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The B&R Technology Magazine

Secure Remote Maintenance

Technician on site without the flight

Machine-Centric Robotics More productive pick-and-place

OPC UA over TSN 18 times faster

Track technology Compact cleanroom performance

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We adapt and we grow

Normally, you would have just picked up a crisp new issue of *automotion*, flipped open the first page, and now find yourself reading these lines. But what does "normal" even mean these days? Unprecedented times call for unprecedented measures. And so, you instead find yourself swiping or clicking your way through the first ever *automotion digital special*. The same technology magazine you know and love, right in your inbox and ready for reading – wherever it is you happen to be working from these days.

But that's not the only part of our work lives migrating to the digital world. In-person meetings and flip charts have given way to video calls and shared screens. Instead of filling fairgrounds and exhibition centers, trade shows are exploring virtual online venues.

But what happens when a production line suddenly grinds to a halt or a crucial component needs urgent service? What do you do when the technician can't just hop on the next plane? Well, in a perfect world, the machine would let you log on remotely and control it from a distance.

Check out our cover story to find out how remote maintenance can help you react quickly and keep your customers' lines running smoothly and efficiently. With our help, you could soon be conducting system diagnostics remotely, managing updates centrally, or putting entire machines into service from anywhere in the world.

Happy reading,

Carola Schwankner
Corporate Communications Editor, B&R

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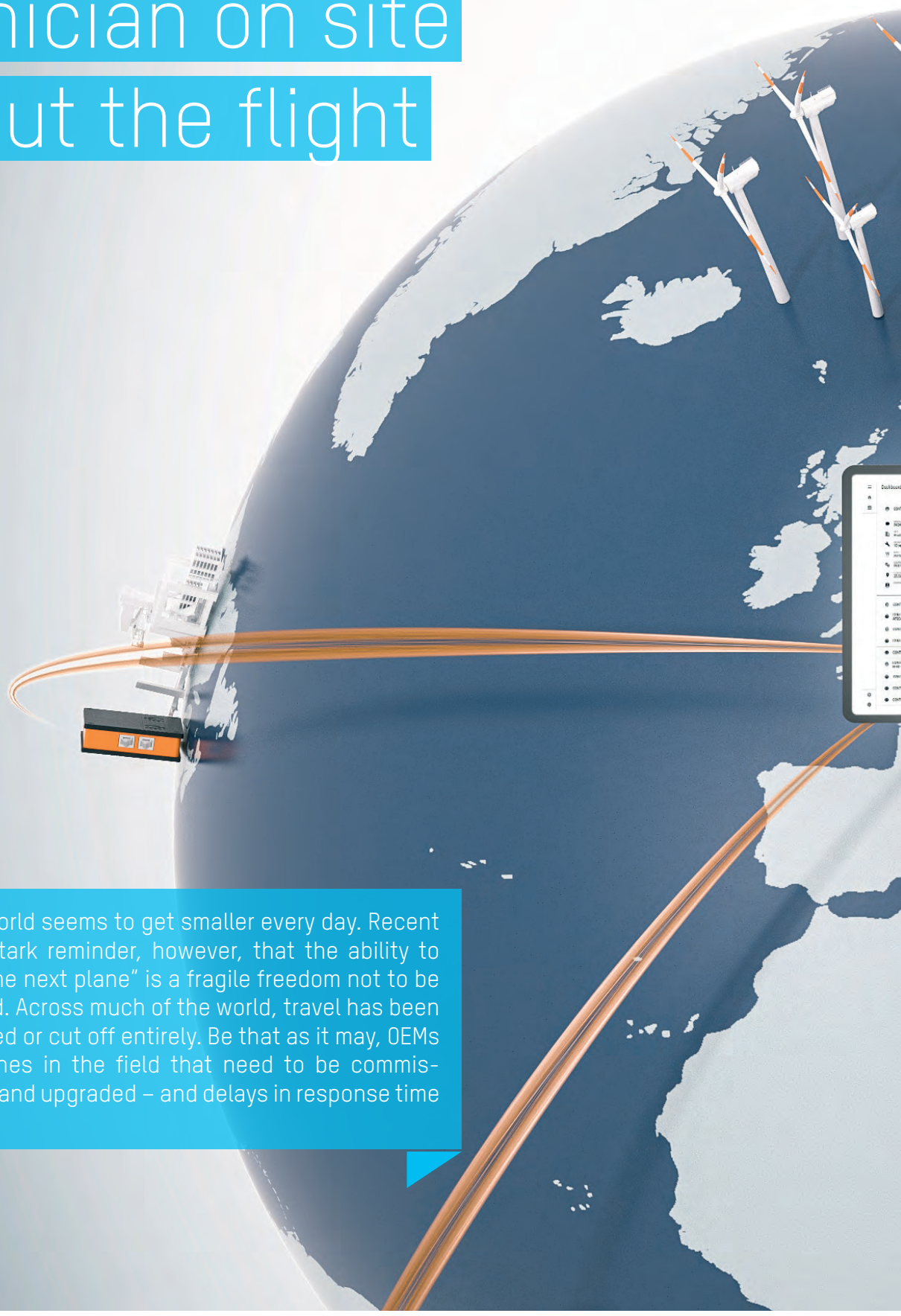
Developed for you

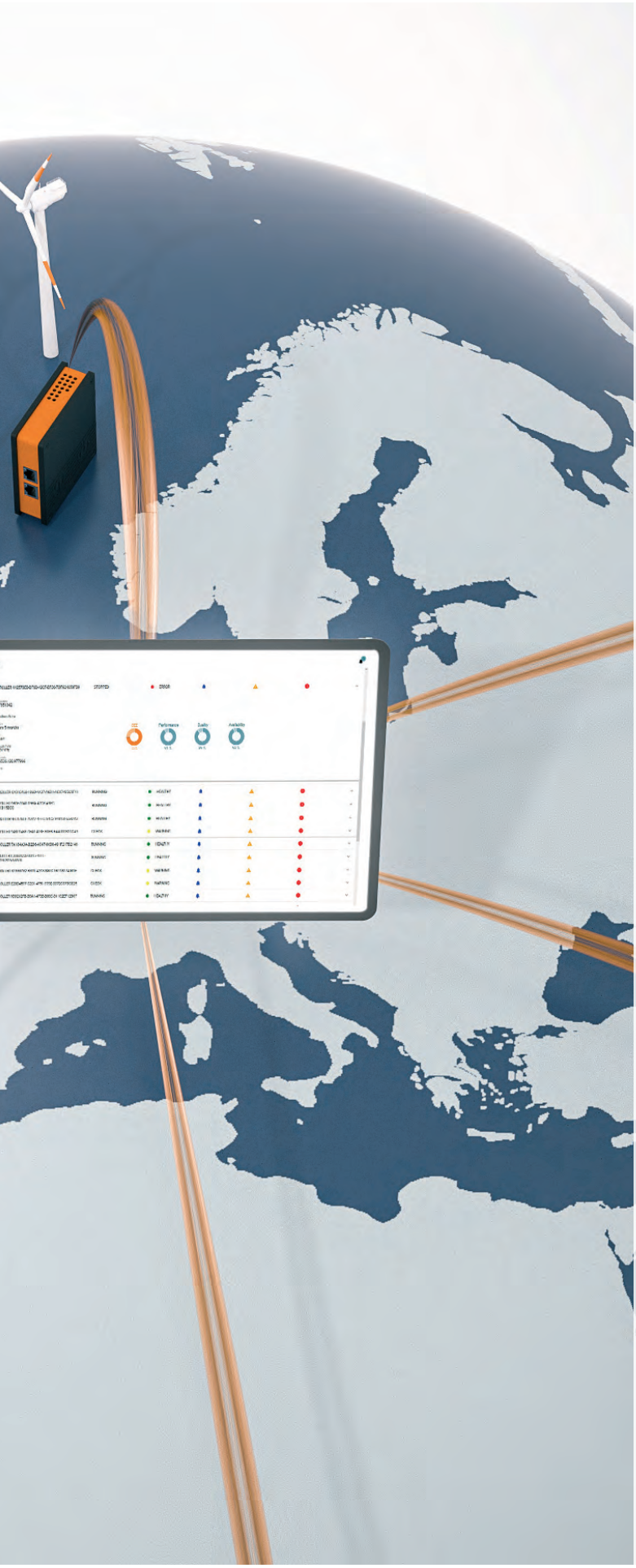
Ideas & Insights

Secure Remote Maintenance

Technician on site without the flight



The globalized world seems to get smaller every day. Recent events offer a stark reminder, however, that the ability to simply "hop on the next plane" is a fragile freedom not to be taken for granted. Across much of the world, travel has been severely restricted or cut off entirely. Be that as it may, OEMs still have machines in the field that need to be commissioned, serviced and upgraded – and delays in response time are costly.



For most OEMs, aside from the occasional spare part or scheduled maintenance, contact with a machine ends at delivery. "Many machine builders shy away from remote maintenance for fear it will be overly complicated or present a security risk," says René Blaschke, product manager for IIoT at B&R. Remote maintenance often requires sensitive machine data to be sent over the Internet, which for many is reason enough for hesitation. Yet, every minute of downtime eats away at an operator's bottom line. Costly downtime can be kept to a minimum with remote maintenance.

Another concern of machine builders is that the time-intensive task of rolling out a complex digital maintenance solution would keep employees from their primary tasks. "That's why we made sure to create a solution that is very easy to implement," says Blaschke. Remote maintenance offers machine builders an enormous advantage: when they get the call, service technicians can connect to the machine quickly and resolve the issue.

Remote maintenance saves time and money

With Secure Remote Maintenance from B&R, machine builders can perform system diagnostics remotely or install updates from a central location. "Service technicians no longer have to hop on a plane. Instead, they can hop on their PC and connect digitally to the customer's machine," says Blaschke. "Remote maintenance saves time and money."

In a few short steps, the B&R remote maintenance solution is set up, and technicians have easy access to machines all over the world. "The SiteManager hardware just needs to be connected to the machine controller. It then establishes a remote maintenance tunnel to the central GateManager," explains Blaschke. Like all B&R hardware, the SiteManager can be configured using the Automation Studio engineering tool.

Quickly mounted on the machine, B&R's SiteManager establishes a remote maintenance tunnel.

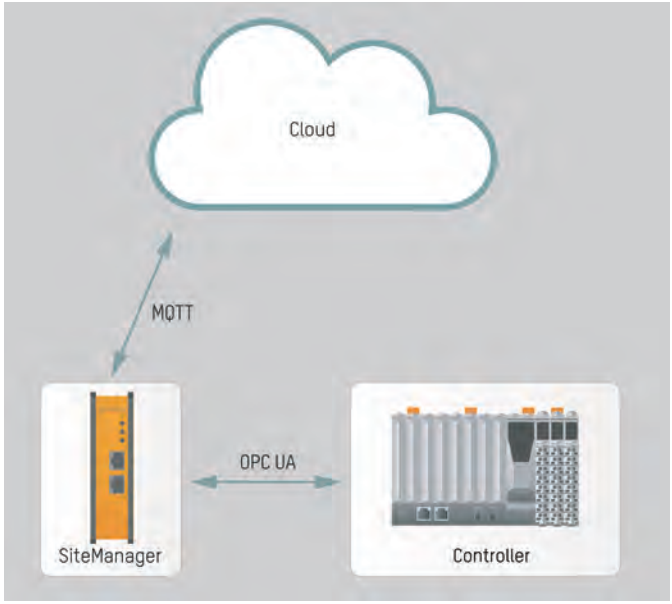
Photo: B&R

The technician can establish a secure connection in moments and then run diagnostics, adjust parameters and resolve any faults as though they were right there on site. All access to the machine is logged in detail and can be traced at any time. The B&R SiteManager can be factory installed on new machines or retrofitted on existing ones. In both cases, the solution is seamlessly integrated into the automation system.

State-of-the-art security

Secure communication is one of the most fundamental challenges of remote maintenance. Transmitted machine data must be highly transparent, yet simultaneously absolutely secure. B&R's Secure Remote Maintenance has what it takes to guarantee a secure and reliable connection. "Through a combination of state-of-the-art protocols, technologies and infrastructure components, our solution ensures optimal protection," explains Blaschke. "The security standards used in remote maintenance are comparable to those used in online banking." Data is encrypted during transmission in order to prevent hackers from accessing it.

When an incident occurs, the SiteManager sends the corresponding alarms, events or status updates to the machine operator via text message or email. These notifications are preconfigured directly via the remote maintenance hardware. This is an easy way to ensure transparent machine operation and that users always know the current condition of their manufacturing assets.



B&R's SiteManager enables secure transfer of data to the cloud.

One solution, many applications

Secure Remote Maintenance does more than just maintenance – it can also be used to commission a machine remotely. When machine builders deliver equipment to their customers, they no longer need to dispatch a service technician halfway around the world to put it into operation. As soon as the SiteManager on the machine is configured, a connection can be established and the machine can be commissioned. System parameters software settings can be adapted to customer's requirements.

Since updates can also be installed remotely with Secure Remote Maintenance, machines and systems are always up to date. A service technician can connect to the machine via the remote maintenance software and update a program or the firmware, for example. That drastically reduces the time and costs associated with keeping systems up to date.

All of an OEM's machinery and equipment can be managed from a central location. This brings machine builders closer to their customers and allows them to offer additional services with significant added value. New business models become possible, such as monitoring the health and performance of manufacturing assets to optimize service intervals.

Secure connection to the cloud

B&R's SiteManager transfers data securely to the cloud. "The SiteManager connects to the machine controller via OPC UA and transfers data to the cloud using the MQTT message protocol," explains Blaschke. The user defines which data is to be transferred when configuring the solution. It is also possible to transfer different data to different cloud providers. Configuration is completed easily in the SiteManager's web-based user interface.

In addition to the cloud interface, various options are available for aggregated analysis, such as calculation of minimum, maximum and average values. An integrated store-and-forward database ensures that no data is lost in the event of connection problems.

Fast service response time

For OEMs, having customers around the world also comes with its share of new challenges. Maintenance work that can only be carried out with the help of the manufacturer is very resource intensive. "A remote maintenance solution removes that obstacle," says Blaschke. OEMs can connect to any asset, anywhere in the field, at any time to keep their customers' systems running smoothly and efficiently. That saves time and money for everyone involved. ←

Secure remote maintenance in 5 easy steps

"Remote maintenance needn't be complex or costly"

The market for industrial manufacturing technology is a global one. Modern communication and transportation make it possible to sell machines and plants to customers in all corners of the world. The task of maintaining those assets, however, can be a daunting challenge. To avoid flying service technicians and engineers halfway around the world, OEMs are increasingly relying on remote maintenance. We sat down with René Blaschke, B&R's product manager for IoT, and had him walk us through the process of deploying B&R's Secure Remote Maintenance solution.

Photo: B&R

Machine builders have tended to shy away from remote maintenance solutions in the past. Why is that?
Blaschke: Remote maintenance has a reputation for being quite complex in terms of the resources and technical know-how it takes to set up the necessary routing, firewalls and VPN tunneling. On top of that, many companies are concerned about the security of sensitive machine data being sent over the Internet.

What can be done to address these issues?
Blaschke: We've created a solution that is remarkably easy to deploy, while at the same time providing the necessary security. The hardware and software involved can be combined and scaled freely and tailored to each user's unique situation. In a few simple steps, the remote maintenance solution is up and running – and they can connect to their plants and machinery from any PC, smartphone or tablet.

What does a user need in order to implement a remote maintenance solution?
Blaschke: What we offer is an easy-to-use complete solution. And of course assets in the field can be retrofitted with Secure Remote Maintenance at any time. All they need to do is order the necessary components, and after a quick setup they have the access they need from anywhere in the world, whether in their office or on the go.

Can you walk us through that process?
Blaschke: Even before they receive the SiteManager hardware, the machine builder is able to log into our system and set up their user interface. How it is structured is entirely up to them, whether by country, customer or machine.

And when they get the hardware?
Blaschke: When the SiteManger arrives, it just needs to be connected to the structure they've already set up. If they're deploying in a series-built machine, that can be done directly in our Automation Studio engineering tool. Then the SiteManager can be sent right to the end customer. At that point, the user can establish a secure connection in a matter of moments and then run diagnostics, adjust parameters and resolve any faults as though they were right there on site.

What kind of technical know-how does the user need to have?
Blaschke: The user really doesn't need any specific previous knowledge. Secure Remote Maintenance is easy and intuitive to use. In the web portal, for example, access rights are assigned via drag-and-drop. And you don't need to be an IT specialist to make the necessary configurations.

You mentioned a web portal. How do users connect to this portal?
Blaschke: The machine builder can open the intuitive portal in a web browser. At the same time, the SiteManager, which is connected directly to the machine controller, also establishes a connection to the portal. In the portal, users have an overview of all connected machines and can simply click to access them. Users can lease the web portal from B&R as a software-as-a-service (SaaS) solution or install it on their own server. Either way, they are guaranteed the same level of secure data transmission.

How do you ensure that the data is protected against hackers?
Blaschke: Secure Remote Maintenance functions in accordance with all the latest IT and cybersecurity guidelines. We employ state-of-the-art encryption and security mechanisms like those used for online banking. All access is logged in detail and archived for later traceability. And there's no need for additional open ports.

So, it's possible to deploy the remote maintenance solution in an existing company network?
Blaschke: That's correct. To access a plant or machine, they simply access the Internet from their company network. No public IP addresses or open firewall connections are used to do this – only standardized encrypted web protocols. For those who don't have a company network or would prefer not to use one, there are also secure mobile options.

Could you finish by describing how the solution works in a real service situation?
Blaschke: During a service call, the technician establishes a secure connection to the machine. The service technician only needs a web browser and an Internet connection in order to log into the web portal. The machine also connects to the web portal via the SiteManager, protected by its integrated firewall. If authentication is successful, the VPN connection is established and the technician can access the machine.

Track technology

Compact cleanroom performance

Workpiece transport systems based on SuperTrak from B&R are compact, reliable and cleanroom friendly. On many production lines, they successfully increase output while introducing valuable flexibility to the production processes. PIA Automation uses track technology in an innovative process module to assemble medical devices both inside and outside the cleanroom.

At first glance, PIA's latest process module isn't particularly spectacular: a standard cell with a handling unit and a workpiece transport system moving items around. The handling unit picks small vials from the workpiece carriers and places them into a magazine.

A second look, however, begins to reveal some interesting details. The workpiece carriers developed by PIA each hold two vials and are mounted on shuttles. The shuttles travel independently through the system at different times and at different speeds. They reach dizzying speeds, change directions, stop and position themselves for each of the vials to be picked out of the workpiece carrier.

The PIA process module is perfect for demonstrating the key advantages of the SuperTrak system and modular workpiece carriers for potential users. Unlike conventional workpiece transport systems with rigid interlinking, such as rotary indexing tables or belt transfer systems, each SuperTrak shuttle can be assigned its own unique movement profile. This is possible because each of the shuttles is equipped with high-grade permanent magnets that correspond to the rotor of a linear motor – one that can be controlled individually. The stator is integrated in the segments that form the modular rail system that the shuttles travel on. Each shuttle has two v-wheels made of POM plastic that travel in a v-groove along the top of the segments to guide the shuttles safely around the track. Two more rollers run along a flat stainless steel guide to provide lateral support and prevent tilting.

The shuttles are controlled individually and equipped with collision avoidance, so they queue up at each processing station without having to write any extra code telling them to do so.

The freely programmable movement of SuperTrak shuttles makes it possible to transport different products on the same shuttle to produce product variants or shorten changeover times.

Smaller footprint – Less particulate

Subject to only minimal rolling friction, these four rollers are the only moving parts in the entire SuperTrak system. The vials are transported gently in the workpiece carrier without touching each other or the transport system. "As a result, the service intervals for the workpiece transport system are exceptionally long," notes Lothar Mehren, head of the medical division at PIA Automation's competence center for healthcare in Amberg, Germany. "It also generates such a small amount of particulate matter that an exhaust system is not necessary. These factors all speak clearly in SuperTrak's favor. The system can be deployed in cost-intensive cleanroom applications to improve process reliability."

With the high costs involved, compact machine design is a high priority in cleanroom applications. SuperTrak stands out here as well, notes Manual Falk, account manager of PIA's medical division: "The linear direct drive system allows us to approach multiple positions in each station with high precision. That means we can integrate multiple transport, inspection or assembly steps in one and the same station, making the processes much more flexible. And, since positioning can be performed with the same high precision anywhere on the track, we can use every inch of it – including the curves. We end up with much better utilization of the available space, and the process modules can be added or omitted at any position. Taken together, these factors enable us to build a considerably more compact machine.

Short changeovers, more flexible processes

Integrating multiple processing steps in one station not only reduces the space required but also makes the system more productive, adds Falk: "Workpiece changeover times are significantly shorter than with other transport systems because of the short distances the shuttles have to travel. They can cover the distance between stations at high speeds and high acceleration and deceleration values. That's what makes the system so fast." Alternatively or additionally, changeover times can be reduced by placing multiple products of the same type on the workpiece carrier simultaneously. Depending on the timing requirements, they can then be processed sequentially at a single station or in parallel at two identical stations.

If a workpiece carrier has enough space to hold multiple products, a line can also be set up to process two different products or product variants without any setup between batches. The qualification requirements for medical technology only have to be carried out once.

Rugged and reliable

Since PIA designed the module primarily for process capability verification and high productivity, it was essential for the track system to be robust and reliable. "SuperTrak is technologically mature and thoroughly proven," explains Mehren. Falk notes another decisive advantage of SuperTrak over other systems: "SuperTrak runs as a self-contained subsystem. We are therefore free to decide whether we want to work with a higher-level plant control system and, if so, which one."

B&R also provides easy-to-use software for commissioning and configuration, so there's no need to manipulate the source code like other systems require. The software provides information about each shuttle, which can be retrieved – via OPC UA, for example – and easily used for functions such as condition monitoring and predictive maintenance.

High level of acceptance among employees and customers

The ease with which SuperTrak integrates into both new and existing software architectures has led to a high level of acceptance

Photo: PIA Automation, Franz Rossmann

The SuperTrak transport system in PIA's meditec process module gives it the flexibility to assemble complex medical devices in large volumes – both inside and outside the cleanroom.

within the company, reports Mehren: "The SuperTrak technology and support from B&R have resonated very positively with even the most critical employees in the company."

The feedback from medical device manufacturers has been similarly positive right from the outset. "At the first public presentation of the cell at Pharmapack 2020, it was immediately clear that we had struck a chord with our customers," recalls Mehren. "The fast, fluid shuttle movements and quiet operation make quite a first impression." But the enthusiasm clearly went beyond first impressions. Shortly after the trade fair, the first orders for solutions with the SuperTrak workpiece transport system began rolling in. With the system´s ongoing success, PIA now plans to expand the process module for the next Pharmapack event. The first steps will be to add a robot and a labeling unit.

"SuperTrak perfectly complements our existing selection of drive systems, and it has more than lived up to our expectations," summarizes Falk. "Other areas of the PIA group are very interested in the new track technology. It wouldn't surprise me if we start seeing the first applications there soon." ←

Lothar Mehren
Head of Medical Division, PIA Automation

"The service intervals for the workpiece transport system are exceptionally long, and it generates such a small amount of particulate matter that an exhaust system is not necessary. These factors all speak clearly in SuperTrak's favor. The system can be deployed in cost-intensive cleanroom applications to improve process reliability."

Integrated machine vision

The self-calibrating printer

The trend toward smaller runs continues throughout the printing industry – and labels are no exception. To keep material waste and downtime between runs to a minimum, Nilpeter equipped its machines with a fully integrated machine vision system from B&R.

Photo: Publico Kommunikation

Jesper Larsen
Software Development Manager, Nilpeter A/S

"With material expenses comprising such a large portion of the label printing costs, it's exciting to imagine what can be gained by cutting waste in half."

The printing market looks much different than it did even ten years ago. It has gone from long runs producing big batches to short runs with many changeovers each day. "Today, many customers need only a thousand labels, where they used to need 30 or 40 thousand at a time," notes Jesper Larsen, software development manager at Nilpeter. "Every second of production time lost while setting up for a new label type is a painful sacrifice."

To keep label printing profitable, it is also important to minimize the number of sheets that go to waste due to misprints. With the web racing through a Nilpeter printing machine at speeds of several meters per second, even the slightest imprecision will leave noticeable flaws on the printed labels. Such quality issues can cost dearly in terms of waste – something the Denmark-based machine builder knows all too well.

Challenges facing today's label printers:

- Shorter print runs increasingly common
- Valuable time lost setting up for new label types
- Costly material waste due to misprints

Increased precision

Nilpeter has worked with B&R for years, developing new solutions for automation and quality assurance. "We immediately recognized the advantages B&R's vision system would have for our machines. The insight it provides into processes like registration control can really help reduce waste," says Larsen.

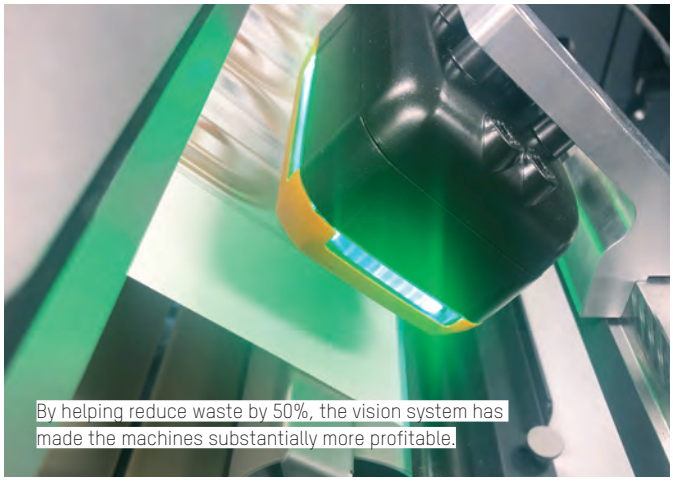
Nilpeter equipped each of its label printer's six units with a B&R machine vision camera. The cameras constantly monitor the position of the labels on the web. If the image processing software detects any imprecisions in the alignment of the colors, the camera alerts the machine control system, and the machine makes any necessary adjustments automatically.

Benefits for machine builders and their customers

Integrated machine vision makes Nilpeter machines more available and more productive. "You get smart, flexible batch production, and the single-cable solution means OEMs can get their machines to market faster," says Jensen, who sees great potential for integrated vision at Nilpeter. "With material expenses comprising such a large portion of the label printing costs," he explains, "it's exciting to imagine what can be gained by cutting waste in half." The integrated vision system from B&R makes Nilpeter one of the few companies in its market to offer a performance boost of this magnitude for its machines.

Advantages of B&R machine vision system for Nilpeter label printers:

- By helping reduce waste by 50%, the B&R machine vision system has made the machines substantially more profitable.
- B&R cameras detect color alignment problems with a precision of 12 µm.
- The printing machine can self-calibrate on the fly, without interrupting the printing process.
- The machine makes the necessary adjustments automatically.
- The lighting and color control integrated in B&R cameras ensures consistent, reliable results.



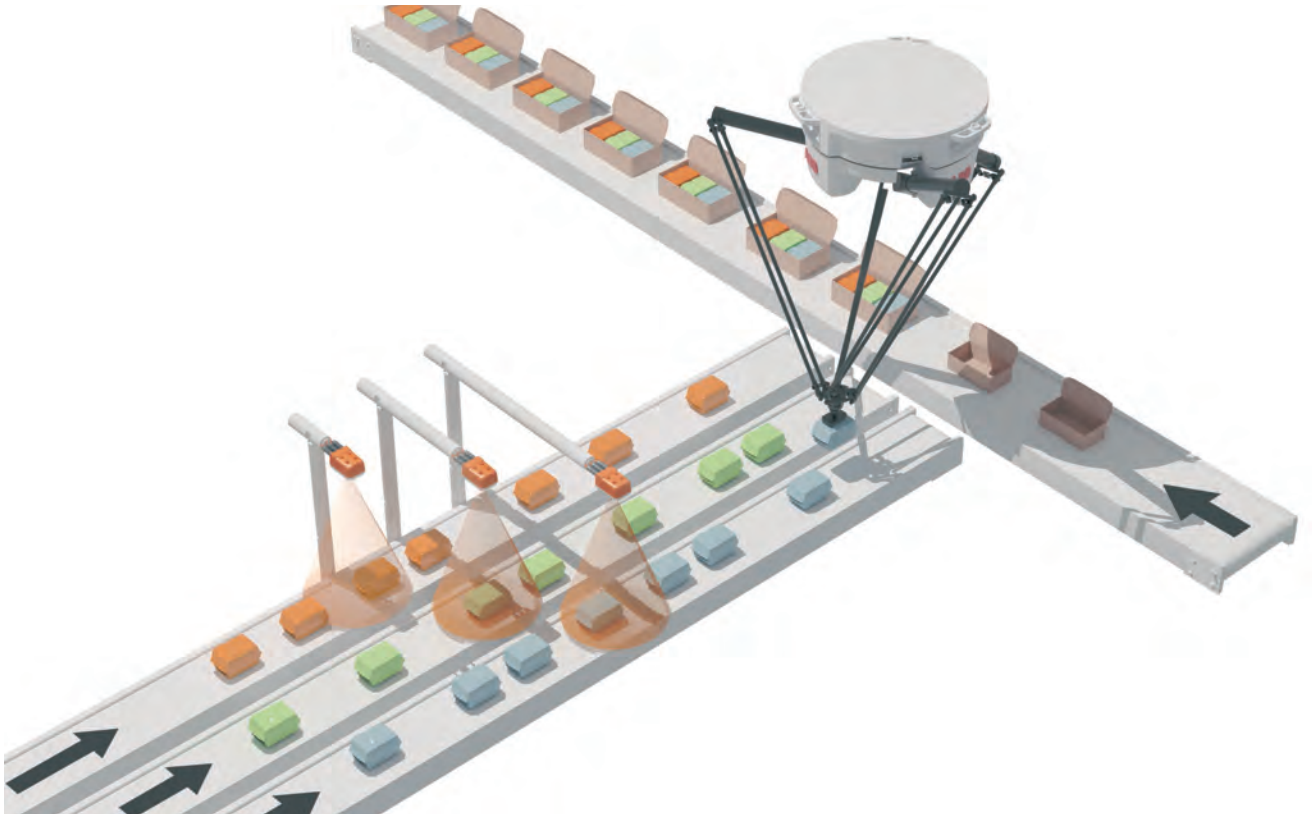
By helping reduce waste by 50%, the vision system has made the machines substantially more profitable.

Nilpeter equipped each of its label printer's six units with a B&R machine vision camera.

Machine-Centric Robotics

More productive pick-and-place

High-precision pick-and-place applications can make production lines more productive and more reliable. Until now, however, pick-and-place robots have been operated as separate units from the machine itself, which places an upper limit on how productive they can be. With the complete integration of robotics control into its automation system and introduction of a new software solution, B&R is now changing that.



With mapp Pick&Place, pick-and-place applications can be set up with just a few clicks.

"Pick-and-place applications have one very big advantage," explains B&R's product manger for integrated robotics, Sebastian Brandstetter. "The robots perform the same exact movement over and over, 24 hours a day, with a constant level of precision." What does that mean for the machine operator?

- More efficiency
- Reduced waste
- Less fatigue

Fewer errors

"Many of the classic pick-and-place activities have already been automated," notes Brandstetter. Still, there remain countless manual stations where human workers perform monotonous tasks like placing products into boxes or sorting out defective items. This has two major disadvantages: First, it's becoming increasingly difficult to find people willing to do this work, and second, the monotonous nature means it's only a matter of time until mistakes are made. That's why pick-and-place solutions are such a perfect fit in these cases.

"However," adds Brandstetter, "implementing a pick-and-place system is more complex than you might think." Simply programming the robot kinematics is not enough. There are many other important factors that the application must take into consideration:

- The movements of each robot
- Coordination between robots and conveyors
- Coordination with a machine vision system
- The machine process itself

Logistical challenge

"When it comes down to it, pick-and-place is basically a matter of logistics," says Brandstetter. You need to transport things from A to B as efficiently as possible. Simple as that may sound, it relies on some very complex calculations and corresponding programming.

"That's exactly why we've added a special new component to our mapp Technology solution," says Brandstetter. To set up an application, all that's left to do is describe the desired process. That can be as easy as "Take all the orange products and put them in the first box." The intelligent mapp component handles the rest.

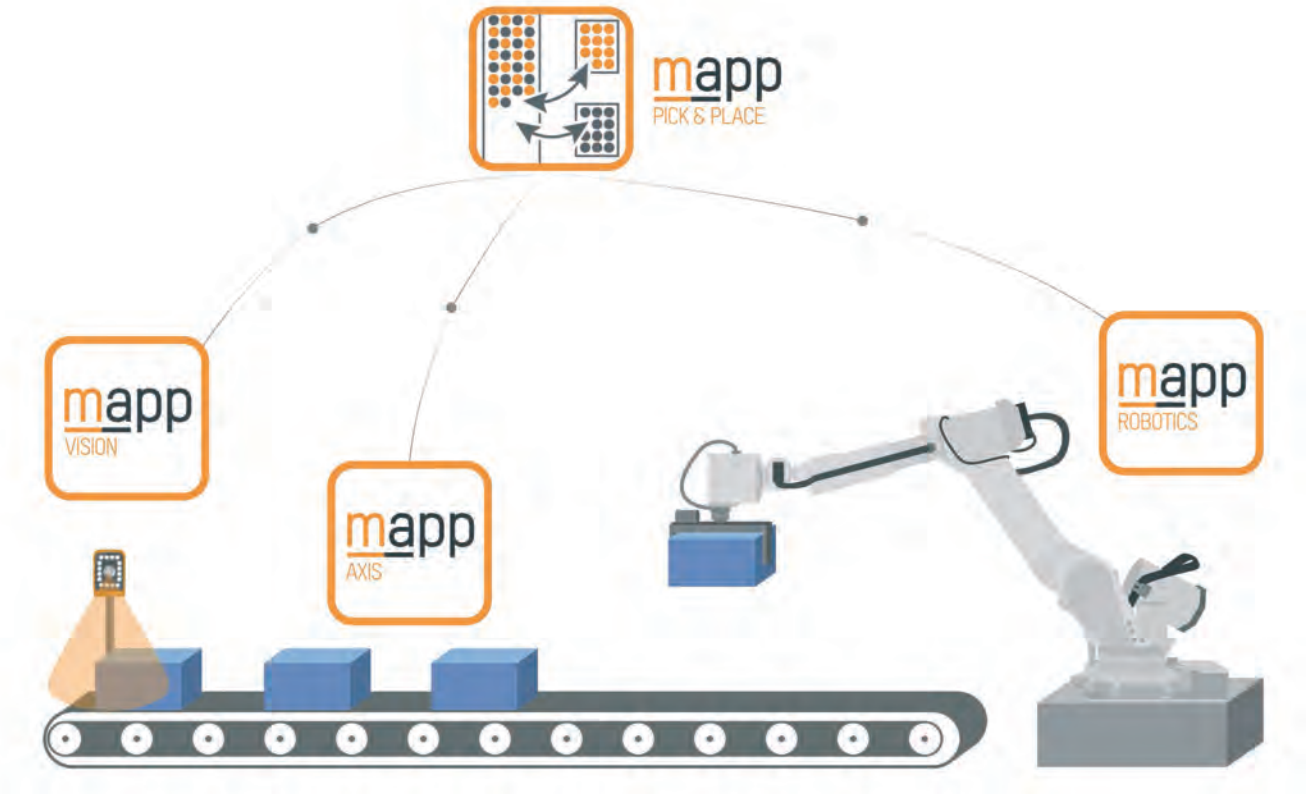
Intelligent software modules

"To make that possible, we programmed many different software modules, which get linked together automatically in the background to arrive at the desired result." The interface between them, known as a mapp Link, also connects them to any other mapp components that are used, such as mapp Vision for machine vision, mapp Robotics for robotics control or mapp Axis for single-axis motion control.

"The great advantage of mapp Technology is that all the components communicate with each other automatically," says Brandstetter. Since the user doesn't have to program a single line of code, they have more time to focus on their primary challenge: optimizing the machine process itself.

To continue the example with the orange products, mapp Pick&Place would work like this:

Photo: B&R



The mapp components exchange all the information they need with each other automatically.

- A machine vision camera detects an orange product
- Its position is sent to the robot in real time via the mapp Link
- mapp Robotics calculates the optimal path
- The robot picks up the product and places it into the box

Configuration instead of programming

"This basic concept also scales to much more complex applications," notes Brandstetter. The box might be moving along a conveyor belt, or the products might be placed into the box in a specific arrangement. "Even in more advanced cases like those, the same principle applies: the person creating the application is only configuring the functions they want – there's no programming involved."

mapp Pick&Place is so flexible, it also works in conjunction with intelligent track systems like ACOPOStrak. Not only that, but there's no limit to how many robots can be used in the application. Especially in high-speed sorting applications, it's often helpful to have a series of robots to maximize output. In addition to delta robots, it's also possible to use articulated arm or SCARA robots.

Sebastian Brandstetter
Product Manager - Integrated Robotics, B&R

"Mapp Pick&Place pairs up perfectly with B&R's intelligent track systems."

The choice is up to the user

"There are a variety of possible logistical strategies for solving pick-and-place tasks," explains Brandstetter. "And we took those into consideration when creating mapp Pick&Place." The user can choose between a variety of strategies, such as:

- First in, first out (FIFO)
- Prioritization of certain tasks or products
- Fastest possible pick duration
- Energy-saving movement profiles
- Movement profiles to minimize mechanical wear

These options allow the process to be optimized for any possible situation. By simplifying implementation of robotics and pick-and-place operations, mapp Pick&Place drastically lowers the investment risk involved in incorporating robots into machine processes. The precise synchronization between the robots and the rest of the machine also brings a considerable boost in productivity.

Robot and machine become one

B&R is the world's only single-source supplier for controls and robotics. Robots from its parent company ABB are fully integrated in the B&R automation system. Customers benefit from unprecedented precision in synchronization between robotics and machine control. They need only one controller and one engineering system for development, diagnostics and maintenance. ←

Food & beverage industry

Meat changing requirements

For a special-purpose machine builder like Singer & Sohn, success depends on the ability to accommodate customer requests quickly and efficiently. That's why the food industry OEM relies on automation technology from B&R.

Compact components such as the ACOPOS P3 servo drive give designers more freedom when laying out machines and their control cabinets.

For more than 30 years, Singer & Sohn has built hygienic equipment for the meat processing industry. Its products range from robotic loading systems, sausage link separators and conveyor systems to solutions for thermal product treatment and metal detectors.

"Among food processing suppliers, we are unique in our ability to offer a comprehensive portfolio of equipment, while at the same time responding to special requests as consistently as we do," says Singer & Sohn Project Manager Matthias Hiemer. By reducing the time it takes to get new machines developed and put into operation, the company is able to direct more resources to implementing customer requests and developing innovative new machine concepts.

"We're seeing a clear trend towards automation as our large and midsized customers seek to accelerate cycle times while complying with increasingly stringent hygiene regulations and at the same time minimizing costs," explains Hiemer. "Yet, different users with different products place very different requirements on the machine."

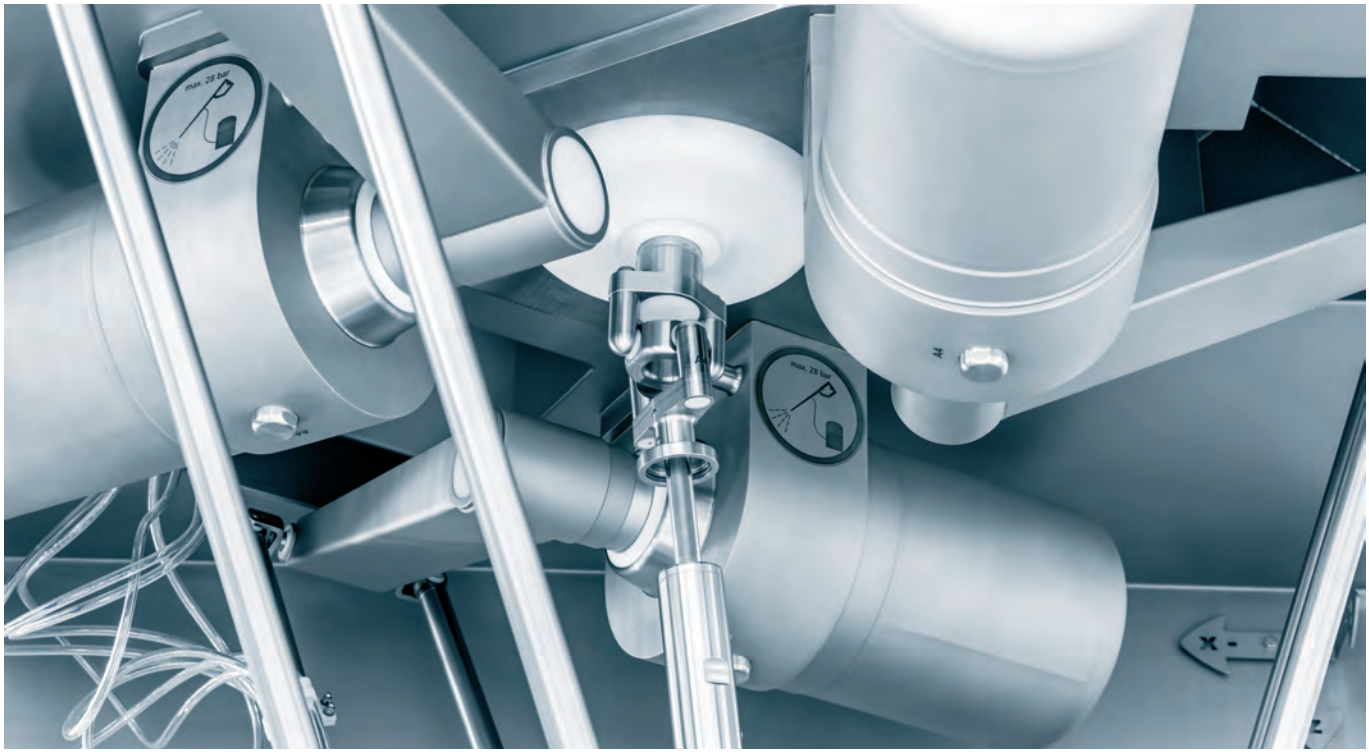
Custom is the only solution

To convey a plump, curved Bavarian Weisswurst sausage, for example, you need a completely different solution than you would for a slender frankfurter or bratwurst. The size and layout of food processing facilities can also vary greatly. To ensure its ability to accommodate such diverse requirements, Singer & Sohn relies on a high level of vertical integration and state-of-the-art technology. The machine manufacturer does its own water-jet and laser cutting, pickling and glass bead blasting. Design, planning, programming and implementation are all done in-house by Singer & Sohn employees. The flat hierarchy of the midsized owner-managed company allows for quick, unbureaucratic decision-making.

To ensure that the benefits of this get passed on to its customers, Singer & Sohn also expects short response times and reliable delivery from its suppliers, explains Hiemer: "A few years ago, we were having more and more problems with our controls supplier. After seeking out and comparing a number of potential alternatives, we decided for B&R."

Compact performance

That decision was influenced not only by B&R's innovative products and expert service, but also key factors like compact component design. A particular highlight for Hiemer: the ACOPOS P3. "It's one of the most efficient servo drives you'll find with integrated safety functions," he notes. With a power density of four amps per liter, the three-axis variant offers the greatest space savings.



B&R's motors and control solutions enable exceptionally dynamic and precise robot movements.

B&R's comprehensive hardware portfolio – ranging from cutting-edge track-based transport to hygienic-design motors and HMI terminals. "Equally important to us has been the scope of software functions B&R offers," adds Hiemer. "The majority of the functions we need are right there out of the box. Since we don't have to develop every detail from the ground up, we're able to direct our energy toward advancing the key features that set our machines apart."

Pilot plant in six months

After only six months of development and construction, Singer & Sohn completed the first WKT-50 machine with completely redesigned control and drive technology based on B&R solutions. The new machine separates a continuous chain of sausage links into pairs using a motor-driven blade. The main challenge: the blade position is not constant. Prior to each cut, the machine must identify the exact center between two sausage links and move the blade into position. During development of the WKT-50, the engineers benefited from B&R's advanced control technology. The appropriate electronic cam can be selected extremely quickly and cuts are performed precisely and in rapid succession.

"Even though this was our first experience with B&R software, the learning curve was quickly behind us," recalls Hiemer. "B&R provided us with excellent training and engineering support, both on site and over the phone. We were very happy with the solution right from the start."

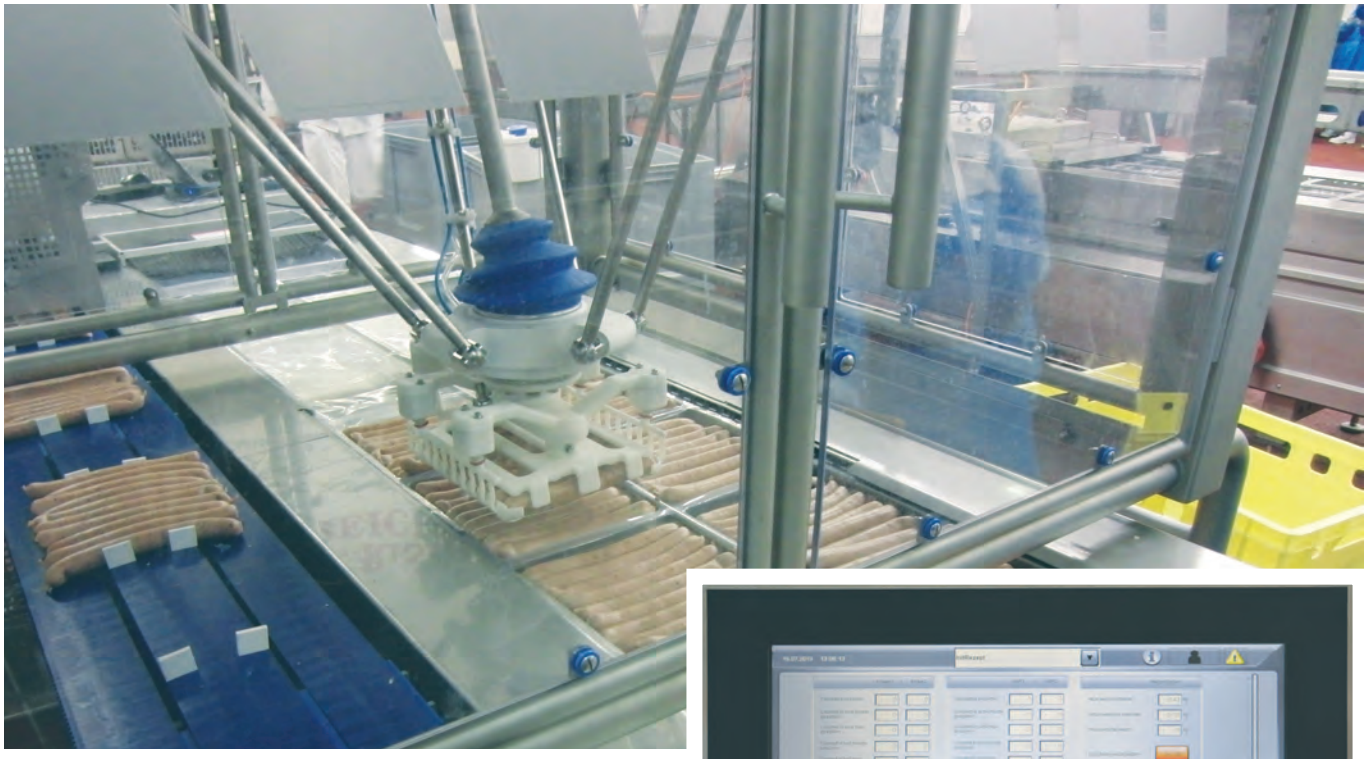
Loaded for the future

Almost in parallel with the WKT-50, Singer & Sohn also tackled a new edition to the line: a robotic loading system for placing products such as sausages or pet food into the respective packaging. In its standard configuration, the V-G-E loading

Matthias Hiemer
Electrical Project Manager, Singer & Sohn

"We benefit greatly, not only from B&R's existing portfolio, but also from the innovative products and features they continue to add all the time. The technology has proven itself in practice, and B&R has always kept their promised delivery times. That was enough for us to make B&R our technology partner for all motion control projects going forward."

Photo: Singer&Sohn GmbH, Franz Rossmann



Depending on the circumstances on site and which products are being handled, requirements can vary dramatically from machine to machine. The scope and scalability of B&R's automation portfolio give Singer & Sohn the flexibility to tailor its solutions quickly and efficiently.

The eye-catching IP69K operator panels running future-proof HMI applications help to further solidify Singer & Sohn's position as a leading supplier to the meat processing industry.

system comprises units for feeding, sorting and grouping as well as one or two delta robots, which place the grouped products into the packaging using a product-specific gripper. Between these units, the products are carried by conveyor belts.

Singer & Sohn chose an Automation PC 2100 as the automation platform for its pilot plant – running all of the HMI, control and motion applications. The machine builder created the HMI solution using the software tool Visual Components. "Our next step will be an upgrade to B&R's mapp View, which will bring us the advantages of web-based HMI built on HTML5." That includes being able to easily view the same HMI application on multiple devices and customize the layout of the user interface for different users and user groups.

Accelerated programming

ACOPOS P3 servo drives and ACOPOSinverter inverters control the pilot system's B&R motors, including those that move the delta robots. For the associated motion control application, Singer & Sohn used B&R's mapp Motion software component. "B&R has thoroughly-tested mapp components that cover all aspects of motion and robotics control, which enabled us to program and deploy the motion control application much faster than a conventional approach," says Hiemer. Commissioning of the delta robots was completed in just one day.

Although the automation for the loading system was considerably more extensive than that for the sausage cutter, Singer & Sohn was able to complete that project in only six months as well, enabling them to premier both solutions at the leading meat industry trade fair, the IFFA.

Visibly better

The new generation of the V-G-E loading system is equipped with an Automation Panel from B&R. The 15" IP69K stainless steel panel has additional buttons and an emergency cut-off. Experts are quick to notice the improved movement sequences of the machine's delta robots – finely tuned for top performance and with gentle acceleration and braking for reduced wear. ←

Passing the baton of leadership

New CSO at B&R

On August 1st, Luca Galluzzi (52) joined the executive management team of automation specialist B&R. As the new chief sales officer, he succeeds Peter Gucher, who entered a well-earned retirement after 34 years at the company.

Photo: B&R

In his new role, Galluzzi is responsible for all of B&R's global sales activities and advancing its entry into new markets. In addition to his position on the executive management team, he retains his responsibilities as managing director for southern Europe.

"Luca Galuzzi has done an exceptional job in the Southern Europe region and has demonstrated a commitment to expanding our business there. I am very pleased that our executive team will now be able to benefit from his knowledge and experience," says B&R Managing Director Hans Wimmer.

27 subsidiaries

Peter Gucher began his career at B&R at a time when the company was still a small Upper Austrian start-up with 60 employees. Over the years, he built up a sales network that now comprises 27 subsidiaries and over 180 offices all around the world.

"This global presence and the closeness it gives us to our customers are the result of Peter Gucher's personal dedication," says Wimmer. "We owe him a debt of gratitude for his hard work and wish him all the best for his well-earned retirement."

Scalable control solution

A change for the better

In early 2014, an update to Germany's renewable energy legislation brought abrupt changes to the nation's biogas market. agriKomp took advantage of the situation to give its biogas plants a decisive upgrade: a completely new control solution from B&R. The company is more than pleased with the results: scalable plants that are faster to develop and commission.

Prior to 2014, Germany's farmers relied primarily on larger biogas plants with an output of at least 250 kWel to generate electricity from renewable feedstock and biowaste. Following the law change, however, demand shifted to 75 kWel systems. The reason for this sudden change was the amendment of the German Renewable Energy Sources Act, which brought a drastic reduction in the subsidy for new plants with an output over 75 kWel.

Only months before the details of the upcoming legal changes were made public, agriKomp had introduced a new B&R control solution for its popular 250 kWel plants. With the proprietary control software the company had previously used, it would have taken great effort to adapt the software to the heightened requirements.

"Both the more comprehensive safety requirements and the users' desire for more individually tailored system configurations were pushing our old control solution to its limits," says agriKomp's chief electrical engineer, Andreas Ströhlein. "The absence of a path for migrating to more efficient control hardware was growing increasingly problematic, not to mention the limited number of supported communication interfaces for integrating third-party systems such as solar panels or surveillance cameras."

More than 100 requirements specified

When the decision was made to introduce a new control system, Ströhlein and his team prepared a 75-page catalog specifying more than 100 requirements and obtained corresponding proposals from all the well-known automation suppliers in the German-speaking world. By the end of the evaluation, B&R had come out on top.

"It was B&R's integrated and comprehensive automation package in combination with the APROL process control system that convinced us. It enables us to meet all our requirements in an especially efficient manner," explains Ströhlein. "For us, it was important that the package contains an integrated safety solution and exceptional interface support. For every physical interface, B&R has a suitable counterpart. Another core criteria was for the control solution to be easily scalable."

One solution, multiple performance classes

This capability served agriKomp well when it came time to respond to the amended Renewable Energy Sources Act with a newly developed 75 kWel plant for biogas production from slurry and manure. To keep engineering and service costs down and simplify spare parts inventory, agriKomp decided to use the same control solution as in its large 250 kWel plants. "There are considerable differences between the two performance classes, both functionally and financially," says Ströhlein.

But the B&R solution helped agriKomp clear this hurdle as well. The fine-grained modularity of the X20 system allows the company to meet the tighter hardware budget by tailoring I/O channels, interfaces and CPU performance to each configuration of the 75 kWel plant. For larger systems, on the other hand, the company installs a uniform standard control station regardless of the system configuration in order to minimize inventory handling overhead.

Efficient and convenient programming

Also exceptionally modular, the APROL software was easy to adapt to the new requirements – allowing the same software project to be used for the new 75 kWel plants as for their larger counterparts. Ströhlein and his team implemented their modular software solution with the help of the process control system's hyper macro technology. The hyper macros allow users to design their own libraries. Even the extensive standard libraries that B&R provides cannot cover every requirement of every user in every industry.

To automatically add a new tank, including the agitators and all the other components, all you need to do is change one variable in a hyper macro," explains Emmanuel Hahn, chief software engineer at agriKomp. "Overall, programming with APROL is very efficient and elegant. We can easily program the machine control application in the APROL development environment, for example, without having to use an extra tool." To configure the hardware and program safety functions, the agriKomp team uses the Automotion Studio development environment and its integrated SafeDESIGNER tool.

Transparency for plant operators and service teams

The software installed on agriKomp plants, including updates, can be managed, maintained and installed on any connected plant worldwide from a central location via a remote maintenance connection. User management can also be implemented centrally. At the same time, plant operators can permit agriKomp to collect data from the plant and use it to provide additional services.

"APROL offers a large number of comprehensive reports. In addition to that, we use the collected data to generate reports for documentation or plant optimization, which operators can view either on site or from their office PC," Hahn explains. "This includes, for example, a feeding plan that lists what materials the operator has introduced into the biogas plant."

"The comprehensive recording functions make it possible to trace all processes and activities," says Ströhlein. "This is particularly helpful when the operator contacts us to help solve a problem or answer a question. The ability to evaluate objective data about the plant's status over time allows us to provide more targeted, efficient support." For the user, this means less hassle and higher plant availability.

Faster commissioning

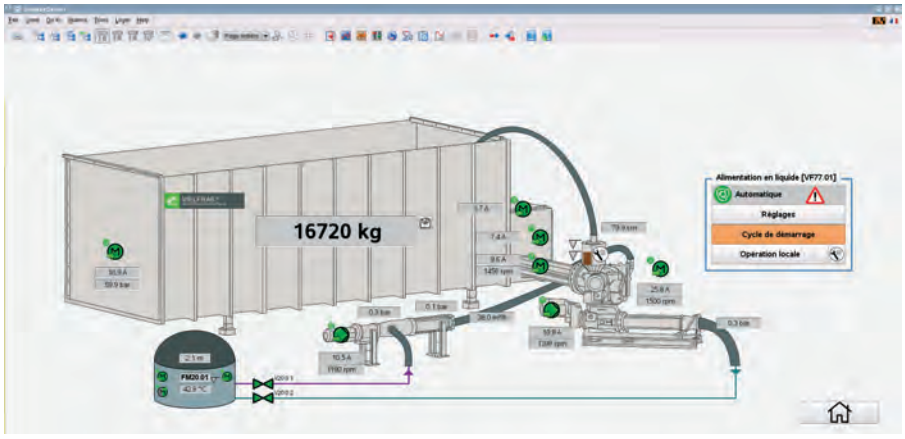
B&R's integrated safety technology also contributes to higher system availability. Before the new control solution was introduced, agriKomp relied on hardwired safety relays. "At the time, we had a lot of overhead going into safety technology. Just implementing the secure locks required for the plant's pumps can easily require 60 relays," says Ströhlein. "It adds up quickly, and all those relays have to be installed and wired." In addition to the time that takes, it also opens up lots of room for errors. As a result, installation and testing of the safety technology used to constitute a substantial portion of the overall commissioning process.

That's where integrated safety technology is a real game-changer, as Ströhlein reports: "We have significantly less wiring work, the error rate has been reduced considerably and very little testing is required during on-site commissioning."

Retrofit increases process reliability

The B&R solution has also proven useful for modernizing older systems. This is illustrated by the example of an existing plant in Germany, where errors had been growing increasingly frequent. The operator had been recording up to 200 errors per month. "Since switching to the new control solution, the plant now has fewer than 12 errors per month with a noticeable improvement in process reliability," reveals Ströhlein. "Our experience has shown that the retrofit can be completed quickly, even for large plants."

Photo: agriKomp GmbH



APROL gives plant manufacturers remote access to their plants in the field, so they can offer operators additional data-based services that help them optimize plant performance.

Andreas Ströhlein
Chief Electrical Engineer, agriKomp GmbH

"It was B&R's integrated and comprehensive automation package in combination with the APROL process control system that convinced us. This enables us to meet all our requirements in an especially efficient manner."

This is made possible in part by the fact that existing third-party I/O modules can generally be reused, and only the signals of the safety-relevant components have to be transferred to the safety modules.

The flexibility and efficiency of B&R's technology have made an important contribution to agriKomp's market success, claims Hahn: "Product development has really picked up speed since we started using the B&R system. We've been bringing more new solutions to market at shorter intervals." In return, the market has rewarded this effort. By the end of 2019, the biogas plant manufacturer had delivered or retrofitted around 200 plants with B&R technology – in spite of further legislative changes in important markets such as France. With the B&R solution, agriKomp can now respond quickly to changing market conditions and offer customized solutions that are efficient and profitable to build. ←

Vender-agnostic communication

OPC UA over TSN
Unified standard for the IIoT

Modular, flexible manufacturing solutions are more important than ever – and also easier than ever to implement, thanks to technologies like OPC UA and TSN. In this second part of our series, Stefan Bina answers frequently asked questions on the topics of performance, cybersecurity, migration and how TSN works in combination with existing fieldbus systems.

Photo: B&R

What kind of performance can I expect from OPC UA over TSN?
The technology is capable of addressing more than 10,000 network nodes, scalable from 10 megabits to 10 gigabits and beyond. Testing conducted by B&R achieved cycle times below 50 microseconds with a jitter of less than ±100 nanoseconds in a network of 200 remote I/O bus couplers totaling 10,000 I/O points. This is consistent with claims that OPC UA over TSN is "18 times faster than today's fastest solution." This level of performance makes proprietary fieldbus networks obsolete. OPC UA over TSN allows high-performance motion control traffic and bandwidth-intensive IT traffic on a single cable without interference between them.

Will OPC UA over TSN help integrate factory and machine networks with our IT requirements?
OPC UA was designed to communicate with IT systems. OPC UA over TSN will enable you to converge OT and IT networks without disturbing machine operations. This is thanks to TSN and the use of OPC UA security mechanisms familiar to IT departments today, including user authentication and authorization, encryption and certificate handling.

Can TSN and non-TSN OPC UA or normal IP devices be used in the same network?
Yes, because TSN is an evolution of standard Ethernet. TSN simply enhances standard Ethernet with real-time capabilities, so it is possible to have standard Ethernet devices and TSN devices present in the same network. Standard Ethernet devices would not need any interface or gateway to connect to a TSN network. However, only TSN-capable devices will be able to communicate in real time.

Will it be possible to synchronize POWERLINK and OPC UA over TSN?
Yes, it will be possible to synchronize POWERLINK and OPC UA over TSN devices in B&R systems.

What about running existing fieldbus protocols – such as EtherNet/IP, Profinet, EtherCAT, EtherCAT G or CC-Link IE – over TSN?
The legacy fieldbus protocols would share a common TSN network, but the devices would not be interoperable as OPC UA devices would be. These protocols also lack the semantics and methods that OPC UA provides. OPC UA has built-in security and is recognized as an international standard for communication from sensor to cloud with new developments being added all the time. The key difference is system interoperability: without it, you are locked into one vendor and one automation solution, with no ability to communicate or synchronize with other systems. In a multi-vendor plant, this means you are unable to secure your communication and implement advanced functionality such as condition monitoring, line balancing, predictive maintenance, machine optimization and plug-and-produce startup and maintenance. As a machine builder, this means you are limited to the level of innovation offered by your chosen vendor. ←

Networking specialist Stefan Bina answers some of the most important questions about OPC UA over TSN with regard to performance, cybersecurity, migration and the combination of TSN with existing fieldbus systems.

Did you know that OPC UA over TSN...

...is 18 times faster than today's fastest solution?

...lets you converge OT and IT networks without disturbing machine operations?

...provides vendor-agnostic interoperability as a recognized international standard for all communication from the sensor to the cloud?

...guarantees cybersecurity through OPC UA security mechanisms like user authentication and authorization, encryption and certificate handling?

Modular safety solution

Test bay of the future

When you manufacture power supply systems, there's no avoiding the barrage of functional and safety testing to ensure that they are fit for use. To futureproof its testing performance, power supply maker Gustav Klein has developed an innovative new test bay. With its modular safety solution from B&R, Gustav Klein is able to manage many different test bay configurations in a single software project.

"Each system we produce is tested exhaustively before delivery," explains Jörg Umbreit, Head of R&D at Gustav Klein. "In response to rapidly growing demand and increasing performance requirements, in 2019 we upped our testing capacity from four to eleven stations and increased the connection power of the test bay. We've also planned in extra reserves to handle projected growth over the years to come." The 500 square-meter test bay at Gustav Klein now has a total of 13 testing stations for large devices and additional stations for small devices.

The company worked with B&R to develop a safety solution that encompasses all of the testing stations, additional reserves and power distribution equipment. This was made possible by the exceptionally modular hardware and software of B&R's safety solution. The safety functions for the specific testing stations used in a given configuration can easily be selected or deselected via the user interface. Authorized employees can select and confirm the configuration on the HMI screen. The machine can be completely reconfigured without having to use a separate programming tool to adapt the safety application. This makes it exceptionally easy to modify the test bay, perform maintenance or put one of the reserve stations into service.

One safety project for all system configurations

The key to B&R's approach is that you only program a single safety application – one that comprises all the equipment and features that could possibly be included in the line. From that you can arrange any conceivable combination of machine modules. This approach substantially reduces maintenance costs, as well as the amount of testing that needs to be done when commissioning modular plants and machinery.

Gustav Klein recognized the benefits of the approach early, and has been benefiting for some time with its infeed testing systems I-TS MI-TS, both fully automated with B&R. "With the SafeDESIGNER tool integrated in B&R's Automation Studio engineering environment, we're able to maintain a single software solution that covers 90 percent of our projects with no new programming," says Umbreit.

All the more impressive when one considers the wide variety of configurations, applications and environments that the I-TS and MI-TS testing and simulation systems will need to adapt to. They can be found simulating charging and discharging cycles during development of electric vehicles, for example, or testing power supply components in the production of batteries and vehicles.

Modularization without special know-how

"The experience accumulated through these projects certainly played a role in our ability to implement the safety application for the test bay in only a few days," reports Roland Bayr, the Gustav Klein software developer who created the safety solution for the infeed tester and test bay. "Our work was also accelerated by how easy it is to connect the safety and non-safety parts of the system, and by the fact B&R's safety solution allows you to create modular software without specialist training. Modularization is a built-in feature with no added cost or effort." That was not an insignificant factor for Gustav Klein. Since development and construction of the test bay would not yield any immediate revenue, the safety application was to be implemented without interrupting daily business.

Comprehensive safety technology

Gustav Klein's test bay planners selected a variety of B&R X20 components. Safe digital input, output and mixed modules were installed in the test bay and the connector units. As the safety controller, they selected an X20SL8101 device from the X20 system. The controller is able to manage up to 280 safe nodes, as well as all the optional safety equipment and all the possible test bay configurations. The safe modules are connected to the safety controller via POWERLINK and a standard cable. openSAFETY is used for data communication.

The new test bay is among the largest and most sophisticated in the industry and has tripled Gustav Klein's testing capacity.

Photo: Franz Rossmann

Entire test bay in view

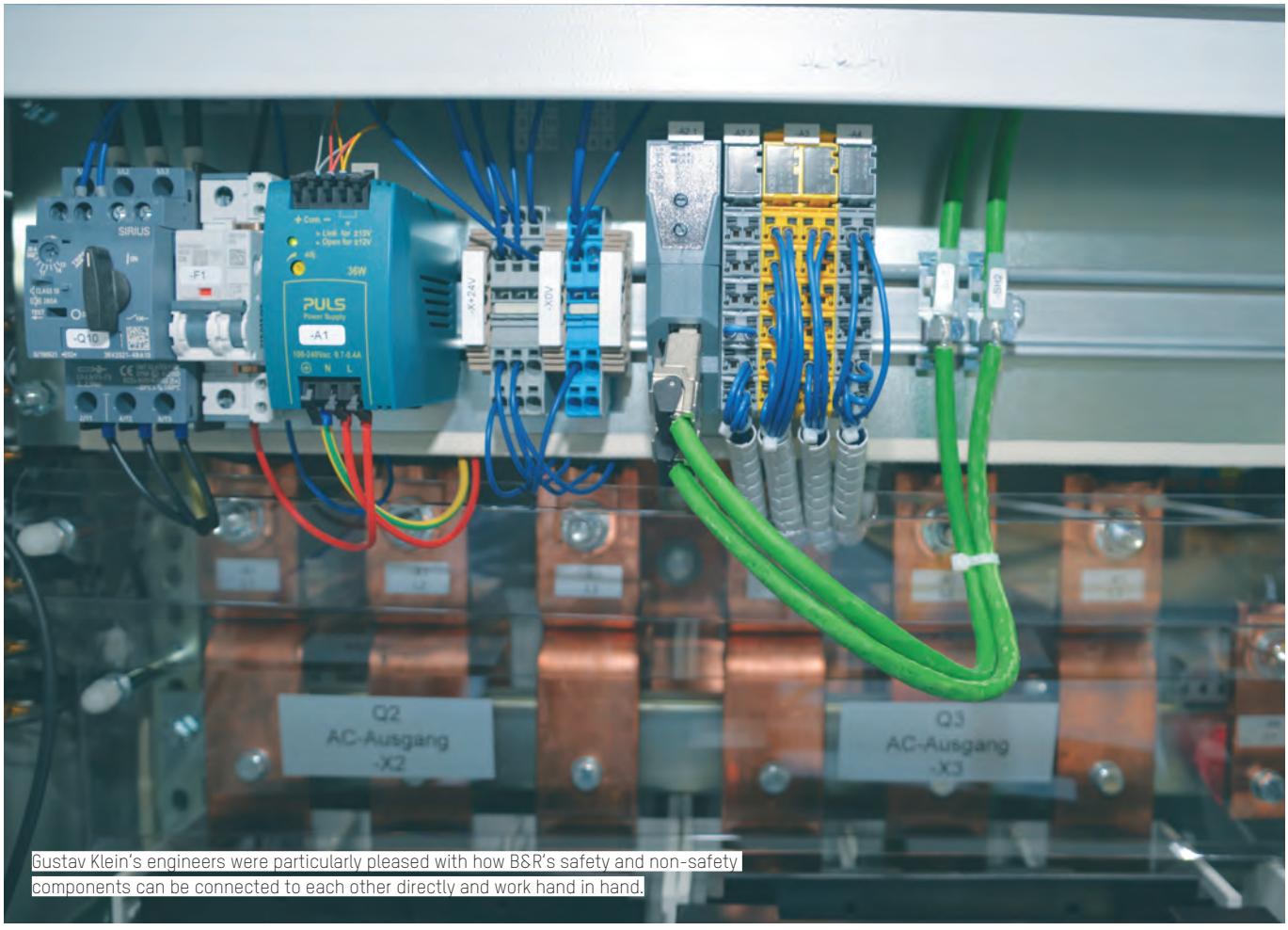
To give employees a quick overview of the test bay's safety status and the state of its switches, Gustav Klein incorporated a 24" Automation Panel 900 HMI screen in the door of the control cabinet in the technical room. Mounted on the back of the HMI is a space-saving Panel PC 2100 running the HMI application that provides workers in the test bay with the information they need. "The large display lets us show the states of all the test bay's central switches in a single view," says Bayr. "That helps ensure no events go overlooked simply because the operator is somewhere in a sub-menu. The layout of the switches on the screen also matches the test bay, making it even faster to localize a problem in an emergency." In the near future, Gustav Klein plans to add additional B&R displays in the test bay, so that inspectors can have an eye on the relevant content at all times.

Flexible, future-proof test bay

The power supply system specialist's test bay is now equipped to test UPS units and inverters with a system capacity of up to 1.5 MVA. It is also possible to conduct high-voltage testing and run simulation systems rated up to 1,000 VAC or VDC, or intelligent power electronics for high-voltage energy storage with a system capacity of up to 4 MW. Through elegantly designed power electronics, the engineers succeeded in minimizing power consumption and the resulting thermal losses during test runs and the required mains connection power. Gustav Klein has created one of the most technologically advanced, full-featured testing facilities of its kind. With in-factory high-voltage testing, the company now saves its customers valuable time during on-site commissioning. The modular safety solution from B&R makes it much easier for the plant builder to adapt the safety technology to the needs of the test bay and react to dynamic changes in market requirements. ←

Jörg Umbreit
Head of R&D, Gustav Klein GmbH & Co. KG

"With the SafeDESIGNER tool integrated in B&R's Automation Studio engineering environment, we're able to use the same safety software in 90 percent of our projects with no new programming."



Gustav Klein's engineers were particularly pleased with how B&R's safety and non-safety components can be connected to each other directly and work hand in hand.

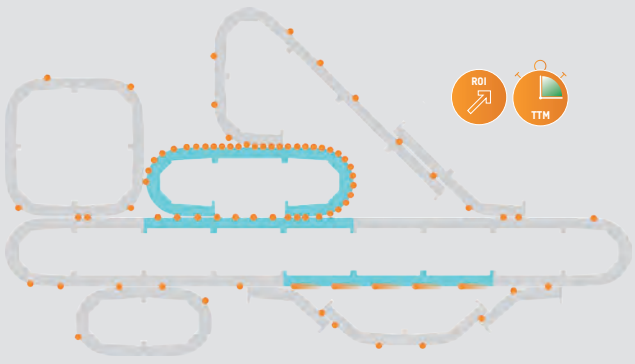
News

Frequency inverters for broad range of applications

New ACOPOSinverter series for three-phase synchronous and induction motors

ACOPOSinverter P86 is a series of frequency inverters for three-phase synchronous and induction motors, with or without encoders. It covers a wide power spectrum from 0.75 to 75 kW and is particularly well-suited for packaging, conveyor system, material processing and hoisting gear applications.

B&R's P86-series inverters already comply with the IE efficiency factors standardized in EN 61800-9-2. The future-proof inverters are easy to configure and exceptionally flexible. The new ACOPOSinverter series is also equipped with the dual-channel safety function Safe Torque Off (STO) in accordance with SIL 3 / PL e.



Intelligent cooling opens up new potential

Improved performance with ACOPOStrak cooling system

Motor segments for the intelligent ACOPOStrak system are now also available with built-in liquid cooling. This further expands the track's performance spectrum. Integrated directly in each motor segment, the cooling system requires no additional installation.

The new motor segments can be used to cool specific sections of track that need it most. In highly dynamic applications, large numbers of shuttles accelerate and brake on certain track segments. The resulting heat is absorbed by the liquid cooling system and transported away via a cooling medium that is pumped through the cooling circuit.

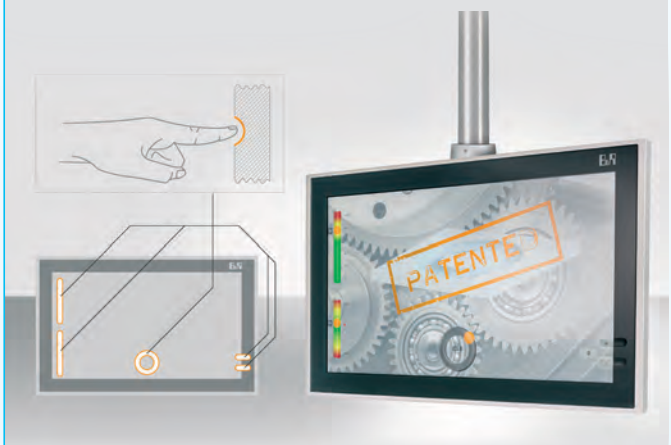
Photo: B&R

Centralized factory-level user management

Easy user group management

B&R has made centralized, factory-level user management substantially easier. With the new software component mapp UserX, it is now possible to use services based on LDAP (Lightweight Directory Access Protocol) to implement centralized management of users and user groups, for example using Active Directory from Microsoft.

With mapp UserX, the administrator can easily create users and grant them access to multiple servers using a single username and password. Rather than having to manage user by user on each individual machine, all the user data is stored on a central server and retrieved from there at every login.



Say goodbye to switches

B&R takes intuitive operation to a new level

B&R enables a unique new form of intuitive operator guidance. Typical operating functions are now incorporated directly into the glass of B&R touch-screen panels. This eliminates hardware elements like function keys and rotary switches and leaves no chance for dirt and grime to collect or enter the device. The panels are therefore ideal for environments with the strictest hygienic requirements.

Upon customer request, B&R offers all HMI variants with a projected capacitive touch screen with corresponding finger guides. The guides can be any shape and size, enabling optimal integration of all types of sliders and dials in the HMI application. This opens up the entire screen surface for displaying content. B&R's patented tactile finger guides allow eyes-off operation. Operators can adjust settings without ever taking their attention off the machine.

Industry 4.0 for brownfield plants

A *jarring* performance boost

Nordfish-Foodmark is committed to leveraging Industry 4.0 manufacturing technology to optimize its operations. To give its existing brownfield plants the necessary connectivity, the company evaluated an innovative solution from B&R that allows it to monitor and optimize the performance of its jar-packing line.

At its plant in Charzyno, Poland, Nordfish-Foodmark processes and packages herring, sprat and mackerel. Adam Schwan, head of operational excellence, realized that a lack of insight into the line's availability was standing in the way of further optimization. In order to take well-informed action to improve system availability and production quality, operators would need comprehensive information about the performance and health of their equipment.

Well informed is half the battle

When he saw B&R's innovative Orange Box solution, Schwan knew he had found what he was looking for. "The Orange Box lets us tap into energy and process data from older, digitally isolated machines," he explains, noting that they can get that data without having to make any changes to existing hardware or software. "The HMI shows a clear overview of performance metrics, making it easy for us to identify the most effective ways to boost overall equipment efficiency."

Nordfish-Foodmark is able to use its Orange Box to calculate real-time KPIs, generate and archive statistical reports, log information about production stoppages and audit changes to settings and variables. They can also easily share production reports with higher-level systems.

How it works

Nordfish-Foodmark began with a test implementation of the Orange Box on its jar-packing line in Charzyno. The 20 machines and other standalone units that make up the line were grouped into four technology zones. Each zone was equipped with a collection of buttons that allows operators to log the reasons for any downtime or interruptions – both scheduled and unscheduled.

The Orange Box acquires data from the line and transmits it to the appropriate operators. Communication takes place via OPC UA, and data is read using distributed I/O islands and a legacy third-party controller.

The Orange Box HMI shows a live overview of key performance data.

Enjoying the rewards

With B&R's tool, operators can now react in real time when they see a dip in performance, and they know exactly what to do to resolve quality issues. Schwan is pleased to have succeeded in getting his operators the data they need. "When something happens on the line – an emergency stop, a conveyor jam, a tripped fuse – they know about it in less than a second and can take immediate action."

Adam Schwan
Head of Operational Excellence, Nordfish-Foodmark

"When something happens on the line – an emergency stop, a conveyor jam, a tripped fuse – they know about it in less than a second and can take immediate action."

The Orange Box also allows them to implement predictive maintenance. Continuous monitoring of the condition of key equipment gives insight that allows maintenance personnel to restore operation faster or prevent stoppages altogether. Schwan also appreciates the quick live analysis of planned and unplanned stoppages.

With the Orange Box, the plant employees responsible for performance reporting no longer spend all their time obtaining the information they need, and can instead focus their efforts on what is most important – developing mechanisms that increase line efficiency.

What's next?

Having evaluated the Orange Box on its jar-packing line, Nordfish-Foodmark is preparing to roll out its modernization project on the other five automatic lines. Planning is also underway for a master Orange Box, which will act as a master system for data archiving, forwarding to ERP systems, generating reports and managing Orange Box versions.

In conclusion, Schwan is eager to point out: "We completed this project using our own technical team and during the busy season – and that says quite a lot about how well-designed and easy this solution is to work with." ←

With B&R's Orange Box, operators at Nordfish-Foodmark get comprehensive information about the performance and health of their equipment.

Photo: Nordfish

B&R's Orange Box

Orange Box is an Industrial IoT solution for brownfield installations. The solution consists of selected B&R hardware and preinstalled software. Machine data can be collected via hardwired I/Os or selected fieldbus connections and used to calculate OEE ratings and other KPIs in real time. This makes it possible to promptly implement well-targeted optimizations and corrective measures. The HMI solution is based on future-proof HTML5.

Control system

Cutting costly copper waste

Copper is an important, yet expensive, component of heat exchangers. For manufacturers of heat exchangers, minimizing copper waste is therefore a high priority. Together, Netto Electronics and B&R developed a solution that monitors copper consumption precisely and delivers serious savings.

Czech-based Leel Coils Europe is a specialist in the production of heat exchangers, and imports the copper it needs from a variety of European countries as well as Mexico. "The high demand and high price of copper make it absolutely essential that we monitor and minimize how much is actually being used for each production order," explains Leel Purchasing Manager Monika Hovořáková.

Monitor copper consumption

Copper arrives at Leel on a large spool, where it is immediately weighed to confirm the exact amount. From then on, the key is to constantly monitor how much copper remains on hand. Time and again, the coveted transition metal gets stolen as it waits in storage. This, as well as any unnecessary waste during production itself, must be prevented. "We approached multiple companies looking for a system to seamlessly monitor copper inventory and consumption. In the end, we found Prague-based Netto Electronics to be the right partner for the job, and together with B&R they really delivered," says Hovořáková.

In addition to the amount of copper, to provide a comprehensive overview you also need to collect and evaluate its composition, origin and type of processing. "Our Netto-Control system is able to trace the copper from the time it arrives at the supplier and throughout production, storage and delivery," says Netto Software Architect Filip Šrámek.

Specially developed B&R software solution

"When it came to the software for the control system, we turned to our long-time partner B&R," says Šrámek. The software is able to trace the copper in each heat exchanger back to its supplier. It also keeps track of the corresponding batch number and when it was bent into the typical U-shape used in heat exchangers.

Communication via data interface

Each copper bending machine has twelve infeed sensors as well as cut, bend and tilt signals. In total, data is processed from 20 different measurement points. The B&R software communicates directly with the Netto control system via a dedicated data interface. All the data from a line's bending

machines is collected and processed. "That enables us to offer a variety of different charts, overviews and all the necessary output data," explains Šrámek. Each bending machine also includes a system for weighing copper waste.

Control and monitoring

The solution that Netto and B&R created not only collects data, it also controls the entire bending machine. When needed, operators can stop the machine and determine the current stage of production. They're also able to view current data about the health of the machine.

"Through the cooperation with B&R, we were able to get real production data online and provide both operators and managers with important information," says Šrámek. "It's possible to implement both the software and the control system on older machines as well."

B&R also equipped the bending machines with Power Panel HMI units that display exactly where the copper is in the process, along with information about the current condition of the machine.

Coupled with ERP system

To accurately monitor inventory and material consumption, it is also important to get data from Leel's ERP system into the Netto control system. "We didn't have that capability before," says Hovořáková. "The new solution from Netto and B&R gives us a good overview over individual batches and production orders."

The combination of the NettoControl control system and the software they developed with B&R succeeded in cutting copper waste during heat exchanger production in half.

Photo: Karel Sedláček

Monika Hovořáková
Purchasing Manager, Leel Coils Europe

"We approached multiple companies looking for a system to seamlessly monitor copper inventory and consumption. In the end, we found Prague-based Netto Electronics to be the right partner for the job, and together with B&R they really delivered."

Millions in savings

In the past, a large amount of copper waste and the associated costs accumulated when changing over between products. "It was crucial for us to get that under control. What used to be eight tons of copper waste per month is now around five. Our long-term goal is to get that down below four tons," says Hovořáková.

Leel is now planning an expansion of the automation program for copper tube cutting machines and production of aluminum heat exchangers. "We're very happy with the system from Netto and B&R, and we want to use it to automate all of our production systems," says Hovořáková.

B&R Power Panels visualize the path of the copper through the machine.

Communication standard for the Industrial IoT

"OPC UA over TSN needs to be ready for 20 years of evolving performance requirements."

Initial testing has shown that OPC UA over TSN averages 18 times faster than existing industrial communication solutions, leading some in the industry to wonder whether such a dramatic leap is really necessary. To get to the bottom of this question, we spoke to one of the new technology's leading experts: Dietmar Bruckner.

Do you see a real need for a communication protocol with the performance of OPC UA over TSN?
Bruckner: It's true that we don't have applications today that require 18 times the performance of existing Industrial Ethernet protocols. Nevertheless, my answer to your question is a resounding yes.

OK, would you mind clarifying that for us?
Bruckner: You could probably get by for another two or three years just making incremental improvements to existing protocols. But that would be short sighted. With the success of OPC UA, industrial communication is currently experiencing the greatest upheaval since the advent of fieldbuses. If we look at the typical lifespans of fieldbus systems and Industrial Ethernet protocols, we can expect to be working with OPC UA over TSN for decades to come.

What are the implications of that in terms of performance?
Bruckner: To make it a future-proof investment that pays off long term, the protocol needs to be ready to meet 20 years of evolving performance requirements. Nobody wants to go to such lengths defining a new standard that will have to be fundamentally reworked only five years down the road. That's why it is so important that OPC UA over TSN is as powerful as possible right out of the gate.

When you talk about performance, what do you mean exactly?
Bruckner: It's a combination of things, but clearly one of the most important factors is the fastest cycle time that can be achieved. If your application has only a small number of network nodes, you can achieve very short cycle times even with a conventional 100-Mbit Industrial Ethernet protocol. At the rate things are currently progressing, however, we expect to see more and more plants and machinery with many hundreds or thousands of network nodes.

Why is that?
Bruckner: As they strive to respond to dynamic market demands, machine builders are making their machines more intelligent and more flexible. And to do that, they are using more sensors and actuators than ever. Many of these are directly integrated into the machine network as smart devices. Already, we've seen machines that synchronize more than 1,000 axes. That's precisely the type of situation where current technology starts to see cycle times go up over a millisecond. And there are plenty of processes where that is just too slow. That's why we need a powerful and high-performance machine network.

What role does bandwidth play?
Bruckner: For the user: an ever larger one. Machine vision, big data analytics, predictive maintenance – these new technologies generate enormous volumes of data that can quickly overwhelm today's 100-Mbit bus systems. And there's one other aspect that should not be underestimated: The more open the network, the more important it becomes to keep components in the field supplied with the latest security updates and operating system patches. You can only do that if you have the necessary bandwidth.

About the interviewee

Dietmar Bruckner has published nearly 100 scientific papers and holds several patents in the field of real-time industrial communication. He is an active member of various standardization committees and working groups – including the IEEE and the OPC Foundation. At automation specialist B&R, Bruckner is responsible for R&D in the area of real-time communication.

Photo: B&R

How does OPC UA over TSN handle this growing competition for bandwidth?
Bruckner: TSN has another advantage that comes into play here: it is independent of bandwidth. The user has access to the full bandwidth of the Ethernet hardware used, whether that's 1 Gbit/s, 2.5 Gbit/s, or eventually even more.

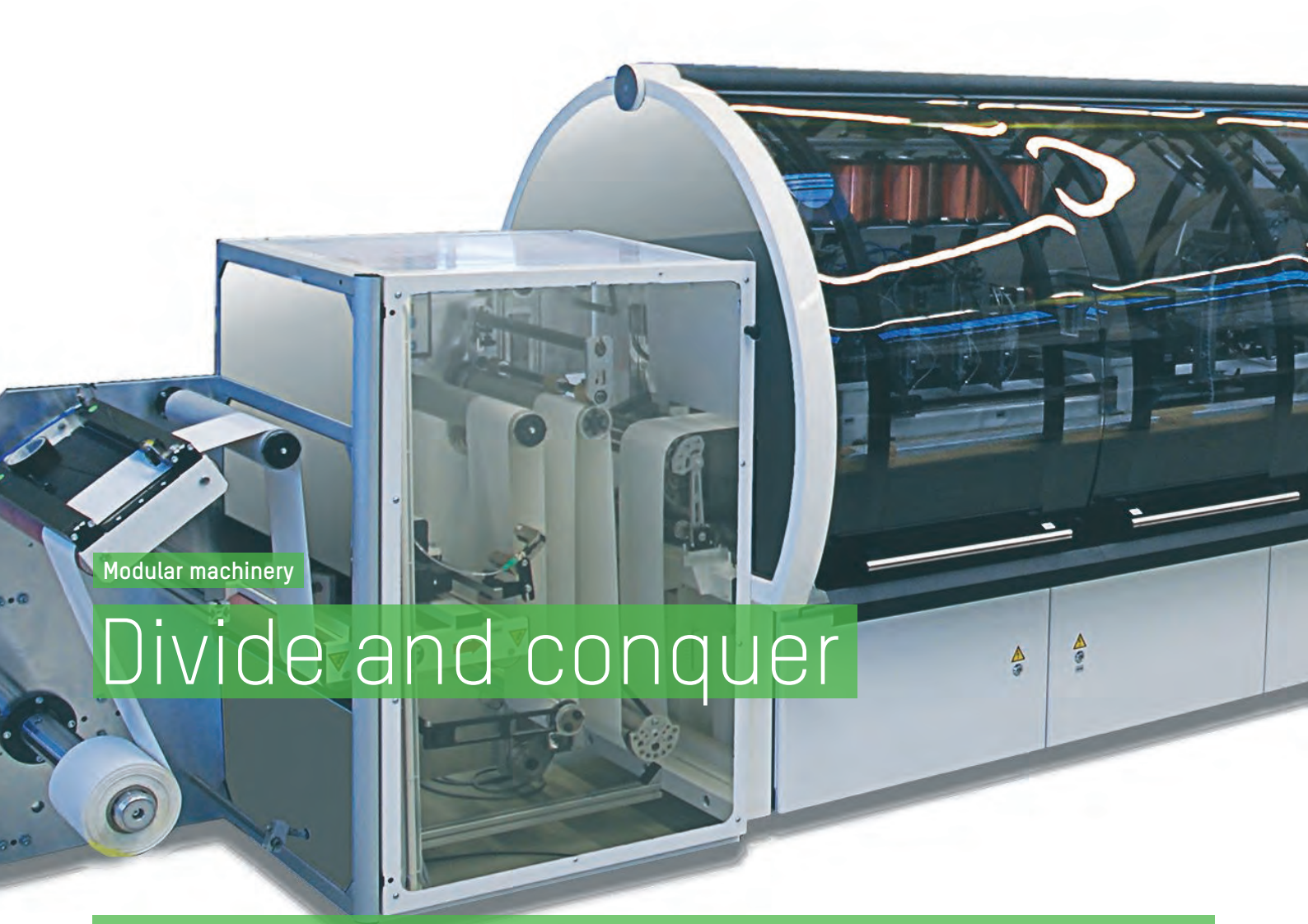
Wouldn't there be a way to do that using existing fieldbus systems?
Bruckner: No, because you can't simply compensate for their limitations by scaling them up to 1 or 10 Gbit/s. The rigid arbitration methods of a conventional bus system with a central master and fixed cycle distribution don't allow that. You have to remember: fieldbus technology dates back to the 1990s. When you plan and administer a TSN network, on the other hand, you're able to benefit from more modern IT infrastructure mechanisms. That's why OPC UA over TSN is even twice as fast as the fastest Gigabit fieldbus protocol.

One last question: Is OPC UA over TSN really ready for the big time? There are voices saying that standardization is still a long way off.
Bruckner: OPC UA over TSN is completely specified and ready for use. The IEEE completed work on 802.1AS-2020 in December of 2019. That was the last important piece of the puzzle for OPC UA over TSN. And the IEEE 802.1Qbv standard – the linchpin for all matters involving TSN performance – was adopted way back in 2016. In March of 2020, B&R became the first manufacturer to sell controllers fluent in OPC UA over TSN. ←

TSN and the role of the IEEE

The Institute of Electrical and Electronics Engineers (IEEE) is responsible for standardizing numerous global communication technologies, including Ethernet, WLAN and Bluetooth. IEEE standardization guarantees that any two devices will be able to communicate with each other, regardless of who manufactured them.

Time-sensitive networking (TSN) extends the Ethernet standard to include mechanisms for guaranteed real-time data transmission. The IEEE included the associated functions as sub-standards in the Ethernet standard IEEE 802.1. As a result, TSN devices from any manufacturer can communicate with each other in real time.



Modular machinery

Divide and conquer

Time-to-market can play a decisive role in the success or failure of a new product. The more flexible the production line, the faster it can adapt and begin turning out a new item. To get that flexibility, OEMs design manufacturing machinery to be highly modular. To see how that works in practice, one need look no further than Ruhlamat.

Ruhlamat builds highly flexible assembly lines for the RFID inlays used in credit cards and passports. Among them is the Wire Coil Embedding (WCE) machine series, which includes an array of machine modules that can be arranged to form a completely integrated inlay assembly line. "If you were to build a line like that as a monolith, it would be much more risky and time consuming. So what we were looking for in an automation system was a sustainable reduction in development and commissioning time," says the leader of Ruhlamat's software development team, Martina Oehring. Dedicated mechatronic units handle each of the key processes: from wire laying, component mounting and soldering to testing, punching and finishing.

Maximum modularity

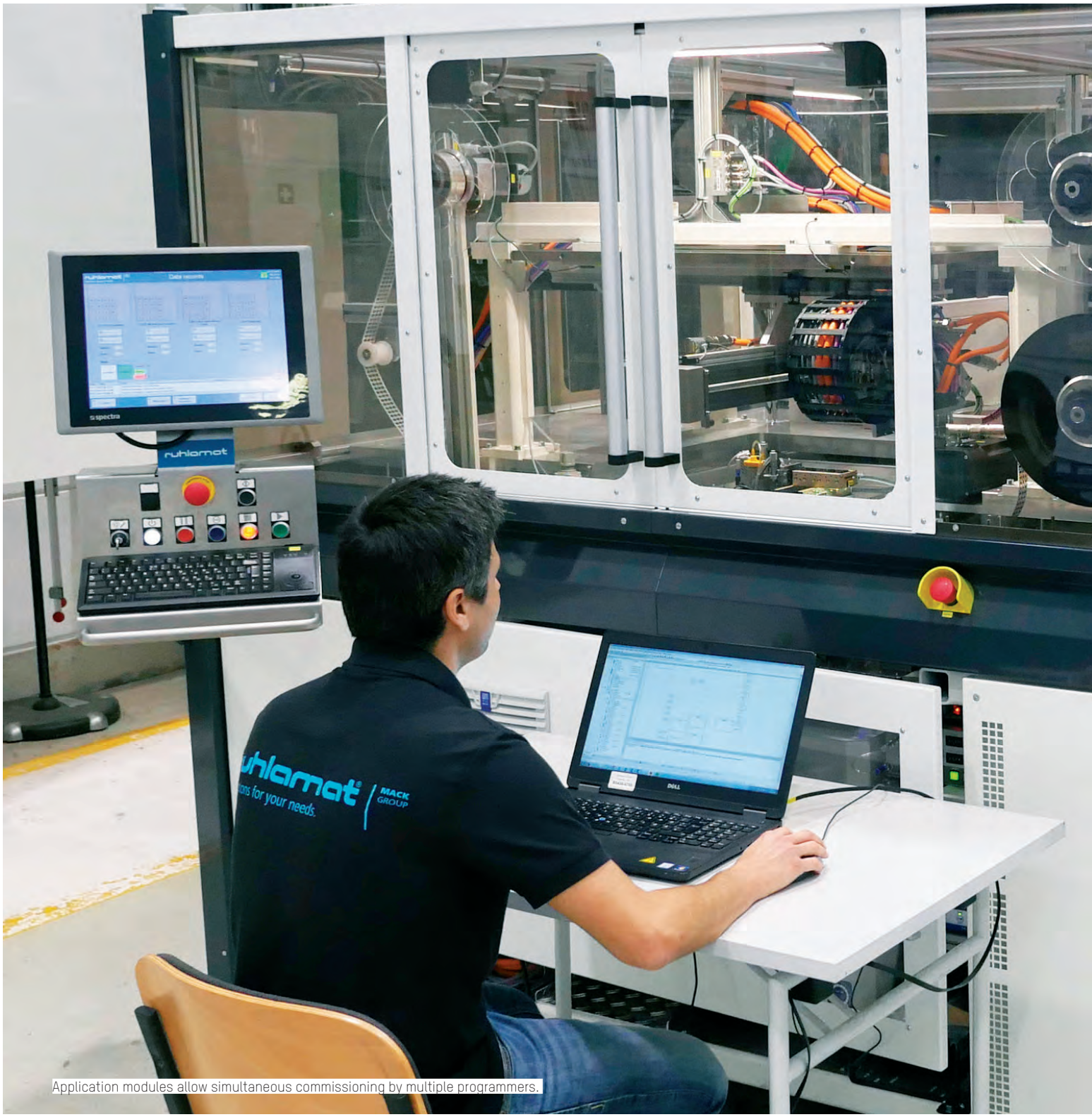
On top of the wide variety of line configurations, there were also demanding technical challenges. A prime example is the module that lays the wire that will serve as the antenna in the finished card. It uses ultrasonic technology to embed extremely thin wire in a substrate with a precision of 10 µm. "We have an inline optical quality inspection module that allows us to mark defective products," adds Oehring.

The WCE has twelve machine modules that can be arranged around the backbone to perform a variety of processes, from wire laying and optical inspection to winding, unwinding and transport.

"We designed the modules as integratable units, so that they can each be subject to their own product lifecycle," explains Oehring. "That way, we're able to freely configure each new variant of the machine using standardized machine modules." To do this, Oehring and her team used a function of B&R's Automation Studio programming tool, which makes it possible to encapsulate the software in application modules. "On the inside, all of our modules have the same structure," says Oehring. That includes data handling, operating modes, position calculation and alarm handling, whereby the actual technological functionality is mapped in a main step sequence. That allows the developers to save valuable time by using some modules unchanged in other machine series. "This was a strong argument in B&R's favor, because encapsulation was something we'd been wanting for a long time," says Oehring.

Martina Oehring
Team Leader - Software Development, Ruhlamat

"The fully encapsulated software enables concurrent engineering, which significantly shortens commissioning times while at the same time reducing the error rate."



Application modules allow simultaneous commissioning by multiple programmers.

All functions in a coordinated framework

An important component of the modular software project is the superordinate framework in which all the processes are coordinated. In addition to parameter structures and job management, this includes control of operating modes, safety and drive functions, the user interface and the interface to the individual application modules. "The configuration of the framework is an important part of the design phase. With B&R's expert support, we have developed a routine that allows us to achieve the shortest possible processing times," says Oehring.

The framework also includes designing the hardware structure, which is linked to the corresponding logic in Automation Studio via a configuration layer. This separation is essential, because it clearly isolates the hardware from the software. When an application module is added or removed, the two worlds can be linked or

Photo: Ruhlamat GmbH

separated via the configuration layer alone. "That also works during operation," adds B&R software engineer Tobias Baumgärtner, who has seen the advantages in numerous customer applications, where module replacement is part of a normal changeover process. "The operator only has to stop the machine and can then remove or replace entire modules, even if that changes the configuration of the safety technology," emphasizes Baumgärtner.

Multiple programmers working in parallel

Oehring is especially happy with the ability to have multiple developers working independently on the same system at the same time. "On one particular order, we had to develop numerous new options with a very tight deadline. At times, we had five programmers working simultaneously to develop and deploy their respective modules. Not only did we deliver ahead of schedule – we also significantly reduced the error rate," she reports, not without pride. ←

Three closing questions

for robotics specialist Sebastian Brandstetter

What do OEMs stand to gain from integrating robots into their machines?
I see three main advantages. First, robots make machines more flexible. Second, a robot can often be the simplest way to accomplish certain tasks. Third, robots can do work that would be too hazardous, strenuous or monotonous for human laborers.

Are there really still machines that rely on human workers?
The amount of automation in manufacturing has clearly grown dramatically over the past three decades. Yet, there are still plenty of machines where human workers are required for certain steps. A sheet metal bending machine is a good example: you still see workers inserting the sheets into the brake and turning them as needed until all the bends have been made. It's a very demanding job, and one that is increasingly hard to find qualified workers to perform. A robot, on the other hand, can not only insert the sheets but also serve as an additional motion control axis in the bending process. Not to mention the fact that a fully automated bending machine can run 24 hours a day.

Could you not build a machine like that with a conventional robotics solution?
It's not that simple. The movements of the bending machine and the movements of the robot are tightly intertwined. To get quality bending results, the axes need to be exchanging data constantly. The only real way to do that is to have the robotics application as an integral part of the machine – so you have only one controller and only one control application.

Machine-Centric Robotics – Robot and machine become one

B&R is the world's only single-source supplier for controls and robotics. Robots from its parent company ABB are fully integrated in the B&R automation system. Customers benefit from unprecedented precision in synchronization between robotics and machine control. They need only one controller and one engineering system for development, diagnostics and maintenance.

Photo: B&R

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