Designing a Turnkey Vision-Guided Bowl Feeder Cell

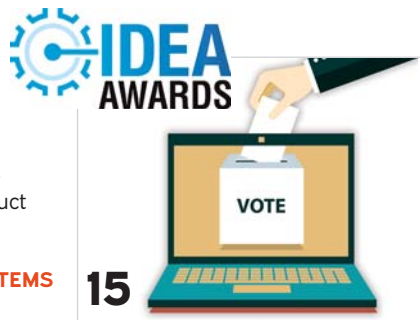
How a visionary automated solutions provider goes about developing a turnkey, flexible feeder sorter system.

Cover Photo Credits: Skye Automation | Machine Design

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From the Editor

By Bob Vavra, Senior Content Director

The Same Space at the Same Time



Tempting though it may be, this is no time to hold off on technology investment.

WE ALL HAVE OUR FAVORITES. I have cultivated a series of lists over the years to include favorite song (“Deacon Blues” by Steely Dan), favorite movie (“Network,” from 1975, which turned out to be a foreshadowing of 2022 American media) and favorite joke (*Did you see the news story about a new corduroy pillow? It’s making headlines*).

But my lists also tend to drift toward the obscure, including my favorite law of physics: Two things cannot occupy the same place at the same time. This axiom has a more formal title: the Pauli Exclusion Principle, which studies the molecular structure of solid objects. Common examples of this principle are seen in football games and car crashes.

Economics cannot be confused in any way with physics. Today we see two opposite forces existing in the same space at the same time. We see manufacturing growth existing in the same place as recession fears. We see productivity rising even in the midst of workforce shortages. We see output continuing to remain solid amid a supply chain crisis.

Manufacturers now must stand in one spot, buffeted by two opposing forces, and choose which way to turn. Staying in one place always is an option, but when you are assailed by competing forces, the results can be debilitating, frustrating and eventually unproductive.

There’s a lot to be said for stepping back and waiting for things to settle down. It’s a safe play to maintain production levels, hold off on technology investments for another day and try to wait for a calmer day and a clearer picture of the future.

As we head into the fall, there will be opportunities to see what technology in an age of digital manufacturing can look like. The future is on display at IMTS in Chicago in September and Pack Expo in Chicago in October. In this month’s issue of *Machine Design*, you will find the 2022 IDEA Awards Finalists. They represent the next wave of product and process innovation.

Embracing equipment investment and process improvement in a time of uncertainty seems like a dicey proposition. Yet despite the crises of the past three summers, we head into the final quarter of 2022 with a clear understanding of the value of digital manufacturing. We see the future of our industry, and the only real choice is to move forward. Staying where you are puts you at risk of being left behind.

Newton’s Second Law of Motion states that a body at rest remains at rest, while a body in motion tends to remain in motion unless it is acted upon by an external force. This law has a manufacturing application. If you’re trying to grow your operation from a static state, it’s going to take a lot more acceleration—in the form of time, money and training—to catch your competitors that already are moving in that direction.

What our fall trade events will demonstrate is that there have been plenty of innovations created over the past year that will help us accelerate our manufacturing growth. This is not the time to stay in the same place. This is the time to invest and grow manufacturing. ■

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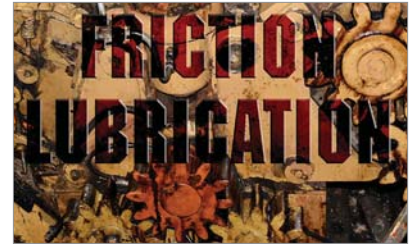
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IMTS Returns to Address Key Manufacturing Issues

From exhibits to education, North America's largest manufacturing show is back Sept. 12-17.



Courtesy IMTS

IMTS IS BACK—two years late and not a moment too soon.

North America's largest manufacturing trade event returns to Chicago's McCormick Place Sept. 12-17 for the first time in four years. The biennial event was cancelled in 2020 due to the global pandemic, and the intervening time has seen global economic, social and technological changes that have had a profound effect on the manufacturing sector.

The return of the International Manufacturing Technology Show, presented by the Association for Manufacturing Technology (AMT), will reflect all that has changed since the last IMTS staging in 2018.

"Conferences at IMTS 2022 offer a deeper dive into the technologies exhibited on the show floor, the chance to network with subject matter experts and like-minded peers, and the opportunity for professional growth," said Bonnie Gurney, vice president – strategic partnerships for AMT, in a press release touting the opening of registration for the 2022 event.

With a focus on the full array of technologies in modern manufacturing, IMTS will provide a forum for every aspect of plant floor technology and strategy.

With the digital revolution in manufacturing gaining momentum, Hannover Fairs USA will once again present Hannover Messe USA as a co-located event at IMTS. The theme for Hannover Messe USA is "Accelerate Industrial Transformation," and this year's event will take a comprehensive look at how manufacturing impacts many of the key issues facing the world.

Education Plays a Key Role

The 2022 edition of IMTS will feature exhibitors from across the vast spectrum of manufacturing equipment suppliers. The show also brings together some of the brightest minds in manufacturing to look at how to take full advantage of that technology.

Among the key educational sessions and symposium are:

IMTS Investor Forum: This discussion will feature show floor tours and information about the \$65 billion manufacturing technology to help investors evaluate opportunities in manufacturing.

The Smarter Sourcing Symposium at IMTS 2022: Supply chain is a significant issue for manufacturers, and the first Smarter Sourcing Symposium will look at how to leverage domestics and regional parts suppliers.

OPC Foundation Conference: Presented by Hannover Messe USA, the OPC UA seminar will focus on the range of industrial interoperability from sensor to cloud computing and the support for the OPC UA standard.

Technology Leadership Summit: ASME will present a discussion around the big topics in digital transformation, including big data, digital twin, robotics and additive manufacturing. The event also will feature a show floor tour.

Focus on the Future

Workforce development remains a critical issue for manufacturing's growth, and a series of sessions at IMTS plan to focus on the broad issues of employee recruitment as well as the need for greater expansion of manufacturing demographic and greater cooperation among public and private partnerships.

The Solutions Theater at Hannover Messe USA will present a series of case studies and discussions around how advanced manufacturing issues such as connectivity, artificial intelligence and a smarter workforce are being addressed by associations and consortiums. The CESMII: The Smart Manufacturing Institute will lead the discussion with participation from such organizations as Automation Alley, German American Chamber of Commerce, Control System Integrators Association and Open Process Automation Forum.

IMTS Specialty Program: Job Shops

Workshop Day 1: The issue of worker recruitment and retention in job shops will be addressed at a workshop on Sept. 12. The workshop will focus on worker development and retention as well as panel discussions on how best to implement digital manufacturing to improve operations. The Technology & Manufacturing Association will discuss the issue of effective marketing in manufacturing.

Another important issue is how to attract and retain more women in manufacturing, and IMTS will feature a focused symposium on that topic. The IMTS Women Make Manufacturing Move program will include a Sept. 12 reception at McCormick Place and a Sept. 14 luncheon and presentation. ■

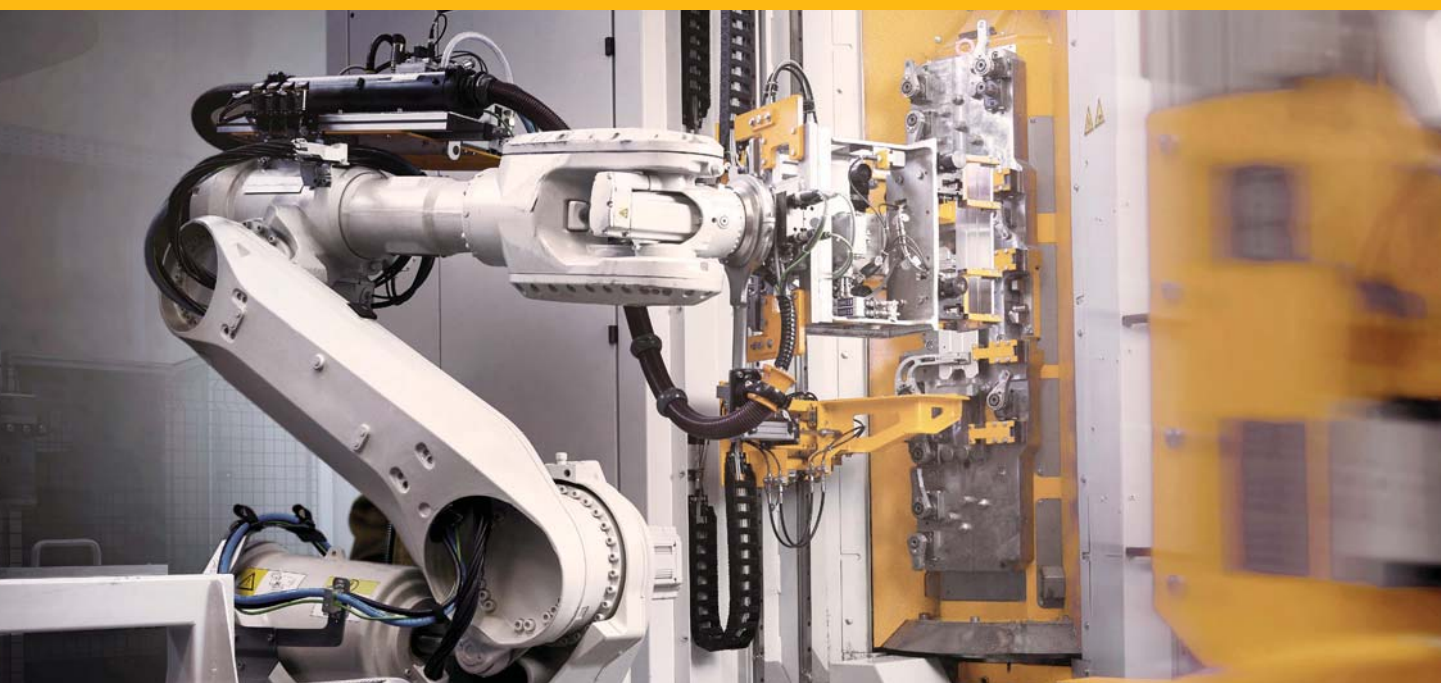
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Designing a Turnkey Vision-Guided Bowl Feeder Cell

How a visionary automated solutions provider goes about developing a turnkey, flexible feeder sorter system.

by Rehana Begg, Senior Editor



On the surface, the job of sorting parts may seem like a singular exercise. In reality, it affects the entire scope of an assembly system. The installation of a parts sorting and feeder system is incomplete without modification and optimization of peripheral equipment.

Parts feeder systems serve a broad range of industries—from high-speed packaging, food and beverage, electronics and metal working to automotive and pharmaceutical—where volume and scalability are crucial. For small and medium manufacturers, a flexible system that can orient and feed multiple part styles is also a priority.

Short of manually feeding parts along a conveyor system, there are a range of automated feeding solutions, including vibratory bowl feeders, bin-picking and flexible feeding systems, and making the best choice is critical to the success of each project. Without exception, exceptional quality,

high feed rates, reliability and easy maintenance are indispensable characteristics.

Installations need to meet the exacting requirements of the feeder design specifications, the production setting and the manufacturer's process, as well as the material, shape and size of the components being fed, according to Skye Gorter, an industrial automation specialist and founder/president of Skye Automation, based in Stirling, Ontario, Canada.

In a recent solution Skye Automation was tasked with configuring an end-to-end automated bowl feeder solution that could perform dimensional and quality inspections on a range of components for an automotive component supplier (Tier 2).

"The challenge was feeding," explained Gorter. "Parts neither fed well through a traditional vibratory bowl, nor did [the client] have the high volumes to justify a vibratory bowl—because that would need a dedicated machine. So, we developed a specific application around the FlexiBowl that could feed various components into a standard inspection station and where we could do a dimensional check on the parts."

Circular System

Unlike a vibratory feeder, a FlexiBowl is a flexible bulk feeder that consists of a rotating plate that relies on the combined actuation of a servomotor and a pulse generator to separate and feed parts.

Skye Gorter, founder and president, Skye Automation, Inc. Credit: Machine Design

The patented brainchild of ARS Automation, an Italian supplier of automation systems, the bowl feeder is compatible with robots and vision systems and is suitable for facilities that have reduced volumes and frequent product changeovers and for applications where parts don't feed well through a vibratory bowl. The FlexiBowl's achieved feed rate is between 20 and 50 parts per minute and has a high payload, with parts total weight exceeding 7 kg, according to ARS Automation.

"The Flexibowl only ever becomes a component of the overall system," explained Gorter, who co-founded his company with his wife, Rachel, in 2015. The company provided a way to channel Gorter's machine vision integration experience and evolved to a machine design and build operation.

Drop, Separate, Pick, Recirculate

In a typical parts feeder scenario, a hopper drops parts onto the surface of a circular feeding bowl, which uses the principles of bidirectional rotation and an impulse generator to separate and stabilize parts. A vision system (camera) takes a photograph of the components before an algorithm identifies the location of the objects on the disc. These coordinates are relayed via communication ports (actuated via Ethernet or I/O) to a robot for the pick and place sequence.

Gorter pointed out that there is a trade off in the feed rate (it is "a little bit slower") relative to a traditional vibratory bowl, but the added flexibility, by having one machine that's capable of doing many different tasks, makes up for what it lacks in terms of speed rate. Skye Automation's client was looking for a feeder system that could handle six different families of components, with a cycle rate of 10 PPM and with dimensional inspection functionality that could ensure components had been formed correctly before being picked and placed.

Alongside these specifications, their needs assessment revealed the design team would have to develop an automatic tool changer at the robot end, with a nest

AT A GLANCE:

- Skye Automation Inc., an automated solutions provider for controls, electromechanical, safety, machine vision and sensor applications, orchestrates a turnkey bowl feeder system for an automotive component supplier.
- Skye Gorter, founder and president, Skye Automation, discusses the design considerations his team made to fulfill the requirements of a pre-built vision guided flexible automation cell.
- In this application, the design team opted to use a FlexiBowl that works in tandem with an industrial robot and a vision system.

for component inspection. At the vision integration end, cameras oriented in two different directions would inspect parts with a high degree of repeatability and accuracy. "We're running at about 50 microns for repeatability and dimensional accuracy," said Gorter.

Process Dynamics

The process of configuring a flexible feeder system (which includes a robot, vision system and bulk feeder) is an analytical process broken down into several fields, said Gorter. "One field would be the vision requirements that are needed for the accuracy and range of products," he said. "And then the mechanics are often geared towards what is required from the vision perspective."

Stability and repeatability are two factors that affect the design of the vision system. "We want to avoid as much as possible ambient influences on the machine vision system," said Gorter. In other words, how the parts feed, how they're manipulated and how they need to move are all dependencies that play into the mechanical feeding system requirements.

For instance, autonomous runtime (the amount of time an operator can be away

from the machine) can dictate some of the feeding requirements and the types and shapes of parts, which in turn affect robot orientations, as well as the end-of-arm tools required. "And then, what those parts have to be fed into would dictate the surrounding mechanics, as well as the safety considerations and guarding," Gorter said.

For the flexible feeder system to work as intended, the vision system had to be calibrated to the robot. The vision software is not proprietary, but it is a stand-alone product for which Skye Automation has secured exclusivity in North America. The software, which Gorter's team paired with GigE cameras, runs on a Windows IoT computer.

"The components are generic; we simply program the vision using pre-made tools that are designed for advanced machine vision functions," said Gorter. "Additional capabilities are possible through scripting custom tools in MvTec's HALCON software and adding them in for more specialized applications."

“The components are generic; we simply program the vision using pre-made tools that are designed for advanced machine vision functions.”

From there, the team used industrial communications from the PC to the industrial components, which is typically Ethernet IP to the robot, and Ethernet IP to the FlexiBowl. The software interface becomes the master controller for the integration and communication between devices, said Gorter. Overall, his team was able to achieve a robust solution with a high degree of precision and reliability for the long term.

Quality and Throughput

Skye Automation's design team also designed a multipurpose tool so the robot could be fitted with a gripper mounted to

the end effector. A custom vacuum component designed for picking seals had to be connected to a stud.

The custom seal feeder uses tension for this application. “We call it tension on winder,” said Gorter. “We developed that to specifically feed the product, as well as vision guidance to detect the location of it. The robot is able to properly identify and pick the seal with a high degree of precision.” The ability to identify seal imperfections is an advantage that prevents the assembly of products that do not meet quality standards.

Price Tag

Although the cost of building a turnkey solution depends on the project scope and the unique requirements, Gorter noted that a starting point is around \$200K.

“In terms of value, that relates largely to many other factors,” he explained. “For example, in this application we eliminated the need for an operator, but we also provided a repeatable solution and high-quality assembly that is going to eliminate other expenses or costs that can be related to missed quality or errors in the assembly that would happen through a manual process. Those are often some of the bigger and unexpected expenses that can reduce profitability for a small company. Whereas, automating that gives you reliability of your manufacturing process—the process times as well as your quality.”

Depending on the machine, the requirements for commission-



The FlexiBowl's achieved feed rate is between 20 and 50 parts per minute and has a high payload, with parts total weight exceeding 7 kg. Credit: Skye Automation

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ing and maintenance may differ, too. Skye Automation's team is increasingly developing self-contained systems, allowing them to build, test and validate the system's output before it is shipped.

Installation and Aftercare

One aspect worth noting, said Gorter, is how flexible and highly configurable these implementations can be. "We design and build it in such a way that it can be loaded onto a truck; it ships and is plugged into a wall and turned on," he said.

Naturally, the project harnessed Skye Automation's multi-disciplinary skill set—including software development, millwright, mechatronics and mechanical engineering—and Gorter credits them for their creativity.

"I'm really proud of our integrators and designers who came up with the concepts, because it's very unique, it's customized, but it's also very functional and simple when you get down to the root of it," he said. "In fact, the first system that we built like this went to a foreign customer. Due to COVID-19, we couldn't visit them. So, we commissioned it remotely."

When the customer later needed to implement new components to accommodate new parts handled by the machine, Skye Automation was able to seamlessly handle the request. "We had remote access to the machine, so we were able to implement new components that weren't anticipated during the machine build phase," he said. ■



The FlexiBowl is a flexible bulk feeder supported by a vision system and calibrated to an industrial robot. It is suitable in applications where there are frequent changeovers. Credit: Skye Automation



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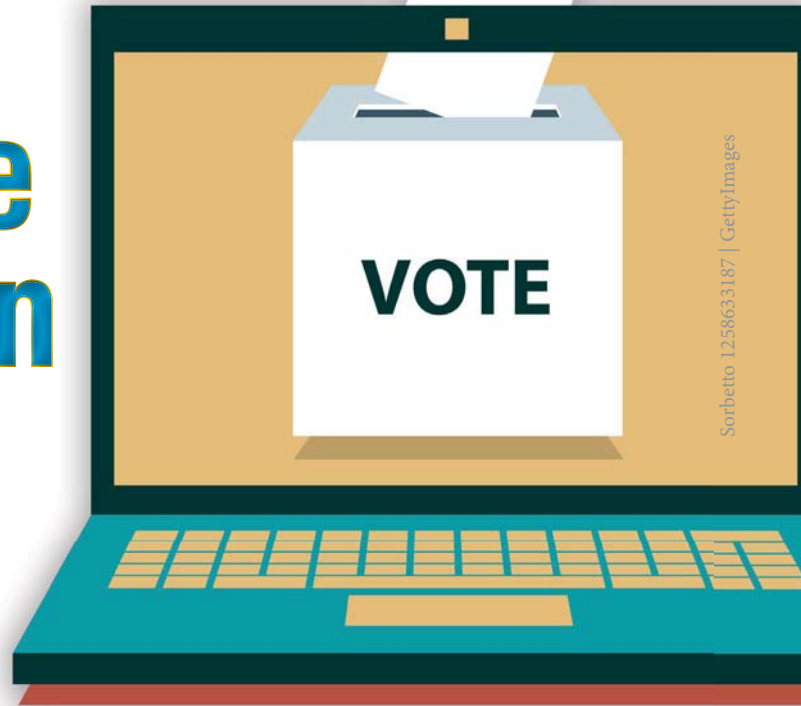




IDEA AWARDS

Finalists Showcase Innovation

Voting is now underway for this year's top awards for new product excellence.



The nominees are in for the 2022 IDEA Awards, presented by *Electronic Design*, *Machine Design* and *Power & Motion*. Nominees in eight categories now will have those innovative products evaluated by the sharpest mind in manufacturing: yours.

Readers can go to machinedesign.com to review the nominations and vote for the products that best exemplify the IDEA Awards program ideal of innovation that helps engineers do their jobs smarter, safer, faster and more efficiently.

The categories are:

- Automation & Controls
- Cloud Computing
- Design Software
- Electric Drives, Motors and Components
- Fluid Power Components
- Mechatronics & Motion Control
- Robotics
- Sensors

“This year’s IDEA Award finalists represent both the present needs of traditional manufacturing as well as the future of the digital age,” said Bob Vavra, senior content director for *Machine Design*. “I’m always impressed with the breadth of entries as well as how these new products bridge the gap between the machine-driven technology in wide use today and the new developments, such as data management, design software and robotics.”

Voting opened Aug. 15, and voters can cast their ballots in any category by using the online ballot on the home pages. Only eligible manufacturing professionals are eligible to cast votes. All other votes will be disqualified.

Voting will conclude Friday, Sept. 16 at 5 p.m. EST, and winners will be announced online on Oct. 15 and in the October issues of *Electronic Design*, *Machine Design* and *Power & Motion*.



AUTOMATION & CONTROLS

Condition Monitoring Toolkit

The Balluff Condition Monitoring Toolkit (CMTK) contains everything needed to monitor the condition of processes and machines, including data acquisition and visualization. It provides an easy-to-implement solution for adding condition monitoring to existing machines and processes. With the CMTK, manufacturers can gain deeper insights into the condition of their machines and systems and detect problems earlier. Each system includes hardware and software and supports up to four IO-Link sensors to measure factors like temperature, vibration, humidity and pressure.

BALLUFF
www.balluff.com/en-us

AUTOMATION & CONTROLS

AV/AES Valve System With Integrated OPC UA

Emerson's AVENTICS Series Advanced Valve system with Advanced Electronic System (AES) Profinet and Ethernet/IP is available with preinstalled OPC UA functionality. The AES helps users solve interoperability challenges and access data more easily, while the integration of the digital twin can improve productivity and efficiency. OPC UA functionality also expands the connected capabilities of the valve system itself, making it easier for users in industries such as automotive, food and beverage, packaging, and pulp and paper to digitally transform.

EMERSON
www.emerson.com/en-us/automation/brands/aventics



AUTOMATION & CONTROLS

GRID32

Grid Connect has developed a universal translator that OEMs can embed in legacy devices like an actuator to enable serial devices to communicate via protocols like EtherNet/IP, Modbus TCP, PROFINET, BACnet/IP and others. OEMs also gain the capability to push data from plant floor and field devices to analytical and business applications via OPC UA and MQTT. With the module, a device can also communicate via protocols for cloud applications. The OEM can analyze data about the device from beyond a factory's walls.

GRID CONNECT, INC.
www.gridconnect.com



AUTOMATION & CONTROLS

CAPAROC Electronic Circuit Breaker System

The CAPAROC electronic circuit breaker system uses data-driven power modules to customize overcurrent protection. With numerous feed-in power modules, circuit breakers, potential distribution modules and current rails, CAPAROC makes it easy to design an intelligent system with communication. The power feed-in module, available in status reset or PROFINET versions, is the "brain" of the system. The status reset uses standard digital input/output to communicate breaker status and to reset tripped channels. The PROFINET power module allows control and monitoring of the breakers.

PHOENIX CONTACT
www.phoenixcontact.com/us-CAPAROC



AUTOMATION & CONTROLS

Remote Access Solution

A new remote access solution packages what OEMs need to remotely access and support equipment. It includes FactoryTalk Remote Access cloud-based software, which allows OEMs to manage, configure and initiate secure connections to a customer's equipment, and a Stratix 4300 remote access router installed on site. A digital input gives on-site staff control of connections, so they're only made when enabled locally. To ease deployment, the solution requires no changes to an existing architecture so long as an Ethernet port is available.

ROCKWELL AUTOMATION
www.rockwellautomation.com/en-us/company/about-us.html



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AUTOMATION & CONTROLS

EcoStruxure Automation Expert

The EcoStruxure Automation Expert is an innovative universal automation platform delivering a new approach to building and designing industrial automation systems by breaking down communications barriers that impede innovation. Users can now design an automation control system by connecting a digital representation of an asset to real-time control. These digital replicas enable testing and adjustments to be conducted online, leading to a significant reduction in conditioning time and cost, allowing for changes to be implemented faster, unlike traditional process control systems.

SCHNEIDER ELECTRIC
www.se.com/ww/en



AUTOMATION & CONTROLS

Sitara AM62 Processors

Helping to expand edge artificial intelligence processing into next-generation applications, Sitara AM62 processors from Texas Instruments enable engineers to meet form-factor requirements and deploy smart designs anywhere. The low-power design enables support for dual-screen displays and small-size HMI applications. AM62 processors bring analytics to edge devices at low power, including suspend states as low as 7 mW and no need to design for thermal considerations, which can give engineers flexibility to deploy these capabilities in size-constrained applications or industrial environments.

TEXAS INSTRUMENTS
www.ti.com

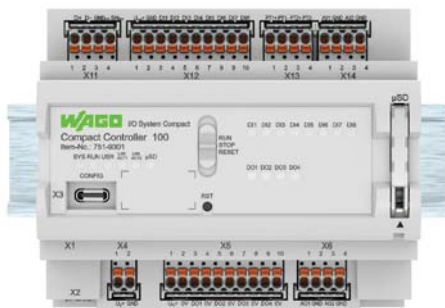


AUTOMATION & CONTROLS

Compact Controller 100

WAGO's Compact Controller 100 is a combination small-scale PLC and remote I/O, perfect for smaller applications. Programming uses Codesys 3.5 and users can interface with industrial devices using protocols such as MODBUS TCP, EtherNet/IP or EtherCat. Along with a powerful processor and MicroSD card slot, the CC100 has additional communication ports including a serial port for connection with numerous devices such as bar code readers and automatic scales.

WAGO CORPORATION
www.wago.com/us



AUTOMATION & CONTROLS

WIN-911 2021

The WIN-911 2021 remote alarm notification software update relies on extensive input from both end-users and technology partners to provide improved features and benefits, including reduced installation time, reduced configuration time and simplified navigation. Streamlining industry-leading capabilities into a simple workspace reduces system resources by up to 50%, providing faster performance and increased productivity. WIN-911 2021 directly connects with top SCADA systems and results in fast, seamless integration to securely interact with equipment and process alarms.

WIN-911
www.win911.com

CLOUD COMPUTING

Allen-Bradley ASEM 6300 Industrial Monitors

The Allen-Bradley ASEM 6300M industrial monitors help OEMs differentiate machines and meet a wide range of application needs. Several design options give OEMs freedom to customize monitors based on cost, performance, look and feel. Design options include stainless-steel for washdown, aluminum or edge-to-edge glass, single- and multi-touch, sizes from 8.4 to 24 in. in standard and widescreen. All have high-resolution displays. The monitors can display up to four tiles on one screen.

ROCKWELL AUTOMATION
www.rockwellautomation.com/en-us/company/about-us.html





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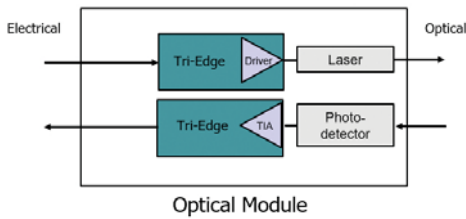
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CLOUD COMPUTING

Tri-Edge CDR Platform

Semtech's Tri-Edge PAM4 CDR platform is optimized for optical interconnect in next-generation 200G/400G data centers and Cloud applications, offering power savings up to 20% per optical link versus DSP technology. To meet demands placed on data center infrastructure by ever-evolving Cloud use cases, Semtech introduced production of its GN2558/GN2559 CDRs to enable advanced connectivity over multi-mode fiber, delivering a low-cost solution with the low power/latency analog signal processing to meet the demands of Cloud applications.

SEMTECH
www.semtech.com

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Altimade

Altimade is the first collaborative experience for designers that brings the manufacturing ecosystem into the PCB design workflow. Altimade is accessible through Altium's EDA tools, delivering a modernized "design with manufacturing" approach. Designers can track the progress of their projects and collaborate with manufacturing from start to finish without leaving their design environment. Designers obtain real-time supply chain data, validate their BOMs, generate quotes, place an order, and maintain a record of design changes and delivery status.

ALTIUM LLC
www.altium.com/altimade



DESIGN SOFTWARE

Design Power

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GATES
www.gates.com



DESIGN SOFTWARE

Studio 5000 Logix Designer

The new version of Studio 5000 Logix Designer software significantly reduces download times for users and improves the overall user experience by allowing users to do more while online. For example, users can now import and export project

activity, including comments and documentation made by others, without first going offline with the controller, which was required before this new Studio 5000 version release. In addition, new data types configured as time types reduce the need for users to manually format integers.

ROCKWELL AUTOMATION
www.rockwellautomation.com/en-us/company/about-us.html

ELECTRIC MOTORS & DRIVES

eLION Motor-Generators

Rexroth's electric 700 V eLION motor-generators cover a nominal power range from 20 to 200 kW (peak power up to 400 kW) and deliver nominal torques of up to 1050 Nm and maximum torque of up to 2400 Nm. They are available in four sizes with different lengths and winding configurations. Both standard and high-speed variants allow the best design solution for traction and implement function needs. eLION benefits include high efficiency, lower emissions, and robust and scalable components designed specifically for mobile machinery.



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ELECTRIC MOTORS & DRIVES

Gen 4 115

Elemental Motors 4th Generation Axial Transverse Flux Motor delivers real-world torque densities of 75Nm/liter, 25Nm/kg continuous. The patent pending topology is compact with large IDs having either inner or outer rotation for bold machine creations. The servo motors unique topology is exceptionally efficient at lower RPM and typically replaces other servo motors and 2-stage gear reduction to improve improving efficiency. The motors are tough with windings encased in iron armatures without end turns for better resistance to vibration and the elements.



ELEMENTAL MOTORS
www.elementalmotors.com

ELECTRIC MOTORS & DRIVES

BLV Series R Type

The BLV Series R Type features an all-new 100/200 W BLDC motor and driver design for battery-powered robotics applications like AGVs and AMRs. The compact driver has reduced its volume and mass by 80%, while the high-resolution motor sensor regulates the speed at $\pm 0.01\%$ and enables better positioning performance. The usable voltage range is expanded to 15~55 VDC, and power consumption has decreased by 10%. Along with software improvements, the compact driver now supports CANopen communications in addition to Modbus.

ORIENTAL MOTOR
www.orientalmotor.com/brushless-dc-motors-gear-motors/brushless-dc-motors-gear-motors-blv-r-type.html



ELECTRIC MOTORS & DRIVES

PowerFlex 755TS Drive

The PowerFlex 755TS variable frequency drive is the first six-pulse drive to incorporate TotalFORCE technology from Rockwell Automation to help companies get the most out of equipment. This new drive brings a simplified and consistent user experience to virtually any motor control application, including traditional fan, pump and conveyor applications, and more advanced processes that typically require specialized drive solutions. Built-in predictive models use continuous operation monitoring to calculate the expected remaining life of drive components, reducing unplanned downtime and maintenance costs.

ROCKWELL AUTOMATION
www.rockwellautomation.com/en-us/company/about-us.html



FLUID POWER COMPONENTS

Hägglunds Fusion Drive System

Hägglunds Fusion is designed to house the motor, pump and controls in the torque arm, allowing for a smaller footprint. Compact in design, the Fusion places the entire hydraulic drive system on the torque arm. No additional gearbox, foundation or external equipment is needed. With all components in one place, it is easy to install and maintain. The plug-and-play design provides maximum torque from zero speed along with built-in protection from torque peaks.

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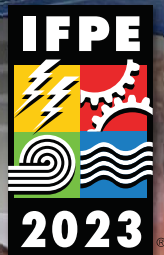
FLUID POWER COMPONENTS

NIV Series PEEK Media Isolation Valves

The NIV Series Media Isolation Valve is a solenoid-operated device that uses a flexible diaphragm to isolate the actuation mechanism from the fluid path. Isolation valves are commonly used for a wide variety of applications, including those that require precise, repeatable dispensing of media for analytical instrumentation. Industries and applications that commonly use these valves to isolate gas or liquid include drug dispensing, laboratory equipment, analytical, chemical analysis, sampling and life science/biotech, among others.

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FLUID POWER COMPONENTS



Aeroquip EC881 Dynamax Hose

Featuring patented DuraPulse inner tube technology, Aeroquip by Danfoss EC881 Dynamax two-wire braided hose delivers impressive lifecycle and high pressure and temperature tolerance. The hose outperforms standard EN857 type 2SC hose specifications with 35% higher

pressure rating, 26% higher operating temperature, 8 times higher abrasion resistance, 1/3 SAE bend radius (50% more flexible) and 5 times more impulse life with a qualified 1 million impulse cycle performance. The hose can replace heavy, rigid four-wire spiral hose in certain applications.

DANFOSS POWER SOLUTIONS

www.danfoss.com/en-us/about-danfoss/our-businesses/power-solutions/

FLUID POWER COMPONENTS

3 NPT Heavy Duty Threaded Line Vac

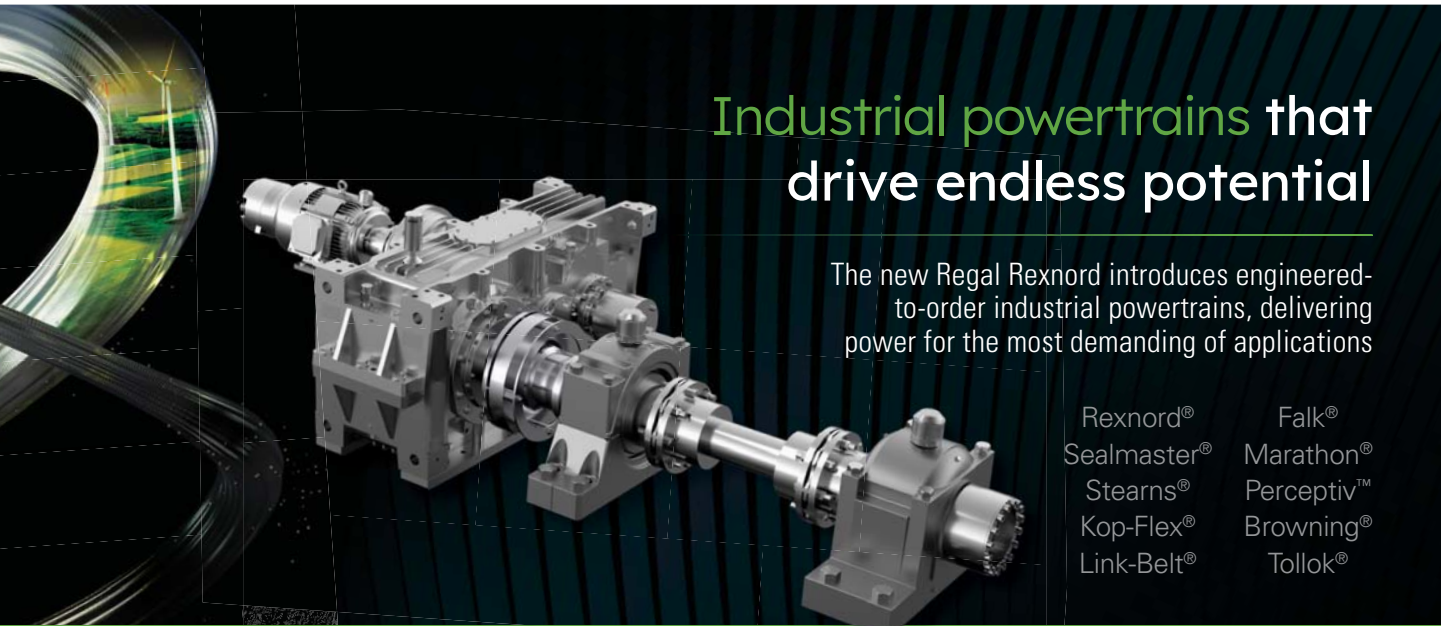


EXAIR's 3 NPT Heavy Duty Threaded Line Vac is a powerful in-line conveyor that transports high volumes of material through ordinary pipe. Designed for rugged, industrial applications, it

is made of a hardened alloy to prevent premature wear when transporting abrasive or heavy materials like garnet, glass, sand, tumbling media and metal fittings. They feature large throat diameters to convey more material over long vertical/horizontal lengths. Utilizing a pressure regulator, conveyance rates can be finely tuned for the application.

EXAIR CORPORATION

www.exair.com



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MECHATRONICS & MOTION CONTROL

LoPro V6 Extended Line

The expanded LoPro actuator line from Bishop-Wisecarver makes it more versatile than any other actuator. LoPro has always provided reliability, especially in harsh and extreme environments. This includes resistance to debris, corrosive washdowns, extreme temperatures and more. The variety of drive systems captures a range of speed, thrust, length and accuracy capabilities. The product features an Enhanced Stiffness configuration provides greater stiffness and moment load capacity. Vibration-resistant wheel plates improve performance in vehicles, agricultural equipment and more.



BISHOP-WISECARVER
www.bwc.com

MECHATRONICS & MOTION CONTROL

The Electromechanical Cylinder EMC-HP

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MECHATRONICS & MOTION CONTROL

Modular Gantry Robot for Automated Liquid Handling

The Modular Gantry Robot for automated liquid handling in laboratory devices allows OEMs to develop instruments targeted to their specific application in minimum time. Customized for load, speed and size, these gantry robots are preassembled or delivered as kits, including cabinet and supporting components. The platform features an open-source motion and fluidic application programming interface. A library of common drivers reduces the learning curve and enables development of an optimized control strategy.

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HEIDENHAIN



The KCI 120 *Dplus* Dual Encoder High-Accuracy Robot Motion

The new KCI 120 *Dplus* dual encoder from HEIDENHAIN combines motor feedback and position measurement in a single compact rotary encoder. Both benefits can be applied to every robot axis, correcting inaccuracies such as gearbox backlash and work-induced reaction forces. The HEIDENHAIN KCI 120 *Dplus* thereby turns a typical articulated robot into a high-accuracy manufacturing system and dependable cobot.



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ROBOTICS

Kria KR260 Robotics Starter Kit

The Kria KR260 Robotics Starter Kit is a scalable and out-of-the-box development platform for robotics. It provides a seamless path to production deployment with the existing AMD-Xilinx Kria K26 adaptive production SOMs. The SOM starter kit enables rapid development of hardware-accelerated applications for robotics, machine vision and industrial communication and control. The KR260 delivers nearly a 5-times productivity gain, up to 8 times better performance/watt and 3.5 times lower latency compared to competitive GPU solutions.

AMD

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ROBOTICS

MP1000R Autonomous Mobile Robot



Using Bosch Rexroth's ROKIT Locator Software, the MP1000R, made in collaboration with mobile robotics company Geek+, can navigate autonomously in highly dynamic environments without additional infrastructure. The MP1000R is a scalable solution which can replace manual forklifts and tuggers, leading to improved efficiency and safety. The MP1000R can safely and autonomously transport materials on pallets or shelves within a facility with flexibility similar to human-operated equipment and has a max payload of 1,000 kilograms.

BOSCH REXROTH, in Collaboration with GEEK+

www.boschrexroth.com/en/dc
www.geekplus.com/en

ROBOTICS

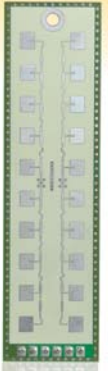
UR20



The new UR20 cobot can handle heavier loads up to 20 kg with a greater reach of 1750 mm. It's the lightest robot on the market in its payload and reach class, weighing only 64 kg with a small footprint of about 245 mm. The cobot features an all-new joint design, increasing all joint torques approximately 25%, joint speeds by as much as 65% and TCP speed of 100%. The updated software brings smoother motion and increased uptime.

UNIVERSAL ROBOTS

www.universal-robots.com



SENSORS

IMD-3101 Radar System For Motion Control Applications

With its special designed radar beam, the IMD-3101 offers reliable motion detection for sensor controlled light automation in warehouses. Its features perfectly meet the requirements of monitoring aisles in high-bay warehouses. The narrow aperture angle sets it apart from the typically wide-angled motion sensors. Thanks to the smart antenna design and modern signal processing, the detection focuses on a limited field to prevent interferences or unwanted triggers caused by movements in neighbored aisles.

INNOSENT GmbH
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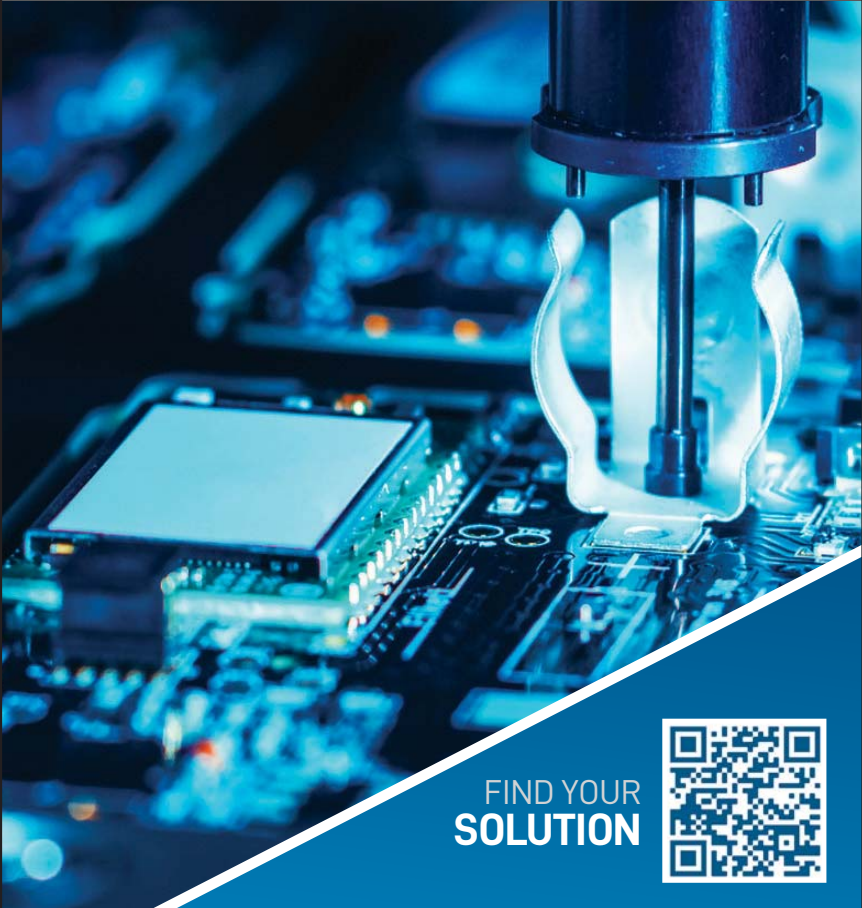





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Medium-Pressure Ball Valves Provide a Rugged Solution

Subsea oil drilling rigs needed a valve that could stand up to the pressure.

After working on large subsea offshore oil and gas drilling projects for several decades, Santiago Gomez, president for Ocean Edge Services, believed he had learned the nuances of the complex processes involved, including the need for more effective hydraulic power units (HPUs). Past iterations of the equipment had flaws in their design, so instead of simply purchasing a new unit when his company needed one, Gomez decided to build his own HPU. By redesigning the unit from the ground up, he hoped to use his knowledge and firsthand experience to make a better HPU than had previously existed.

Gomez realized he needed support when taking on this task. He called long-time colleague Jeremy Rogers, CEO for Ocean Edge Services, who reviewed a rough sketch of what Gomez had in mind and immediately committed to helping him. Together, they formed a company called Ocean Edge Services (OES) with a singular focus: creating rugged equipment for the oil and gas drilling industry with the end-user in mind.

But to build equipment that was significantly better than what had come before, they needed to find a partner who could supply them with components that would improve safety and reliability and reduce the assembly time of their HPUs. To achieve that, they turned to Swagelok.

Withstanding the Pressure

OES designs HPUs that allow for the remote control of offshore oil and gas platform production, which means the components are under immense pressure—somewhere between 20,000 and 60,000 psi. That amount of pressure is necessary to force the hydraulic actuation of equipment from the topside of oil and gas platforms to the sea floor. Performance under those conditions is challenging, and each component, from the pumps to the connections, must work as intended to keep operators and the environment safe.

To improve the safety profile of their HPUs, Gomez and Rogers wanted to remove vibration from the system. Vibration poses a serious risk to drilling com-



After working on large subsea offshore oil and gas drilling projects for several decades, Santiago Gomez (right) believed that he had learned the nuances of the complex processes involved and wanted to improve his current equipment. Past iterations of the equipment had flaws in their design, so instead of simply purchasing a new unit when his company needed one, Gomez decided to build his own hydraulic power unit (HPU) with Swagelok's help. *Images courtesy Swagelok*

ponents because it can affect connections, causing them to wear, slip or blow out. When any of those problems occur, they can lead to unplanned maintenance and accidents.

When they looked closely at previous HPUs, Gomez and Rogers focused on the medium-pressure ball valve and the use of a compression-end connection. Offshore

applications have required cone-and-thread connections to withstand the pressure necessary to execute the operation, but they require the addition of a vibration gland to minimize potential vibration damage. These glands must be installed by a knowledgeable and experienced technician to ensure they work properly, adding another level of complexity to an already complex situation.

Cone-and-thread connections also tend to loosen over time when subjected to vibration and must be tightened manually to ensure leak-tight connections. Gomez and Rogers realized there was a significant opportunity to improve their HPUs by investing in medium-pressure ball valves with tube fitting end connections instead of traditional cone-and-thread connections.

The advanced design of the ball valve Gomez and Rogers chose reduced seal wear and improved the reliability of connections across a full range of operating pressures up to 20,000 psi as well as temperatures. The trunnion-style ball valve features an innovative direct-load design to enable leak-tight performance and a bottom-loaded stem design to eliminate stem blowout.

Before they decided to commit to using the medium-pressure ball valves in their units, OES had to do its own rigorous testing to ensure they would perform as promised. They found the valve operated smoothly with 100% differential, indicating one side of the valve received all the force while the other side saw none.



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OES team members spent time testing the HPU, to ensure that the new equipment would be safe and require less maintenance than the old equipment.



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Gomez and Rogers found the valve outperformed expectation—while it was rated for 15,000 psi, it held all the way to 22,000 psi. In addition, the valves acted like an antivibration unit, making it the perfect valve to eliminate vibration as the team at OES hoped to do.

Improving Productivity and Reducing Costs

Eliminating vibration was only part of the equation, since Gomez and Rogers also hoped to reduce the installation time and maintenance required for the HPU under grueling conditions. In the field, OES discovered that assemblers could complete installations with the tube fitting end connections five times faster than those with the traditional cone-and-thread end connections. For the end-user, that reduces rework after the HPU is delivered and lowers the long-term maintenance costs.

The assembly process was less complex, which means technicians made fewer mistakes. That leads to more consistent, reliable performance over the HPU's lifetime. Finally, preparing

the valve for installation is five times faster with the medium-pressure ball valves using tube fitting end connections over the traditional cone-and-thread connections. ■

The Swagelok Company provided this case study. The original version of this article appeared on the Swagelok Reference Point blog at www.swagelok.com.



The trunnion-style ball features an innovative direct-load design to enable leak-tight performance and a bottom-loaded stem design to eliminate stem blowout.

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Automation a Scalable Solution for Smaller Manufacturers

PLCs and HMIs can ramp up efficiency and quality regardless of operational size.

The words “industrial automation” may conjure up images of massive factories filled with equipment and machinery turning raw materials and parts into finished goods. It is equally true that a lot of manufacturing is performed at a much smaller scale, in small shops and even garages. At many of these smaller operations, the work is performed manually, and the users may think that automation is out of their economic and technical reach.

As a one-person independent systems integrator, I specialize in connecting with these smaller operations and use modern automation products to create solutions that significantly improve their throughput and quality. One recent project at a wooden game call manufacturer shows the benefits



(a)



(b)

Small manufacturing operations everywhere would like to automate some of their equipment and processes for better throughput and quality, but many are concerned that modern digital controls may be economically or technically out of reach. Credit: DO Electrical

for small manufacturers to incorporate modern automation into their workflows.

Calling on Automation

My client in this case is actually a relative who builds about 20,000 wooden game calls each year. These calls are a cylinder that make a sound attractive to ducks, geese, deer, crows and elk. Some calls make mice sounds to attract predators. The details, sizes and shapes vary, but the basic construction requires boring out the center of the material to receive the proper reed.

The work is performed substantially by hand, and the operator begins each piece by placing the wooden blank into an older horizontal drilling machine. This machine is hydraulically powered, and originally used limit switches and hardwired relay logic to extend the rotating drill bit a preset distance, then retract it after the drill cycle was completed (see figure).

One problem with this arrangement, other than the fact that it required manual setup adjustments for making different parts, is that when drilling a hole 3 in. or deeper into the wood it is much better to first drill in part of the way, then retract the bit to release the cuttings, and then to repeat this cycle a few times as needed. If not done in this way, the hole may not be drilled cleanly, or there is a chance of scoring the wood in an undesirable manner. The basic machine had no capability to perform a sequence like this, or any variations to improve production.

I was asked to create a small automation system that could perform this sequence and allow easy con-

figuration of the desired number of drilling steps and depths.

One Step at a Time

Based upon the operational needs, the I/O count and the small available installation space in the existing electrical cabinet, I knew that a stackable micro-modular PLC would meet the need.

Analog I/O capability was important because for best flexibility it was necessary to obtain the drill head position feedback using a linear potentiometer instead of only relying on fixed-position discrete limit switches. In addition, the automation system would need to be connected to monitor and control other devices including:

- Hydraulic pump
- Solenoids to operate the extend/retract cylinder
- Drill motor
- Solenoid for the air clamp holding the workpiece in place

The PLC, I/O modules, relays, motor contactor, power supply, linear position sensor and other products were sourced from AutomationDirect, providing the components needed to design and assemble a compact arrangement.

While the control system could have gotten by with a few buttons and lights, an HMI provided the best configurability. The HMI was installed in an accessible location in a small enclosure, with a hardwired emergency stop button.

The HMI was configured to work in conjunction with the PLC, providing the following display functions:

- *Home*: Start/stop buttons for the drill and pump, with an indication of the real-time stroke depth, and a batch cycle counter to help the

operator track how many pieces have been made.

- *Presets and Settings*: Allows the operator to define up to five unique sets of extend and retract distances and set the “home” position of the drill to calibrate the linear transmitter, as well make other necessary settings.
- *Manual and Status*: Allows the operator to manually operate machine functions and check on the operational status, mostly for diagnostics and testing purposes.

Automation Game Changer

As an automation expert with years of experience within industry, this PLC/HMI configuration was straightforward and similar to what I would develop for many types of end-users. But for my client, who struggled with manual operation of the original equipment, the usability of this drill automation was game changing.

Before automation, my client could drill 100 parts per hour with a cost per operation estimated at \$0.30 each. After automation this changed to 150 parts per hour with a cost per operation of \$0.20 each. At quantity, the savings are a few thousand dollars annually and resulted in a payback of less than a year. Waste reduction was minimal, but the accuracy improvement resulted in fewer rejected parts.

The real significance of the modern PLC and HMI hardware and associated programming and runtime software is that it is easy and economical to obtain, configure, deploy and operate. The website has plenty of informational materials and how-to videos, and the support team is only a phone call or an email away. There is also a complete array of associated controls and sensor products available, making it simple to specify everything needed for a project.

Small manufacturing operations, even those working out of their garage, will find it feasible to automate their workplace by engaging a local SI, or even performing the work themselves. When properly scaled, automation can help elevate the performance and output of these companies. ■



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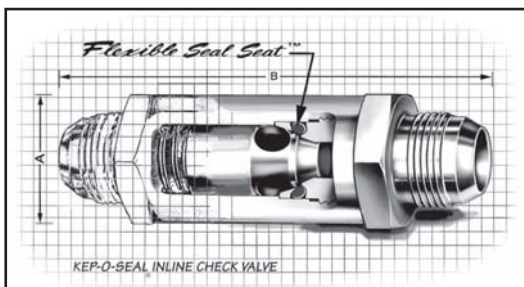
version that is compatible with Through-Hole Reflow (THR) solder processes, in addition to the existing THT and SMT versions. SMT components are used for PCB assemblies. Ideally, these components are compatible with solder reflow processes to fully automate the assembly. The solution is Through-Hole Reflow (THR) components, combining the features of PCB THT mounting with a component capable of withstanding the high thermal stress of a reflow oven. The THR component is first printed into the pin vias, and then pushed through the solder paste. As the paste melts in the reflow oven, the liquid solder retracts into the vias, and then pushed through the solder paste. As the paste melts in the reflow oven, the liquid solder retracts into the vias, due to wetting and capillary forces, to form the solder joint. The series is rated 16 A at 500 V AC/V DC according to UL and CSA and 10/16 A at 500 V AC according to VDE. The series can be enclosed with an optional cover. Rated power acceptance according to IEC is 4 W/1 6A at Ta 23°C for the version without cover.

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On-demand Transient Pacemaker Communicates Through Sensors

A proof-of-concept, temporary postoperative cardiac pacing device integrates with sensors and a control unit.

by **Rehana Begg**, Senior Editor

Northwestern University researchers have upped the ante with a smart pacemaker device that continuously monitors physiological functions such as oxygen levels, respiration, muscle tone, physical activity and the heart's electrical activity.

An upgrade from a transient pacemaker developed in 2021, the implantable device is designed for patients who need temporary pacing after cardiac surgery or are waiting for a permanent pacemaker.

The latest iteration benefits from an automation feature that enables on-demand pacing. Sensors placed at specific points on the body communicate with each other and that data is fed to algorithms, which then analyze the combined activity in order to detect abnormal cardiac rhythms. The information is streamed to a smartphone or tablet so that physicians can remotely monitor their patients.

The integrated system consists of a transient, bioresorbable pacemaker; a cardiac module that sits on the chest; and a network of wearable sensors, including:

- A hemodynamics module that is placed on the forehead to sense pulse oximetry, tissue oxygenation and vascular tone;
- A respiratory module that sits at the base of the throat to monitor coughing and respiratory activity; and
- A multi-haptic-feedback module that vibrates and pulses in a variety of patterns to communicate with the patient.



A smart, dissolving or transient pacemaker (on the left) is shown with complementary sensors.



Multiple devices on a volunteer along with the tablet app. Images credit: Northwestern University

The research team explained in a press release that the chest-mounted cardiac module syncs with the pacemaker to record an electrocardiogram in real time to monitor heart activity. The pacemaker wirelessly harvests energy from the small wireless device that adheres to the patient's chest without needing sutures. The transient pacemaker eventually dissolves, noted the researchers, but not before releasing an anti-inflammatory drug to prevent foreign-body reactions.

Northwestern University's John A. Rogers stated in the press release that this work marked the first time the research team had paired soft, wearable electronics with transient electronic platforms. "This approach could change the way patients receive care providing multi-nodal, closed-loop control over essential physiological processes—through a wireless network of sensors and stimulators that operates in a manner inspired by the complex, biological feedback loops that control behaviors in living organisms," Rogers said.

The study, "A transient, closed-loop network of wireless, body-integrated devices for autonomous electrotherapy," was published in the journal *Science*. The research was led by Northwestern's John A. Rogers, Igor R. Efimov and Dr. Rishi Arora. ■

Visit <https://www.eurekalert.org/multimedia/935591> for footage of the devices off the body in the lab, being placed onto a volunteer and then removed. (Courtesy Northwestern University)



Collaborates with teammates
in Asia and Europe

Tests everything

**Is in total control
with i³ Control**

Is connected 24-hours a day

Drinks 3 cups every morning

Stays up late answering work emails

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