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The B&R Technology Magazine



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Dear Reader,

These days, it seems almost everyone has their "head in the cloud". With all the hype, you might be forgiven for thinking the cloud was a miraculous cure-all for every Industrial IoT related challenge.

As usual, though, the reality is a bit more complex. Simply shoveling data en masse into the cloud is wasteful from a cost perspective and in many cases infeasible from a bandwidth perspective. Add to that the security risks, and the question remains: How can industry make effective, sensible use of the cloud?

The silver lining in this case is what's known as edge computing, where data is collected, preprocessed, aggregated and evaluated decentrally on site. This can take place in conventional controllers or in powerful factory automation systems fully equipped for maximum cybersecurity – like our APROL.

Compression reduces continuous signals to 15% of their original data volume. Data aggregation extracts valuable information and passes it selectively to the cloud via secure communication channels like OPC UA and MQTT.

From this long-term storage it can be leveraged at any time using big data analytics tools. Locally, the analytics tool integrated in the edge controller enables convenient, in-depth analysis of raw data.

Among the many interesting topics in this issue of automotion, you'll learn how APROL can help manufacturers optimize their processes easily and securely with edge computing.

Happy reading!

Martin Reichinger
Business Manager – Process Automation

contents



→ cover story

04 A smart move toward mass customization
B&R's intelligent SuperTrak transport system is the reliable industrial solution for agile manufacturing.

28 "No more unplanned downtime"
B&R's Orange Box is a manufacturing intelligence solution for legacy equipment. Ralf Hagen (Nestlé Germany) and Thomas Rienesl (B&R) explain how brownfield plants can be transformed into smart factories.

→ interview

08 "SuperTrak delivers industrial-grade reliability for flexible manufacturing"
Versatile transport systems offer solutions for today's smaller batch sizes and frequent product changeover but have so far failed to gain market traction. B&R's Robert Kicking explains how SuperTrak is about to change that.

10 "We're right on track for continued growth"
Automation specialist B&R is being acquired by ABB. Asked about the implications of this development, Managing Director Hans Wimmer affirms that the company and its current workforce will continue to operate independently.

16 "One familiar interface for all software components"
With its mapp Technology, B&R radically simplified the development of machine software. Dr. Gernot Bachler and Christoph Trappl explain the advantages B&R customers can expect to gain from the latest additions.

22 "The market demands open standards and a uniform protocol landscape"
Dr. Richard Soley (IIC) and Sebastian Sachse (B&R) discuss the role of development testbeds and whether the IIC stands in competition with initiatives such as Industry 4.0.

36 "Connectivity is the lifeblood of advanced manufacturing"
Mathias Bihler (Bihler) and Markus Sandhöfner (B&R) explain how collaboration between OEMs and their automation suppliers can get machine tools up to speed for Industry 4.0.

54 "OPC UA unleashes a whole new dynamic"
EDM specialist exeron has developed a communication solution based on OPC UA. We sat down with software specialists Michael Lamparth and Paulus Kolb to find out more about this and future OPC UA projects.



32



50



40



58

→ report

- 12 **Taking sorting to a whole new level**
The **Swiss Post** has been perfecting its precise and productive logistics for 16 years. Together with B&R, they developed a new line that takes performance to an all-time high.
- 18 **State-of-the-art retrofit**
The CNC trimming machine at **Gut Metallumformung** had reached the end of its service life. To restore it to full operation, Gut turned to **BSR Automation** and B&R.
- 32 **IO-Link has it handled**
Together with **Sick** and B&R, **Starlinger** is using advanced technology to transform the block bottom sack. The benefits IO-Link brings to the solution will certainly carry weight with customers.
- 40 **Filling the need for simplicity**
The complexity of multi-vendor solutions can hinder performance and usability. **FG Industries** found the answer in an integrated solution from B&R.
- 43 **Making ends meet**
Pipe and fitting manufacturer **GF Piping Systems** wanted to boost quality by automating the pipe joining process. Featuring B&R products, **AVM Engineering** offered the perfect solution.

- 50 **Quantum leap for the Octopus**
Industrial bakeries keep their cakes from sticking using release agents from **Wito Dübör** – applied using B&R control technology.
- 58 **Single source, print to finish**
Shrinking batch sizes and rising energy prices mean printers have to be more flexible and efficient while also ensuring perfect quality. **Codimag** solves the challenge with future-proof technology from B&R.

→ technology

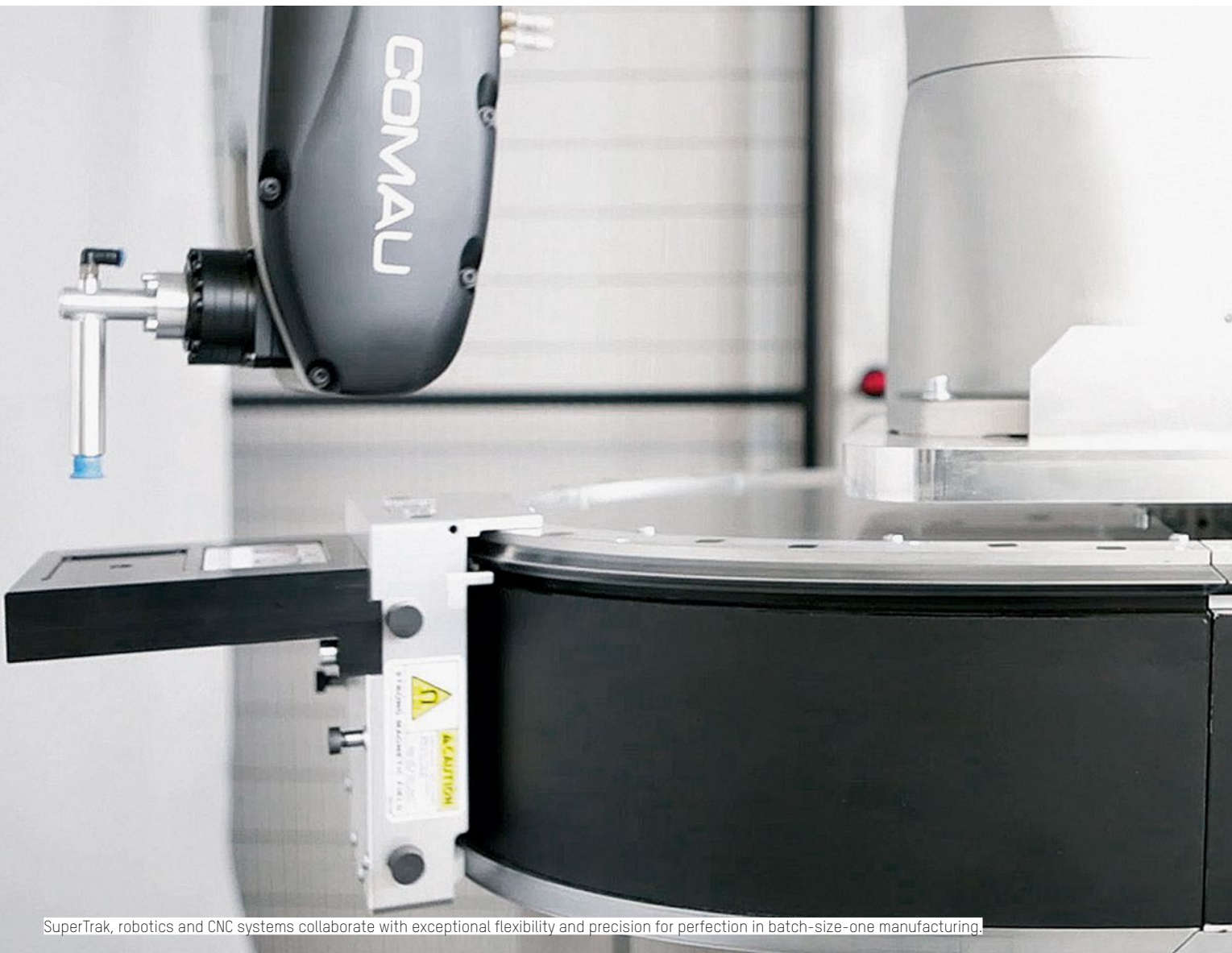
- 24 **Optimizing processes with the cloud**
Increasingly, big data analytics tools are being used to mine enormous volumes of production data. When these tools utilize cloud services, there are a number of important factors to consider.
- 46 **Consistently simple engineering**
Frequently, making a new product requires extensive reprogramming. With an open, object-oriented automation platform, plant operators are able to significantly reduce the time and cost involved in making the necessary changes.

→ news

- 21 **B&R makes investment push**
B&R is investing in R&D, infrastructure and workforce expansion.

Intelligent transport technology

A smart move toward mass customization



SuperTrak, robotics and CNC systems collaborate with exceptional flexibility and precision for perfection in batch-size-one manufacturing.

Consumers are willing to pay a premium for personalized products. At the same time, increasingly responsive production technology is making it possible to create them under mass production conditions without a corresponding increase in unit cost. For manufacturers, the resulting margin boost is an enticing prospect. B&R's intelligent SuperTrak system is the reliable, industrial-grade material transport solution for flexible production lines that enable mass customization.



"Customized products have added value for consumers," says Robert Kicking, mechatronic technologies manager at B&R, "so they're willing to pay more for them." That's what makes things like custom photo albums, which customers can create online and have delivered straight to their door, such an interesting business model. Rather than pay the lowest possible price for a traditional photo album with sleeves or adhesive pages, consumers prefer to pay several times more for a personalized item. For the manufacturer, however, these customized products must meet one condition: "They need to be suitable for highly automated mass production," notes Kicking, "or else the unit costs are too high to be profitable."

One in a million, not one of a million

The transition from simple reproduction to customer-specific production is already complete within the printing industry. The shift was facilitated in large part by the advent of industrial digital printing, which eliminated the pre-press stage and enabled the development of highly flexible post-press machinery.

Automated post-press equipment processes the variable output of a digital printing press and allows batch-size-one production of custom photo books with mass-production efficiency. But, if this works so well in the printing industry, what's taking it so long to catch on in other areas?

The crux of custom production

What many segments still lack is the necessary production machinery, though the race to achieve added value through product personalization is already well underway. The trend past decorative personalization toward products with custom geometric dimensions is sweeping across numerous industries – but at this point still involves manual intervention at numerous steps along the way.

The machine still has to be stopped to change over between product variants, eating up valuable production time and squandering the benefits of mass production. Window manufacturing is a perfect





On machines that produce windows in a variety of sizes, manual changeover eats up valuable production time. An intelligent transport system allows the changeover to be fully automated and controlled via software.



Consumers are willing to pay a premium for personalized products. This makes customization an interesting prospect for manufacturers – but only if it can be done with mass-production efficiency.



Robert Kickingger
Manager – Mechatronic Technologies, B&R

“SuperTrak from B&R delivers the reliable, industrial-grade motion control it takes to implement highly responsive production technology that enables mass customization.”

example of this. In addition to a range of standard sizes, today’s builders are also able to order windows with custom dimensions. “Production of the individual window components is efficiently automated,” notes Kickingger, “except that every changeover requires a worker to step in and adjust the size from, say, 130 to 140 centimeters.”

Toward mass customization

At least in terms of production machinery, there are still some obstacles to be cleared on the road to mass customization. “The only way to achieve mass-production levels of efficiency is with automated responsiveness,” explains Kickingger. Advances in technology now offer the means to do this.

- Modern IT systems make it possible for the customer to interact directly with the manufacturing process and trigger production simply by placing an order.
- Automated, software-controlled changeover processes provide the kind of responsiveness that makes production profitable even at batch size one.

“When you combine these two possibilities, you’re able to manufacture customized products under mass production conditions without a corresponding increase in unit cost,” says Kickingger. “What we’re looking at is a whole new generation of production technology.”

It all rides on product transport

Flexible batch-size-one manufacturing operations need machinery that can adapt automatically without operator intervention. The frame of a 140-centimeter window is larger than that of a 130-centimeter window, and the machine must be able to account for this size difference. An intelligent transport system is an ideal way to implement a motion control solution with this level of responsiveness. Unlike conventional belts with rigid timing, an intelligent transport system moves and positions each product individually – with variable target positions, speeds and clearances.

The devil’s in the details

“Such transport systems are surprisingly scarce in modern plants considering the actual level of demand there is for them,” says Kickingger. The technological maturity of what is currently available on the market may have a lot to do with this. “The existing technology has severe shortcomings when faced with industrial conditions.” The task of adjusting the guide rollers, for example, can often be extremely time consuming. Some systems have insufficient load capacity; others lack the necessary safety functions.

“Although what they need is true integration, many manufacturers struggle with complex system architectures that require gateway modules,” reports Kickingger. The guideway and other components are prone to wear, resulting in frequent service downtime. These flawed implementations have stunted the growth of what is an otherwise a vital technology.



It is the only intelligent transport system on the market with an uncompromisingly rugged design for industrial use. Built to last and easy to maintain, it delivers the high availability needed for efficient mass production.

Industrial transport technology

ATS SuperTrak from B&R has been specially developed for 24/7 operation in harsh industrial environments. The system is reliable, safe and remarkably service-friendly. "The fact that shuttles can easily be replaced without having to disassemble the track is a huge advantage of the B&R system," explains Kicking. This results in a very low mean repair time and increases the productivity of the entire line.

Seamless integration of CNC and robotics

Hard real-time synchronization between shuttles and all types of servo axes, CNC and robotics systems guarantees high quality

production output. SuperTrak dovetails perfectly with robotics and other CNC-controlled components to form an automated production unit.

Rapid changeover

SuperTrak optimizes the changeover times for different products manufactured on the same line. As soon as a new option is selected on the operator panel or via a production planning system, the transport system automatically switches over to the new product. Extended downtime for mechanical changeover between products is either reduced substantially or eliminated entirely. With its high load capacity, SuperTrak can handle heavier products as well.

Programmed in Automation Studio

Like all B&R solutions, SuperTrak is programmed in the Automation Studio software development environment. Software developers can take advantage of ready-to-use libraries and function blocks to configure shuttle movements.

On the demand side, the product personalization trend is driven by consumer expectations – particularly among a generation of digital natives. On the supply side, the continuing evolution of mechatronics is giving rise to a new generation of production technology for mass customization. "SuperTrak delivers the reliable, industrial-grade motion control that will advance this highly responsive production technology to its rightful place in the smart factory landscape," concludes Kicking. ←

Automation Studio – the SuperTrak programming tool
Like all B&R solutions, SuperTrak is programmed in the Automation Studio software development environment. Software developers can take advantage of ready-to-use libraries and function blocks to configure shuttle movements.

Interview

"SuperTrak delivers industrial-grade reliability for flexible manufacturing"

Smaller batch sizes and more frequent changeovers have manufacturers and their OEM suppliers on the search for more agile, responsive manufacturing solutions. Versatile transport systems could potentially play an integral role in these solutions, but have yet to break through to widespread implementation. B&R's mechatronic technologies manager Robert Kicking explains how SuperTrak is about to change that.



With a number of linear-motor-driven transport systems on the market, why do we still see so few of them in the field?

Robert Kicking: The systems available so far have a variety of shortcomings that make them unsuitable for industrial usage. They are prone to wear and their maintenance requires extended downtime. A lot of times you have to disassemble the entire track just to replace a component or add a workpiece carrier.

How is it that SuperTrak doesn't suffer these same problems?

Kicking: With manufacturing solutions specialist ATS on board, we have a very strong partner with many years of field experience. SuperTrak has seen action in many applications across a variety of industries since 2002. The system is already in its third generation, so the technology is fully mature.

What does that mean, exactly?

Kicking: SuperTrak is exceptionally reliable, service friendly and readily adaptable. The secondary motor components, called shuttles, can be added or replaced in seconds. Even the electrical components are modular and can be replaced without having to disassemble the track. The low mean time to recovery (MTTR) meets the tough requirements of 24/7 operation. We've made SuperTrak an integral component of our automation system, so our customers



gain important benefits from the way it synergizes with the rest of our portfolio.

What kinds of benefits?

Kickinger: With development, simulation, diagnostics and maintenance all handled in Automation Studio, they have a single software tool that covers their entire automation solution. They also only need a single controller. The Automation PC 910 that controls the SuperTrak can also handle the rest of the control tasks for the machine or system. They can even integrate robots without having to add a dedicated controller.

How does that work?

Kickinger: We've worked together closely with robotics manufacturer COMAU to develop a solution called openROBOTICS. Equipped with B&R automation components, the robot mechanics become an integral component of the machine. There's no need for a dedicated robotics controller because the Automation PC handles everything.

How does that help the machine operator?

Kickinger: With no external robotics controller – and thanks to the high power density of B&R's servo drives – the machine footprint

shrinks considerably. The solution also allows very tight synchronization between robots and workpiece carriers. The robots can process workpieces while the shuttles are in motion. SuperTrak's extreme precision even makes it possible to eliminate additional processing axes in the direction of the track, since these tasks can be handled by the movement of the shuttles.

How does SuperTrak work?

Kickinger: SuperTrak is a flexible transport system based on long stator linear motor technology. The system comprises a motor stator in the form of an oval track and any number of shuttles. The shuttles are held in place on the track by magnetic force alone and are propelled electromagnetically, so there's no need to transfer drive torque to the guide rails via the shuttle wheels. This minimizes frictional wear. The wheels and guide rails themselves are constructed from materials selected to guarantee rugged reliability in industrial applications. ←



Robert Kickinger
Mechatronic Technologies Manager, B&R

Interview

“We’re right on track for continued growth”

Automation specialist B&R is being acquired by ABB. Asked about the implications of this development, Managing Director Hans Wimmer affirms that the company and its current workforce will continue to operate independently.



What changes can B&R customers expect following the ABB acquisition?

Hans Wimmer: For our customers, there will be no changes. B&R will remain an autonomous company that makes its own decisions. Our customers will continue to deal with the same contacts. In the medium and long term, they will benefit from an even broader product portfolio with ABB at our side. ABB’s robotics offering and their ABB Ability digitalization platform, for instance, perfectly complement our own products.

How does the corporate culture of a mid-sized company like B&R match up with that of a giant like ABB?

Wimmer: Culturally, our two companies are a perfect match – that was clear from the

very beginning. B&R will continue to conduct its daily business with the agility, responsiveness and customer focus our partners have come to expect. We will still be providing them with the most innovative solutions on the market. In the background, we will have the support of ABB – including a readiness for substantial investment and increased access to global markets.

B&R has always emphasized proximity to its customers. Will the global sales and support network remain intact?

Wimmer: Absolutely. Our success has been built on two pillars: technical innovation and close, personal relationships with our customers. We’ll be keeping our locations around the world and continuing to reach

into new areas. B&R’s local presence is a vital part of our company.

How about B&R’s headquarters in Eggelsberg – any changes there?

Wimmer: We’ll continue to step up production capacity and add office space to keep pace with our accelerated growth. Other than that, there won’t be any significant changes. I will continue to lead B&R, supported by the same management teams and same workforce. After all, it’s our employees who made our success story possible in the first place.

What effect will overlap between the ABB and B&R portfolios have on B&R?

Wimmer: Our combined portfolios represent



an enormous added value for our customers, who are increasingly looking for integrated, single-source solutions. Once the acquisition closes, we will work closely with our existing customers to develop and implement a strategy to handle the few cases where there is overlap. Our primary focus will be on maintaining ongoing relationships and ensuring uninterrupted supply for all of our customers. It has already been determined that ABB teams in the areas of PLC and servo drive technology will be integrated into the B&R organization.

How about process automation? Doesn't B&R's APROL compete with ABB's process control?

Wimmer: APROL has enjoyed many years of


success in the area of factory automation, and that will not be changing. ABB's products, on the other hand, are used in large-scale process automation applications. It remains to be seen how the two solutions may tie in together. With both companies' products already performing successfully in their respective market segments, however, this is not a top priority.

What are the next steps for B&R going forward?

Wimmer: We're currently expanding mechatronic production in Gilgenberg, just a few kilometers from our headquarters in Eggelsberg. Here at our main plant, we're in the process of boosting circuit board production capacity by nearly 20% with a new SMT

line. Beyond that, we will continue dedicating our full attention to the needs of our customers and working to add exciting new innovations to our portfolio. ←





High-precision, high-performance logistics

Taking sorting to a whole new level

Package distribution center in Frauenfeld: 2,100 meters of conveyor were installed for the infeed and outfeed of the new six-meter high cross-sorter. The center was fully operational the whole time.



The three distribution centers operated by the Swiss Post have been delivering exceptional precision and productivity for 16 years. Doing so requires continual measures to keep the technology at the state of the art. A new line recently developed with B&R has taken performance to an all-time high.



"It almost looks like an oversized model railroad," says Support Automation Manager Andreas Hädinger, standing in the control room overlooking the labyrinth of chutes and conveyors. Below him, packages of all sizes race past at 2.5 meters per second on the tray sorter. From there they are brought to a tilt tray, and a chute guides them to their destination: the loading container for their postal code.

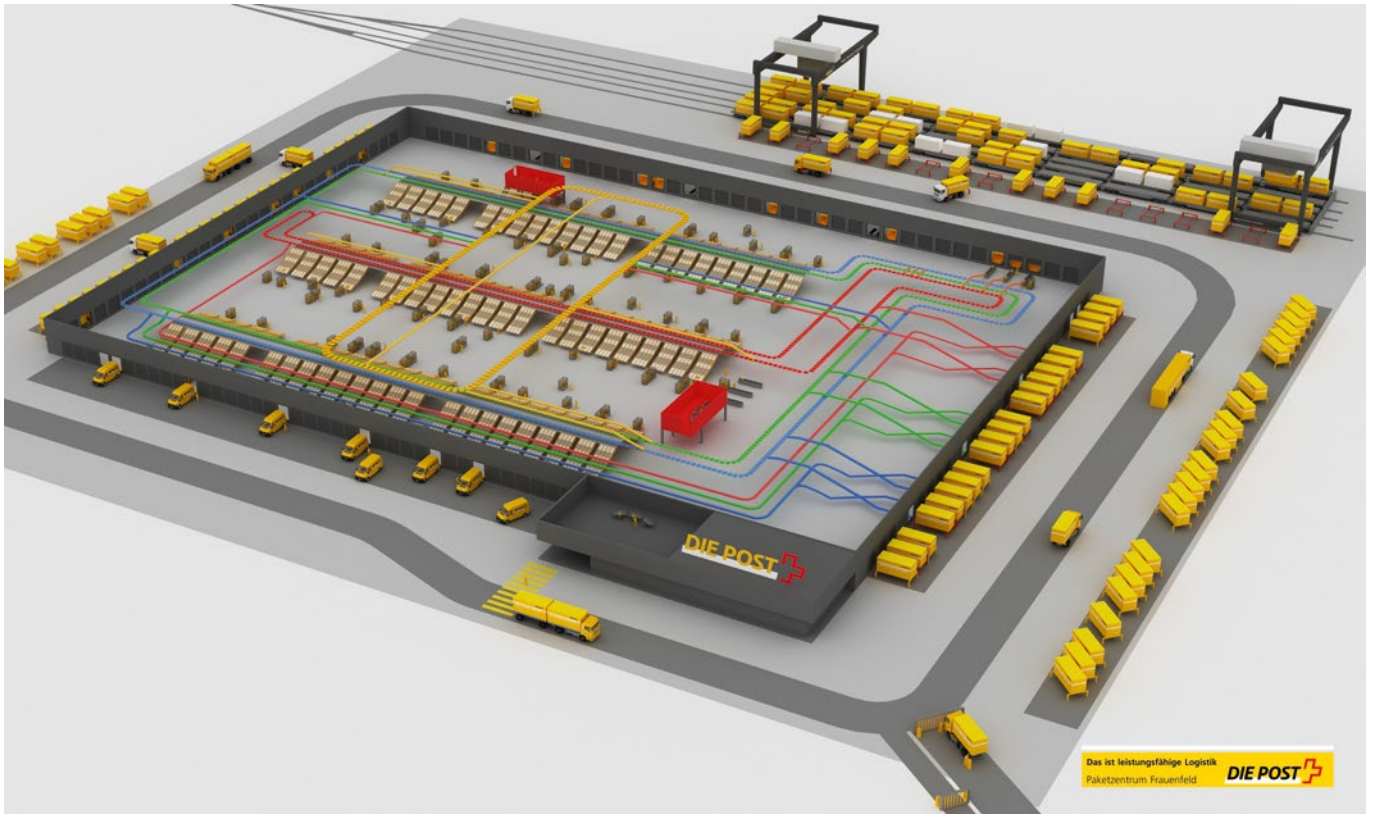
Important step: Switching to POWERLINK

To say the distribution center is larger than a model railroad is quite an understatement. In the 21,000-square-meter facilities, 450 workers operate 123 docking stations, 26 automated address readers, 272 chutes, 4 tracks and 2 portal cranes with a capacity of up to 16 tons – sorting around 26,000 packages per hour and more than 500,000 on a busy day. The Swiss Post operates two other nearly identical distribution centers in Härkingen and Dailens. To achieve such an impressive sorting performance, they must be kept up to date with state-of-the-art technology. A significant upgrade came in 2012 with the implementation of new controllers and the switch to POWERLINK. "The X20 controllers from B&R give us a substantial boost in processing performance, and switching to POWERLINK made us considerably faster," says Hädinger.

800 new drives installed

The performance enhancements didn't end there, however. On the heels of the switch to POWERLINK began the planning phase of another expansion that would once again rely on components from B&R. To improve sorting efficiency, the plans called for a new line that would divert incorrectly sorted packages to an additional loop, from which they could then be resorted. This expansion pushed the hourly throughput from 20,000 to 25,000 packages.

This substantial increase in efficiency was achieved without any structural changes to the hall, despite the installation of 670 new conveyor belts covering an additional 2,100 meters. A cross-sorter



The expansion (yellow) was built above the existing system. It required 800 new drives. X20 controllers with nearly 90 drives each provide response times of 2.5 milliseconds. That means there are as many as 16 levels before the last drive.

was also added to join the new and existing systems. 800 new drives were installed to handle the infeed and outfeed lines of the cross-sorter, which was erected on a 370-ton iron structure 6 meters above the hall floor.

Pushing the limits

Achieving this level of precision logistics had the developers pushing the limits of what is possible. Recalling the early stages of the project – when the architecture was being developed for the cross-sorter and the additional 800 drives – Hädinger explains: “We wanted to use the X20 controller to run 90 drives with response times of 2.5 milliseconds. That means there are 16 levels between the first and last drive. That was an unbelievable challenge.”

B&R finds optimal solutions

“Customer requirements can be staggering at times,” says Daniel Christen, who is responsible for application development, training and support at B&R, “but those are the challenges that are the most rewarding once you arrive at the optimal solution.” In this case it was not only the requirements for the drives, but the safety technology as well, that put B&R to the test.

There were two particularly tough nuts to crack: “We wanted controllers with two safety modules each, which wasn’t yet common at the time. That was because we wanted to process as many as 170 modules and each safety controller is limited to 100. We therefore had to split the program and have two safety controllers in the master.”

The right mix of virtual and hardware-based safety

The other challenge was making the architecture work with the safety circuits of the existing hardware, whereas the new SafeLOGIC safety controllers from B&R offer an extensive range of functionality: safe I/O, motion control, line integration, machine options and integrated diagnostics. The safety application is programmed in B&R’s Automation Studio development environment.

“Traditional hardwired safety technology responds to safety events by abruptly shutting down the machine – often making work more

ETHERNET **POWERLINK**

100% system availability with POWERLINK
 POWERLINK has made the Swiss Post’s cross-sorter not only faster, but absolutely stable. System availability can now be ensured 100%.



Applications with Safelogic are scalable and can be configured flexibly to accommodate additional safe I/O modules without any reprogramming.



View of the control cabinet with B&R controllers and safety modules.



123 docking stations, 26 automated address readers, 272 chutes, 4 tracks and 2 portal cranes with a capacity of up to 16 tons sort up to 26,000 packages per hour – at times up to 500,000 per day.



Daniel Christen
Development, Training and Support, B&R

“Traditional hardwired safety technology responds to safety events by abruptly shutting down the machine – often making work more difficult for service personnel. B&R safety technology, on the other hand, allows production to continue at a safely reduced speed even when a safety door is open or an operator reaches into a protected area. In most cases, a full production stop can be avoided.”

difficult for service personnel. B&R safety technology, on the other hand, allows production to continue at a safely reduced speed even when a safety door is open or an operator reaches into a protected area. In most cases it is possible to avoid stopping the machine,” says Christen, pointing out the advantages of the new safety solution.

Safety circuits simplified

Hädinger now has some tips for anyone planning the safety technology for a large facility: “It’s easiest if you first clarify exactly where systems interact. When you have conveyor belts spanning multiple levels, you have to carefully consider what’s going to happen at the top when someone at the bottom hits the stop button,” he says. “Our adaptations to the hardware architecture helped simplify the safety circuits and minimized the number of belts affected when we have a stoppage.”

High system availability

With the scale of the project and the challenging nature of the requirements, B&R knew they would need to have engineers on site at the distribution center in Frauenfeld to provide assistance through critical phases. This was something that Hädinger greatly appreciated, particularly one instance when B&R support technicians even traveled from Austria to Switzerland over the weekend. “By Monday morning, everything was up and running smoothly.”

System availability is 100% ensured. “The system has been unbelievably stable since switching to POWERLINK – virtually the only time we have a problem is when there is a package jam,” reports Hädinger, standing in the window of the control room surveying the hall below, where a steady stream of packages flows to and from the cross-sorter. “Using openSAFETY over POWERLINK has also saved us several kilometers of cable,” says Christen. ←



Andreas Hädinger
Support Automation Manager, Swiss Post

“The X20 controllers from B&R give us a substantial boost in processing performance. Switching to POWERLINK not only made us much faster, it also enables us to ensure 100% system availability.”

Interview

"One familiar interface for all software components"



Would you like to start by explaining how mapp Technology works?

Christoph Trappl: The mapp Technology software framework comprises modular blocks that handle basic machine functions. Rather than write lines and lines of code to create a user management system, alarm system or even motion control function, developers simply configure a ready-made component with just a few clicks. Benchmark testing has shown that the development process is completed three times faster. This frees up develop-

ers to focus their energy on implementing and optimizing the machine's core value-adding processes.

Are you saying that mapp is a collection of software libraries?

Trappl: It's much more than that. mapp components are fully networked and exchange data automatically. To name just one example: The audit trail component and the user management component talk to each other. With no additional programming, they remember who changed what and when.



Christoph Trappl
Manager – International Applications, B&R



Dr. Gernot Bachler
Business Manager – Automation Software, B&R



Two years ago, B&R radically simplified the development of machine software with the introduction of mapp Technology. Encouraged by the overwhelmingly positive market response, B&R continues to expand the portfolio of its revolutionary software framework. We asked Dr. Gernot Bachler and Christoph Trappl to explain how ready-made, thoroughly tested software modules are able to replace the repetitive, low-level programming otherwise required for generic machine functionality. We also wanted to know what specific benefits machinery and equipment builders can expect from the new mapp components.

And now you're adding more of these mapp components?

Gernot Bachler: That's right, we're massively expanding the component portfolio. More important than the sheer number of them, however, is the fact that all of the software technologies we offer – whether for alarm handling, axis control or complex hydraulic controls – will now be accessible through the same familiar interface.

What is being done to keep everything organized?

Bachler: We've harmonized the version and release data for all B&R software, making it easier for machinery and equipment builders to plan when specific functions will be available. Users no longer need to be concerned with dependencies between software versions.

Are you saying that mapp will soon be replacing Automation Studio as the B&R software development tool?

Bachler: Not at all. Automation Studio will remain the universal environment for engineering, commissioning and diagnostics.

Our customers can code their machine software using any IEC 61131 programming language, C and C++. How much B&R know-how a customer wishes to leverage in the form of mapp components is entirely up to them. Judging by the enthusiastic feedback, however, I'm confident our customers will be looking to use mapp anywhere they can.

So far, mapp components have been primarily dedicated to basic machine functionality, like the alarm system. What new areas are now being covered?

Bachler: In addition to the basic functions – which are now called mapp Service – we are introducing mapp Motion, mapp Control and mapp View.

Can you tell us a bit more about what functions are provided in each area?

Bachler: If I start listing each individual function and component we'll be here all day, but I'd be happy to give you an overview. mapp Motion spans everything from control of individual axes to CNC applications and even highly complex robotics

solutions. mapp Control includes advanced closed-loop algorithms for things like temperature, hydraulics and crane control. mapp View is our web-based HMI solution. In typical mapp style, mapp View obtains the data it needs from other mapp components automatically and displays it in a clearly organized user interface.

Are there any more plans for future additions?

Trappl: mapp is growing all the time. We update and expand the mapp portfolio four times a year. One of the most recent additions is a component that enables large cranes to transport loads quickly without twisting or swinging out of control. What used to require elaborate calculations, mapp Crane lets you do with just a few clicks of the mouse.

Bachler: mapp is also expanding into entire new domains. One of these currently in the works is mapp Safety, which will allow machine builders to benefit from the many advantages of mapp Technology in their safety technology as well. ←

mapp Technology

State-of-the-art retrofit

After twenty years of operation, the CNC trimming machine at Gut Metallumformung had reached the end of its service life. The control components in particular were suffering more and more frequent breakdowns, yet otherwise the versatile machine was still a perfect match for company's needs. To restore it to full operation, Gut turned to BSR Automation. With solutions from B&R, they were able to get the CNC trimmer up to speed with the latest technology.



In Gut's production hall in Hombrechtikon on Switzerland's Lake Zurich, the trimmer is used in the production of scale trays. Deep-drawn workpieces are clamped in the center and rotated while the machine trims and beads the edges. The whole process runs automatically according to programs stored on the CNC controller – until the machine suddenly shudders to a halt. A worker, well familiar with the machine's idiosyncrasies by now, fixes an error in the controller. He finds himself relying on his screwdriver and soldering iron more and more often these days to keep production up and running.

Gut built the machine twenty years ago and has been expanding, adapting and fine-tuning it ever since. It has been versatile, robust, compact and perfectly tailored to Gut's needs. Nevertheless, with outdated software and ever shorter intervals between controller failures, it was only a matter of time until a total breakdown. The solution: a comprehensive retrofit to get the machine back up to speed with state-of-the-art control technology.

**Solid partners for successful retrofit:
BSR, Gut and B&R**

To implement the retrofit, Gut turned to BSR Automation in Kriens, Switzerland. The 25-employee company offers a range of industrial automation solutions for food and beverage producers, airport operators



BSR's Automation Panels can be equipped with a PC unit to create a Panel PC. This modular platform strategy results in a product portfolio with extraordinary flexibility.

and machine builders. BSR selected B&R to retrofit the CNC trimmer. "As an independent service provider, we're free to select which manufacturer to work with. BSR's products enabled us to implement the best solution," says Jakob Brun, who was responsible for the project at BSR.

Following the retrofit, the modular trimmer cuts, forms, beads crimps and stamps metal into virtually any shape. "For our customers, the quality of the final product is the top priority. The trimmer needs to follow its defined curves with absolute precision," Brun explains. "At the same time, though, we also wanted to improve the machine."



The Panel PC 2100 offers a powerful, full-featured PC system in an ultra-compact housing.



The compact B&R components fit nicely into the control cabinet of the trimmer.



Since the retrofit, the trimmer is easy and intuitive to operate via the new touchscreen.

The goal was to make the machine more intuitive to operate and increase the range of functions it offered. The safety technology would also need to be brought up to the latest standards.

“The project was certainly a challenge. Particularly when it came to integrating the third-party motor and adapting to today’s safety standards, we relied heavily on B&R’s expertise and in-depth support,” recalls Brun. “The result is a testament to the mutual trust we have built up over years of successful collaboration. There’s no substitute for having a quick, direct connection to your supplier, especially when starting a new project.

The induction motor challenge

Following the retrofit, the trimmer’s controller and drive technology is once again state-of-the-art. “Reliable and cost-effective operation make B&R’s X20 control system the optimal solution,” says Brun. On the machine’s HMI, comprising a Panel PC 2100 and an Automation Panel 923, Gut is able to create, edit and save processing sequences for trimming different workpieces. “They used to have to call in a specialist to do that,” says Brun.

For B&R, the biggest challenge was driving the existing induction motor that was to remain in place. “Together with B&R’s specialists, we elected to use an ACOPSMulti inverter with a dual-encoder module,” says

Brun. The ACOPSMulti delivers the performance they needed in a compact housing. According to Brun, integration was made more difficult by the fact that some of the old motor’s parameters were no longer known, so he and his team relied on B&R’s drive technology experience. “Together we were able to deduce the parameters that gave us the optimal torque. B&R’s support was exceptional,” says Brun.

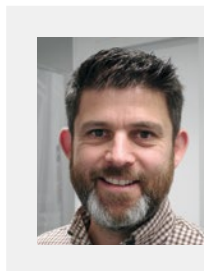
Safe operation of the new drive is ensured by SafeMOTION functions such as Safely Limited Speed (SLS) and Safe Torque Off (STO). The architecture of the safety application integrates these functions and distributes the software to connected hardware components. This saved additional space. For safety communication, B&R relies on the openSAFETY protocol.

BSR relies on B&R mapp Technology

This was the first project where Brun and his team used mapp Technology – B&R’s software framework that encapsulates ex-

tensive functionality into ready-to-use software blocks that cut an average of two-thirds off of development time for new equipment. “With mapp, we didn’t have to do any programming ourselves, and instead could integrate preconfigured blocks for everything from CNC control to alarms and file handling,” says Brun. B&R’s hardware products dovetail perfectly with one another. Paired with its modular software, the resulting solutions can be scaled effortlessly at any time.

Brun has been observing the trend toward integration of automation components for quite some time. “Packages that combine HMI, PLC and safety technology have been around for a number of years,” he says. What’s new are the ready-to-use software modules that customers can simply integrate into their own applications – like B&R’s mapp Technology. “We’ve been very happy with mapp Technology,” says Brun. “It saved us a lot of time, while also offering us a full range of functionality.” ←



Daniel Hirschi
Managing Director, BSR Automation

“B&R’s products meet the functional requirements in a way that lives up to our high technological standards. Our know-how paired with B&R’s excellent support make for highly effective solutions.”

B&R makes investment push



Expanded production capacity and R&D infrastructure

B&R is investing in R&D, infrastructure and workforce expansion. At the Hannover Messe trade fair, Managing Director Hans Wimmer and General Manager Peter Gucher announced B&R's plans to up production capacity. The company will also be expanding its R&D offices in Salzburg. "These measures will bring our sales a big step closer to the billion mark," anticipates Wimmer.

Wimmer paints the acquisition of B&R by ABB as a unique opportunity for the company's employees and customers as well as its headquarters in Eggelsberg. The transaction is expected to be finalized early this summer. "ABB is a fantastic platform for the next chapter in our long history of growth," says Wimmer. "Together we'll be able to provide our customers with the full spectrum of solutions they need for the Industrial IoT." B&R will form its own business unit within the ABB Group and will continue to operate on the market as a legally independent entity. "That means our management structures and points of contact with our customers will remain unchanged," emphasizes Wimmer.

Expansion in three locations

To handle the steadily increasing demand for B&R products, the company is currently boosting circuit board production capacity at its headquarters in Eggelsberg by 20%. A few kilometers away, the company's Gilgenberg site will be expanded to accommodate production lines for its mechatronic solutions. Further expansion and modernization is planned for B&R's R&D offices in Salzburg, making room for 50 new highly skilled positions in the development of industrial communication, robotics and control technology.

"B&R's impressive track record of growth has been fueled by our innovative products," says Gucher. One such innovation presented at this year's Hannover Messe was the Orange Box, which makes it easy for plant operators to retrofit brownfield equipment with smart manufacturing connectivity to collect data from existing machines and lines and pass it on to higher-level systems or the



At the Hannover Messe trade fair, Managing Director Hans Wimmer announced B&R's plans to expand production capacity and R&D infrastructure.

cloud. "The Orange Box is extremely easy to install," says Gucher, "and software updates are as straightforward as with a smartphone. With the Orange Box, we can quickly get existing equipment up to speed for the Industrial Internet of Things." ←

The market demands open standards and a uniform protocol landscape



Dr. Soley, the IIC is getting more and more attention around the globe. Can you start with a quick introduction to what your organization does?

Dr. Richard Soley: The IIC is a global, member-supported organization where companies are joining forces to solve the challenges presented by the Internet of Things. In working groups, the members define how to develop and promote the technologies that will be needed to for IIoT implementation. Although we are not a standards organization ourselves, we work with dozens of them worldwide. Our membership is approaching 300 companies – among them IT companies, manufacturers, research institutions, universities, microprocessor makers and automation companies like B&R – a very heterogeneous mix.

Sebastian Sachse: That diversity is a great illustration of what Industrial IoT is all about: the interplay between automation – or operational technology as it's often known in this context – and information technology.

The IIC has to contend with other initiatives, such as the Industry 4.0 movement that dominates German-speaking Europe. What sets you apart?

Soley: I don't see the situation as one of rivalry. Quite the opposite in fact – we've

been working more and more closely with other initiatives, including not only Industry 4.0 but also initiatives in China, Japan, Russia and India. And the number of signed relationships is growing all the time.

Sachse: From our perspective, what the IIC is doing dovetails nicely with Industry 4.0, because the two are working on different levels. Industry 4.0 operates at a very abstract level and is centered around industrial manufacturing. The IIC, on the other hand, is concerned with the nuts and bolts of reference architectures and testbeds. These are two critical – and complementary – aspects, which is why B&R is actively involved in both organizations.

What is being done in these testbeds?

Soley: Let's take a step back: before we initiate a testbed, we first lay out a reference architecture. This architecture dictates general things like how to get data from the plant to the cloud. Then our members implement that in a testbed, where components from different manufacturers – typically prototypes – are brought together to create a concrete solution that mirrors the reference structure. Based on this concept, the IIC by now has a broad variety of frameworks that help to solve the challenges of IIoT and give different viewpoints on the topic. Whereas the security and con-

nectivity framework are still quite technical topics, the business strategy and innovation framework take a different viewpoint. The testbeds help to collect requirements for new standards, as well as best practices for integrating IoT into many industrial settings – including healthcare, finance, energy, mining, manufacturing & production, and more.

Sachse: These testbeds are incredibly valuable to us. Before we're even done developing a new product, we're able to see whether it's going to work as planned in its future environment. And the testbeds come very close to the real-world applications we find on site at our customers. Especially with regard to IIoT applications, these collaborations yield powerful insights that translate into added value for our customers. They bring IIoT out of the realm of abstract theory and turn it into hands-on applications.

Doesn't that mean that you're revealing know-how to the competition?

Soley: Of course it does. And, until a few years ago, that would have been simply unthinkable. But the IoT is shaking things up to a point that many companies are reevaluating that mindset. One thing is clear: the market demands open standards and a uniform protocol landscape. That's

The gathering winds of connectivity and digitization are making big waves in industrial manufacturing. Numerous associations and organizations are working to navigate these changes and harness their transformative potential. Dr. Richard Soley, executive director of the Industrial Internet Consortium (IIC), and Sebastian Sachse, open automation technology manager at B&R, discuss the role of development testbeds and whether the IIC stands in competition with initiatives such as Industry 4.0.



the only way you can set up and manage these increasingly large networks efficiently.

Sachse: Whether you call it Industry 4.0, IIoT or Smart Factory – the advanced manufacturing systems we envision for the future will only be possible if all the components in a production line are able to communicate over a uniform network. It's this realization that now has competitors sitting at the same table, specifying the necessary technical framework. Of course, these manufacturers will continue to have their differences – but they will be speaking the same language. OPC UA TSN has established itself as the uniform market standard. In the future, customer benefit will be measured

in terms of knowledge distilled from data, so that's where more and more of the innovations in automation technology will be coming from.

Can you describe how a testbed works in more detail?

Soley: At the moment we've got 26 testbeds working on things from medical technology to transportation and logistics. For industrial manufacturing, though, it's probably the TSN testbed that is the most interesting. TSN – which stands for time-sensitive networking – is an extension of the IEEE 802.1 Ethernet standard to include various real-time functions. The standard is nearing the end of the specification phase, but throughout the process, member companies

have already been testing the compatibility of pilot implementations on a shared experimental setup. Since OPC UA has established itself as one of the market standards for Industrial IoT communication, we've incorporated it in the testbed along with others like DDS and MQTT. That ensures that the first OPC UA TSN enabled products will have already been tested in a simulated industrial environment.

Has testing yielded any results yet?

Sachse: The results so far have been extremely promising. Together with many of our testbed partners and other well-known automation and IT companies, we announced at the 2016 SPS IPC Drives that we'll be offering products with OPC UA TSN. B&R controllers with OPC UA TSN will be available in 2017. The speed with which this technology has moved from drawing board to market is a perfect example of the dramatic acceleration of innovation cycles you hear about so often in conjunction with the IIoT.

Soley: It's also a perfect example of the IIC fulfilling its mission to the letter. We brought together a diverse group of companies, supported the establishment of new standards and shortened the time it took to get new technology from concept to production. ←

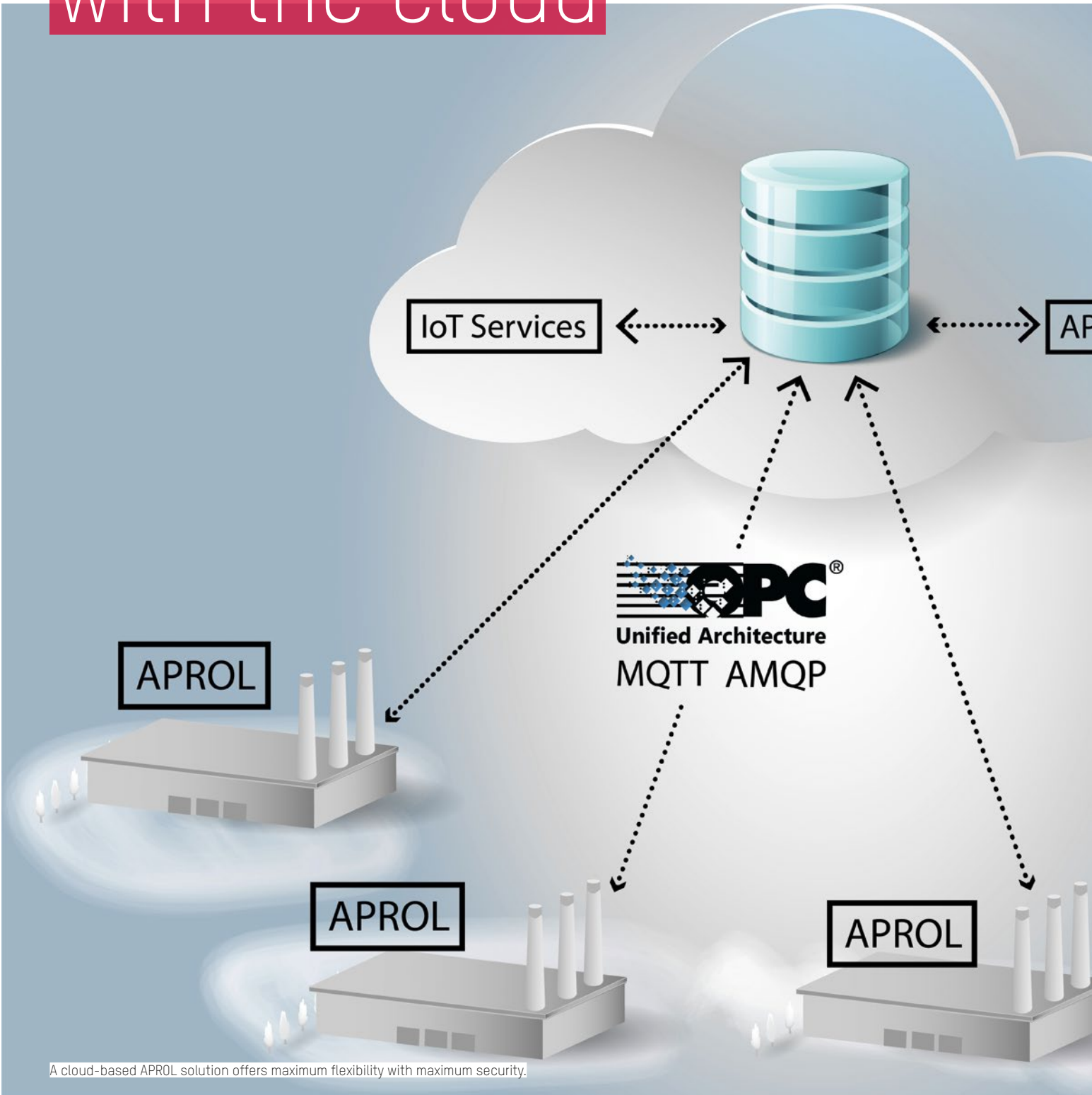


Sebastian Sachse is B&R's open automation technology manager

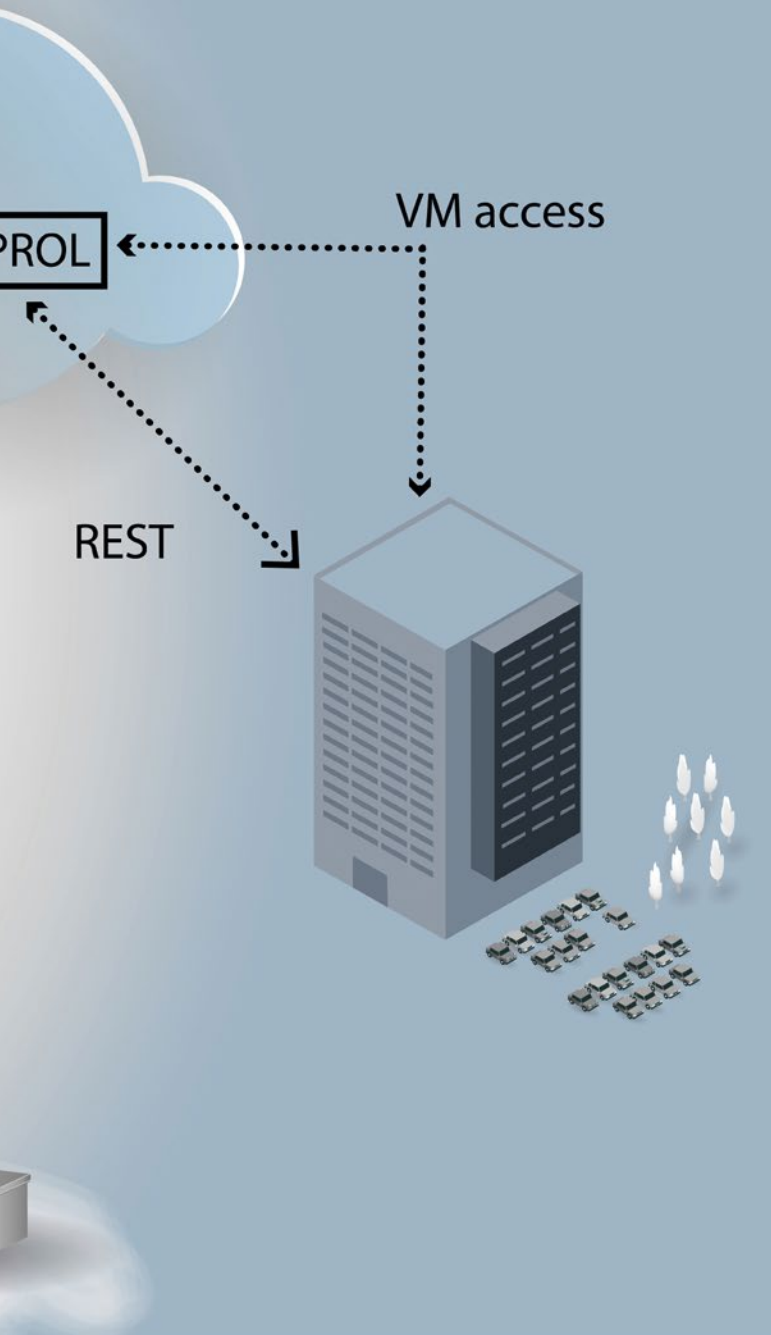


Dr. Richard Soley is the executive director of the Industrial Internet Consortium (IIC)

Optimizing processes with the cloud



Manufacturers are under constant pressure to optimize their processes in order to remain competitive. Increasingly, this means using big data analytics tools to mine enormous volumes of production data. When these tools utilize cloud services, there are a number of important factors to consider.



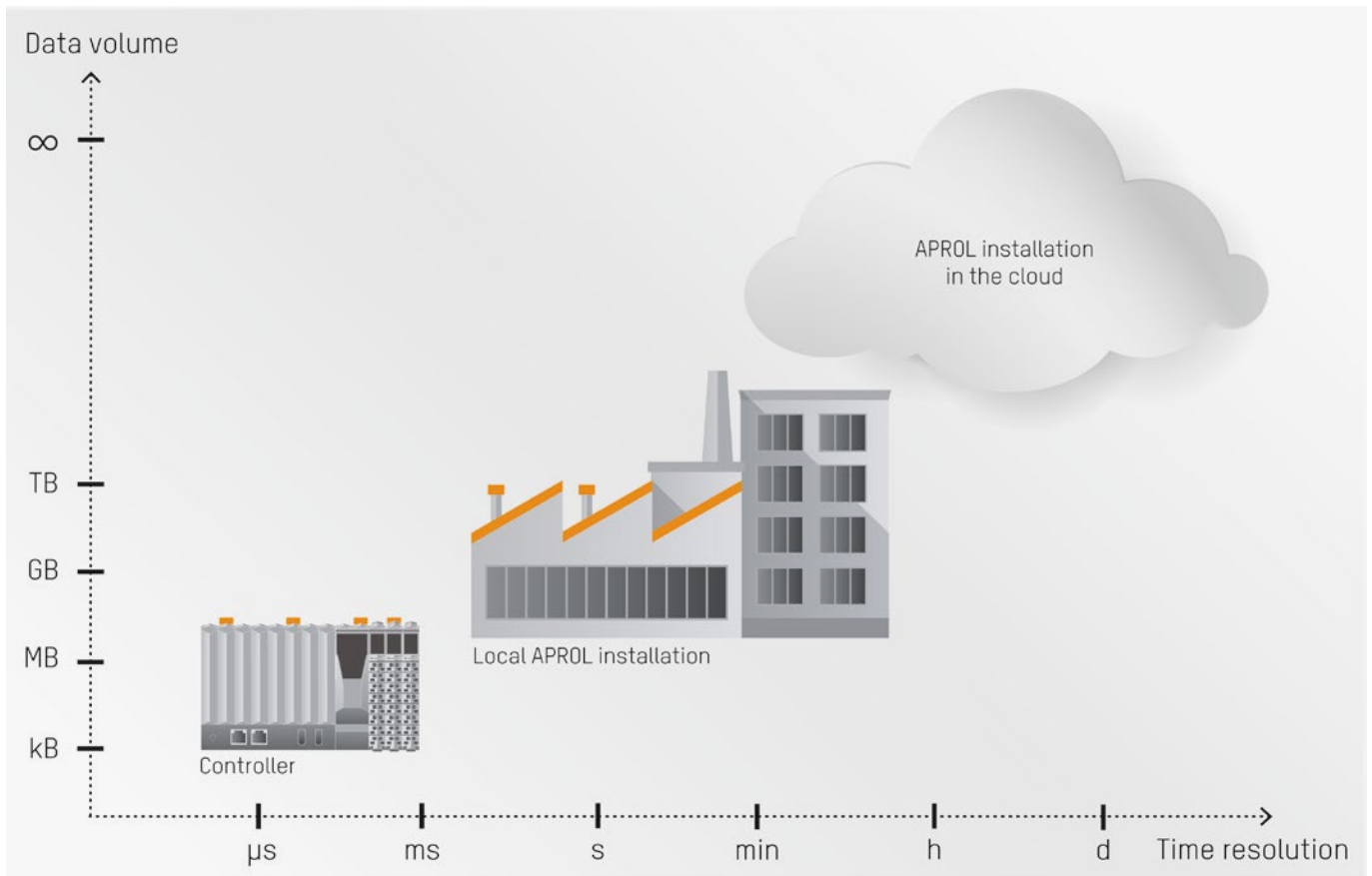
"Today's manufacturing plants generate gigabytes – sometimes even terabytes – of data every day," says Martin Reichinger, manager of B&R's Process Automation business unit. The days when this data could be stored and analyzed on a single computer are long gone. "More and more companies are moving toward database solutions or internally hosted private clouds."

Operating a private cloud requires an in-house data center and IT specialists working around the clock to ensure availability. These can be prohibitive costs, particularly for small and medium-sized enterprises, which is why they instead turn to solutions offered by large cloud service providers. "The thing is, you're dealing with huge volumes of what in some cases is very sensitive data," explains Reichinger, "so you don't want to be sending it all unfiltered into a public cloud."

Preprocessing

The alternative is to preprocess the production data and upload only what is necessary into the cloud. This approach, known as edge computing*, retains all the advantages of a public cloud – an IT infrastructure with limitless scalability, world-wide availability and big data analytics services – while at the same time minimizing the risks.

"B&R's APROL* process control system makes implementing such a solution very easy," notes Reichinger. One instance of APROL is installed on an industrial PC at the production site to handle preprocessing and data compression. A second instance, running on a cloud-based virtual machine, collects data from any number of local APROL systems. "A company with 50 production sites around the world can easily aggregate all of its important data in a single system. Data is compressed to reduce transfer volume, and highly sensitive data can be restricted to local storage only."



The system architecture with two instances of APROL optimally satisfies all the requirements of connected manufacturing.

Big data analytics

"In the cloud I can take advantage of APROL's built-in analysis and reporting tools, such as our powerful business intelligence suite," highlights Reichinger. The business intelligence platform aggregates and displays a clear overview of analysis results so valuable information is readily available to make well-informed decisions that help optimize production. The database can also be evaluated using data mining tools offered by the public cloud service provider.

To transfer data between local and cloud APROL systems, B&R relies on the vendor-independent OPC UA* communication protocol. In locations with high latency times or poor network quality, it is also possible to use AMQP and MQTT* to ensure successful transmission of OPC UA data packets.

APROL's integrated APIs can be used to access analysis results generated by the cloud-based APROL. There is also a RESTful API for accessing results generated by the integrated business intelligence suite. Centralized data management allows all information to be accessed remotely from anywhere in the world.

Optimal architecture

This system architecture satisfies all the requirements of connected manufacturing:

- **Control level:** At the control level, response times and sampling resolution in the sub-millisecond range allow you to do things like sense mechanical vibrations with extremely high precision. Data at this level is stored only temporarily, with volumes in the kilobyte or megabyte range.
- **Local APROL:** Data is preprocessed and stored in the local APROL system for intermediate archiving. "Here, you have access to the data for hours, days or months," explains Reichinger. Depending on computing power and storage capacity, the data can have a time resolution in the microsecond range. "That allows us to mine real-time data directly in the local APROL system."
- **Cloud APROL:** For long-term archiving and data mining on a larger time scale, data is aggregated in the cloud, where it can be stored indefinitely and the storage volume is virtually unlimited.

Key terminology

* Edge computing

involves decentralized preprocessing and intermediate storage of production data before it is passed on to a central location. This reduces the volume of data to be transferred and guarantees operability even in the event of network failure. Edge computing is considered a key requirement for the Internet of Things.

* APROL

is the B&R process control system. Unlike conventional process control systems, it can be scaled as needed and even used for factory automation. It offers complete, packaged solutions for tasks such as energy monitoring and condition monitoring that are ready to use with minimal effort.

* OPC UA

is a vendor-independent communication protocol for industrial automation applications. It is based on the client-server principle and allows seamless communication from the individual sensors and actuators up to the ERP system or the cloud. The protocol is platform-independent and features built-in safety mechanisms. Since OPC UA is flexible and completely independent, it is regarded as the ideal communication protocol for the implementation of Industry 4.0 and IoT solutions.

* MQTT and AMQP

are queuing protocols that allow data packets to be transferred reliably even in cases where the network connection has low bandwidth or is intermittently unavailable. They do this by saving data packets in a queue to be sent at a later time. Other protocols, including OPC UA, can be transferred over MQTT and AMQP.

"In the cloud you're looking at a time resolution in range of minutes or even hours," says Reichinger. "That explains why it's still not a good idea to move control tasks into the cloud. Today's standard solutions don't yet ensure the necessary response times and availability."

Globally distributed development teams

APROL lets users enjoy other advantages of the cloud as well. Development of APROL applications can be completed entirely in the cloud. "This is a huge benefit for companies with developers at various locations around the world," explains Reichinger. APROL's built-in support for concurrent engineering allows even larger teams to work efficiently on a shared online project.

Virtual plant in the cloud

"We can even set up an entire virtual plant in the cloud," says Reichinger. In addition to an APROL Runtime Server, this involves setting up the necessary number of simulated controllers and potentially even a simulation of the entire process. "All functionality and even the operability of the plant as a whole can be tested

during virtual operation. That saves a whole lot of time and money and prevents many of the surprises that can otherwise pop up when commissioning the actual system."

The cloud can also be used to test new updates before switching to new system software. B&R provides images of all currently supported APROL releases that can be quickly installed and used in the cloud. "With APROL in the cloud, our customers enjoy savings across the board – throughout development, runtime and maintenance," concludes Reichinger. ←



Martin Reichinger
Business Manager –
Process Automation, B&R

"All of APROL's analysis and reporting functions are available in the cloud."

“No more unplanned downtime”

For those looking to implement manufacturing intelligence solutions at brownfield sites, B&R now offers the Orange Box. Data acquisition and analysis solutions can be implemented easily by setting the necessary configuration parameters – without having to modify any existing hardware or software and regardless of who supplied the existing control system. We sat down with Ralf Hagen, E&A engineering manager at Nestlé Germany and Thomas Rienesl, head of industry-specific business development at B&R, to find out more about how the Orange Box transforms brownfield plants into smart factories.



Mr. Hagen, what makes a factory a smart factory?

Ralf Hagen (Nestlé): In a smart factory, components need to communicate and interact in a much better way than what we’re currently used to. There should be an unbroken logical chain for each customer order that can be executed automatically, start to finish. A machine should know when it needs to speed up or slow down – when it should request additional materials or refuse them. Currently, these decisions still require the experience of human operators, but in the future the machines should be able to handle them autonomously.

And what makes a factory smart from an automation perspective?

Thomas Rienesl (B&R): One characteristic of a smart factory is certainly resource efficiency – with reduced consumption and the resulting reduction in operating costs. Virtually all modern equipment is automated by intelligent components that produce enormous

amounts of data. Manufacturers are therefore looking for ways to leverage this data to be more competitive. That can mean making production processes more agile and responsive, for example, or increasing availability by preventing unplanned downtime.

Are all Nestlé plants already “smart”?

Hagen: No. That’s in large part due to the size of our company. Smaller plants have less clout when it comes to innovations, market penetration and investments. Our plants vary greatly with regard to sector and size, so the level of smart manufacturing really runs the gamut.

Has Nestlé set concrete production goals?

Hagen: With regard to KPIs – yes. The most straightforward definition is in terms of overall equipment effectiveness, or OEE. We have set OEE targets and time frames for achieving them.



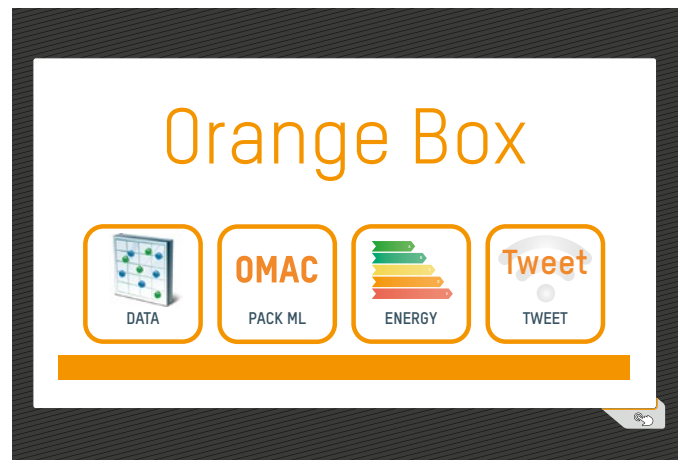
The Orange Box collects and evaluates data from previously isolated machines and lines and helps plant operators get existing equipment up to speed for smart manufacturing.

So that's one of the main challenges – but I'm sure there are others.

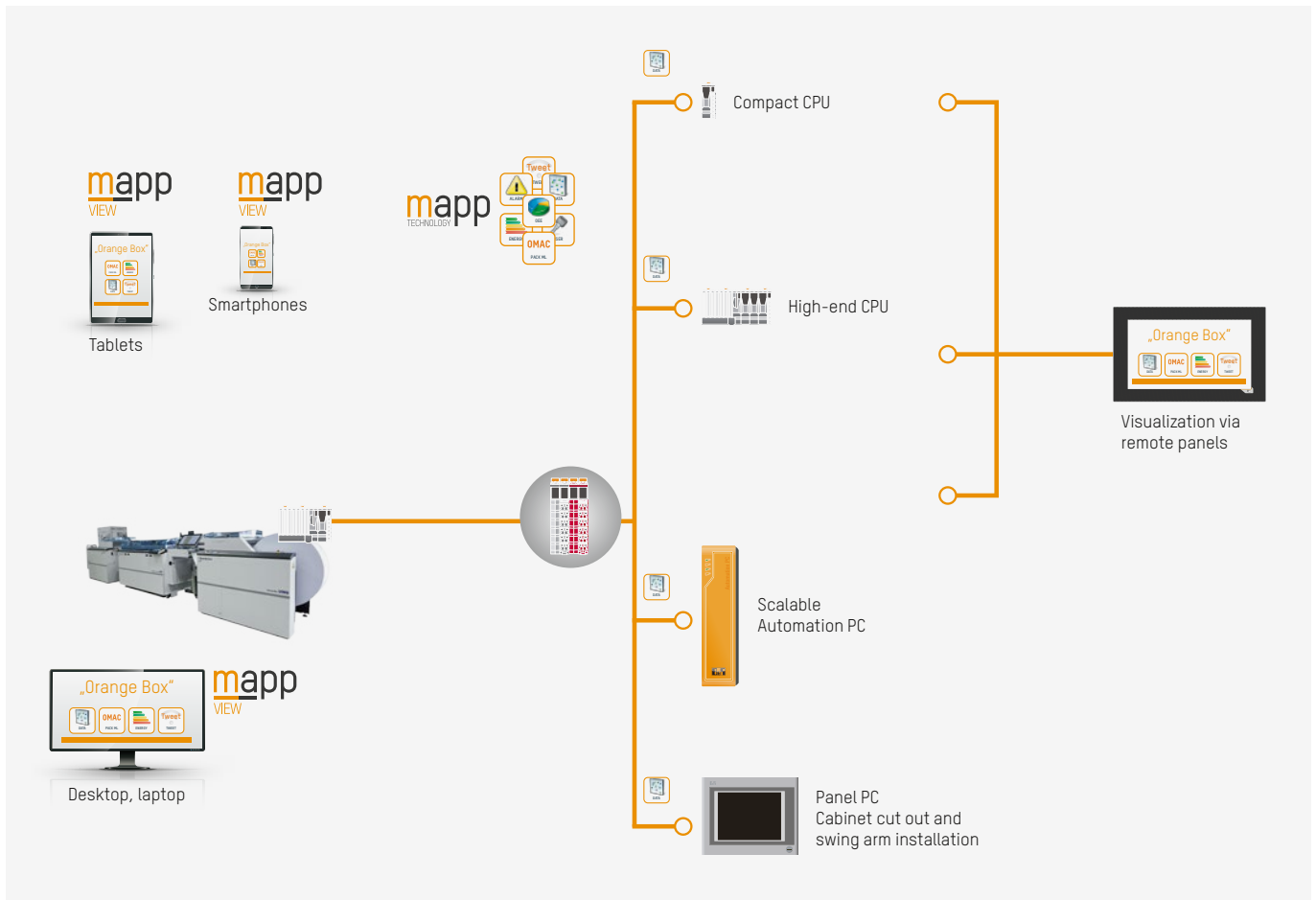
Hagen: There definitely are, because of the many correlations. If your machine has problems with unplanned downtime, for example, you also tend to have problems with operator safety. The more often they have to intervene, the greater the risk of injury. Another key aspect is energy efficiency. When a line is constantly starting and stopping and starting and stopping, that has a real impact on consumption. At the same time quality suffers, because of the waste that is produced when the machine is starting up or shutting down.

Safety, energy, product quality: these are the main areas where Nestlé is looking for improvement?

Hagen: Yes, those are the areas that are the easiest to quantify globally.



B&R's Orange Box is the perfect platform for Industry 4.0 production.



B&R's Orange Box is the perfect platform for Industry 4.0 production.

Does B&R hear these same requirements coming from other customers?

Rienessl: We do, but the landscape is extremely varied. Specific customer requirements depend heavily on the industry – whether it's discrete or process manufacturing and what the level of automation is. The challenge is always to figure out how to improve production with the means and equipment you actually have on hand. In theory, things like the RAMI reference model always assume that you have unlimited access to the latest technology. In practice, however, greenfield plants are simply far outnumbered by brownfield ones. The real challenge in terms of productivity is therefore to get more out of the assets that are already in place.

How did Nestlé arrive at B&R for the solution?

Hagen: We talked to many potential suppliers, but B&R was the only one who could offer the total package of structure, framework, applications and modularity we were looking for. We wanted someone able to encapsulate the necessary expertise in a thoroughly tested package that you can install, use and update with the push of a button like a smartphone app.

Can you tell us more about the solution you developed with B&R?

Hagen: We created a solution that evolves modularly and organi-

cally – that's really the art of it. After all, we live in a world of constant change. If you put a system in place and say "OK, that's it" – you're going to run into trouble when it comes time to migrate. So far, the B&R system is the only one that can do this.

So is the Orange Box a custom solution developed specifically for Nestlé?

Rienessl: The Orange Box is a very versatile, open solution for collecting, standardizing and evaluating data in real time. If the requirements change, the Orange Box simply changes with them. Essentially it is a combination of B&R's mapp Technology and Scalability+. The Orange Box allows machine operators to check



Ralf Hagen
Engineering Manager E&A/MES, Nestlé

"Installing and configuring the prototype at the Nestlé plant in Osthofen turned out to be even faster and easier than we expected."



Ralf Hagen (Nestlé) and Thomas Rienessl (B&R) discuss the Orange Box manufacturing intelligence solution for brownfield equipment.

relevant parameters on site and intervene immediately when necessary. When you're talking about high availability, it's essential that any deviations are detected early and the right corrective measures are taken right away. That's exactly what the Orange Box lets you do, which is why it has been so well received.

What kinds of applications is the Orange Box suited for?

Rienessl: The Orange Box can be used in any industry, but it's particularly well suited for plants where there are large numbers of machines involved in the production process. Basically there are two types of customers that it appeals to: large industrial manufacturers and machine builders.

How has your experience been with the Orange Box at the Nestlé plant in Osthofen?

Hagen: Installing and configuring the prototype turned out to be even faster and easier than we expected. Now we're working on improving the analysis results and how they are displayed for daily use such as shift handover meetings.

What are your future plans for the Orange Box?

Hagen: What we want to have is intelligent analysis that identifies the root causes of a problem before the problem ever occurs. Over

the next four years, we want to get to a place where the machines warn us of an impending stoppage in advance, rather than having to troubleshoot after the fact the way we do now. Eventually, there should be no more unplanned downtime whatsoever, and the Orange Box will help us increase both machine availability and output.

Thank you very much for taking the time to speak with us. ←



Thomas Rienessl
Head of Business Development
Industries, B&R

"The Orange Box is a versatile, open solution for collecting, standardizing and evaluating data in real time. If the requirements change, the Orange Box simply changes with them. The Orange Box allows machine operators to check relevant parameters on site and intervene immediately when necessary."

IO-Link has it handled

New technology enables new solutions. At the K trade fair in Düsseldorf, Starlinger recently presented a machine that demonstrated this twice over. On the one hand, the machine produces woven polypropylene sacks with innovative new punched handles for easy carrying, and on the other it features cutting-edge technology from Sick and B&R. Like the new handles, the benefits IO-Link brings to the solution will certainly carry weight with customers.





For certain products, packaging makes all the difference. Not only does it protect the contents during transport and grab attention from the store shelf, it can also help the consumer carry it home. Quite often, plastics like polypropylene play a key role. Processed into strips and woven into fabric, it offers strength and durability that go far beyond the conventional plastic shopping bag. It's hard to imagine carrying home tile adhesive or cement mix by the shovel full. Instead, these products are sold in sacks, which must be extremely robust to handle up to 20 or 25 kilograms of material. For the producers of these materials, choosing the right sack is crucial.

Single-source synthetic sacks

When a conversation turns to the topic of woven plastic packaging, it won't be long before the name Starlinger is mentioned. Headquartered in Weissenbach, Austria, the company has a 45-year history developing and building machines that make robust and versatile polypropylene sacks – around 15 billion of them per year, as a matter of fact. From processing the primary material to weaving and printing the fabric and all the way to the finished sack itself – Starlinger has the entire production process covered. Over the years, the renowned machine builder has proven a knack for introducing innovations that are well received on the global market.

A better bag that doesn't break

With its internationally patented Ad*Star block bottom valve sacks, Starlinger has significantly reduced the occurrence of breakage – a clear advantage for cement mix producers and their customers. Capable of holding up to 50 kilograms, Ad*Star sacks are ideal for all types of dry bulk goods for

wholesale and retail, from construction materials and chemicals to feedstuff. Starlinger's latest innovation was unveiled at the K trade fair for plastics and rubber in Düsseldorf: a new machine that makes block bottom valve sacks with a convenient handle.

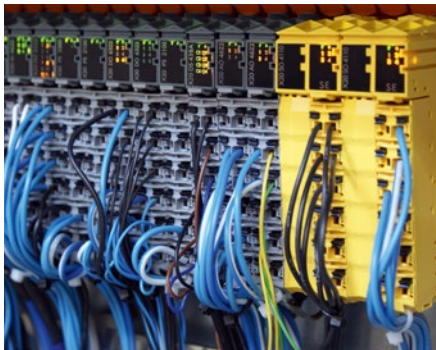
"These sacks have never been available with a handle before. The new design has the handle welded firmly right on the sack. This makes the heavy loads much more manageable," says Rene Weiss, head of electrical engineering at Starlinger. In the EU, block bottom bags carry up to 25 kilograms, while elsewhere in the world up to 50 kilograms are permitted.

The reel-to-reel deal

Production of an Ad*Star block bottom valve sack begins with polypropylene pellets, which are melted and extruded into a film that is then cut into tapes six to eight millimeters wide. The tapes are drawn out and heat-treated to improve durability. Having once again been wound onto reels, the tape is then mounted on a reel, woven into a polypropylene tube and respooled onto another reel – all at breathtaking speed. This tube can be further processed. In the case of the Ad*Star, a heated polypropylene film about 15 to 25 micrometers thick is applied. Then the material is spooled up again.

High-tech handles

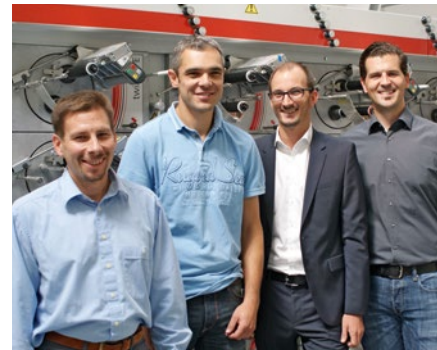
Printing – industrial printing or OPP lamination – is also performed as a reel-to-reel process, which Starlinger has continuously developed and fine-tuned over many years. In the conversion line, the sacks are cut, folded and the handle is welded on. Production of the handles also runs – you guessed



Communication bridge to the controller and higher-level systems – B&R offers a selection of IO-Link master modules for easy connection of sensors and actuators from different manufacturers.



Smart and well-connected: the DT35-B15251 distance sensor from Sick does more than just measure. With IO-Link, it opens up exciting possibilities for IIoT manufacturing.



(From left to right) Rene Weiss, Head of Electrical Engineering at Starlinger; Michael Hecher, Electrical Engineer at Starlinger; Rene Pfaller, Product Manager Presence Detection & Industrial Instrumentation at Sick; Christoph Gugg, Open Automation Technologies at B&R

it – reel to reel. “To make the handles, the primary material – woven polypropylene tape – is fed straight from the reel into the machine. There it is folded into four layers and punched to form the shape of the handle. Then the material is unfolded and spooled onto the final production reel with a precisely defined tension,” explains Weiss. From there, the roll goes to the next machine, where the handles are welded onto the sacks. This step is completed with hot air and pressure alone and doesn’t require any additional materials.

Tension to detail

Once the handles have been punched, spooling them onto the final reel is a particularly sensitive step. Too much or too little tension would shift the positioning and result in a warped handle. This is a challenge both for the high-precision torque control of the actuator and the sensor system that detects the reel diameter. “Absolute precision is essential here,” says Weiss. “Even the smallest deviation can easily cause big problems.” This is a job for Sick sensor systems. An encased DT35-B15251 laser distance sensor detects the position of the reel shaft and thus the diameter of the completed handle reel. The distance

between where the sensor is installed and the reel shaft makes it possible to calculate the reel diameter with a high level of precision.

Contingencies considered

In developing the new line, Starlinger truly thought of everything: commissioning, ongoing maintenance, future adaptations and interfaces with upstream and downstream equipment were all important topics. “Our motto is to plan for all contingencies, because looking ahead helps avoid unnecessary costs later on,” says Weiss. “That’s why we wanted an Industry 4.0 type sensor here – one that can do more than just measure. The vision of Industry 4.0 is for sensors to provide the master and higher-level databases not just with measurements, but also the sensor’s serial number, diagnostic data and other important information. Equally important are easy configuration and the ability to network with other machines. With the combination of IO-Link and POWERLINK, that’s no problem at all – and many of the things we would have wished for ten or fifteen years ago are finally possible. The DT 35 laser distance sensor connected via IO-Link was the perfect solution.”

All the info at a glance

Because the distance sensor on the handle converter is not readily accessible, remote configuration was particularly important. “The sensor’s specifications only need to be entered into the control system once,” says electrical engineer Michael Hecher. “That way, all the processes match up right from the start, and no other settings are required.” Even in the event of a sensor replacement, all the essential data is retained and there is no need to recalibrate. “Not having to go find a parameter list or use additional software to configure the sensor is a huge benefit. In the future, it will also be possible to read a component’s serial number to identify whether it’s the original that came with the machine. If there is an error, you’ll immediately see which part is affected. Optical sensors will also be able to report the degree of contamination so the operator knows when they need to be cleaned,” says Hecher.

Simple cabling

IO-Link offers numerous design benefits. There is no need for shielded cables, tedious analog cabling is eliminated entirely, and the system is fieldbus independent. The end user has the advantage of being able



From reel to reel – Starlinger packaging machines transform strips of woven polypropylene fabric into finished handles for its versatile Ad*Star sacks.

to replace the sensors without having to give it much thought. “Until now, the customer has had to maintain a spare parts inventory of uniform sensor types, and there would often be problems because certain applications require very specific programming,” explains Hecher. “If the new sensor wasn’t adjusted correctly, the customer would have to fall back on complicated calibration mechanisms or had to be trained by us in order to correctly install the replacement. Thanks to IO-Link, that’s now a thing of the past.”

The master matters

In addition to the IO-Link sensor, another highlight of the Starlinger machine is the X20 control system from B&R. The X20-DS438A I/O module functions as the IO-Link master. Process data is passed on to other nodes via the open POWERLINK interface. This was particularly important to Starlinger, because the company has eliminated proprietary bus systems from its portfolio entirely. Each machine is now equipped with as many as 45 POWERLINK nodes. “In addition to simplicity and stability, switching to POWERLINK brought us two distinct advantages. One was safety integration, and the other was the system’s decentral-

ized architecture. B&R’s POWERLINK nodes allow for connections to solutions from various manufacturers – including not only actuators, but in the future cameras and sensors as well. This kind of seamless connectivity is one of the cornerstones of Industry 4.0,” says Weiss. The numerous advantages of open POWERLINK interfaces are why Starlinger, B&R and Sick are working to advance the technology as members of the Ethernet POWERLINK Standardization Group (EPSG).

Decentralized architecture

From the central control system, remote POWERLINK nodes can be added via a bus

controller. Also connected via the bus controller is the IO-Link master, from which the IO-Link layer is accessed radially. “Hierarchically speaking, process and safety control are handled on the POWERLINK layer, and the sensor technology at the IO-Link layer. That applies to the entire production process,” explains Weiss. “All the actuating elements, including both servo drives and inverters, are controlled via the POWERLINK fieldbus layer using information received via IO-Link. This enables our customers to have their entire production firmly under control and makes them flexible enough to be prepared for future developments,” Weiss is clearly pleased to report. ←

Rene Weiss

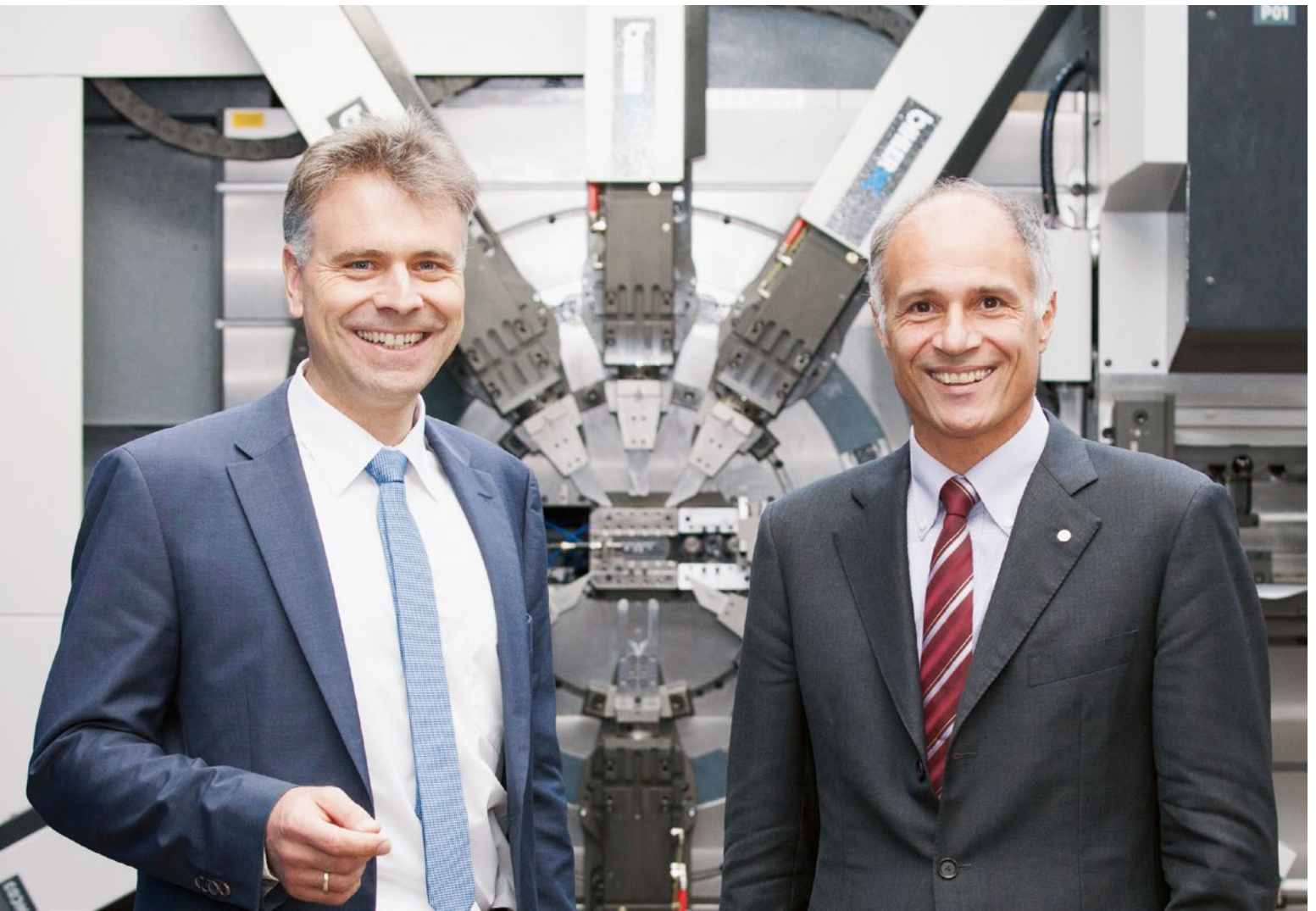
Head of Electrical Engineering, Starlinger

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Interview

“Connectivity
is the lifeblood
of advanced
manufacturing”

Evolving market requirements demand increasingly flexible manufacturing systems. Mathias Bihler (Managing Partner, Otto Bihler Maschinenfabrik) and Markus Sandhöfner (General Manager, B&R Germany) explain how collaboration between OEMs and their automation suppliers can get machine tools up to speed for Industry 4.0 and the Internet of Things.



Mathias Bihler (Managing Partner, Otto Bihler Maschinenfabrik, right) and Markus Sandhöfner (General Manager, B&R Germany) in front of Bihler's newest NC machine. (Source: Otto Bihler Maschinenfabrik)



If there's one thing that pervades every sector of industrial manufacturing, it's the need to produce ever smaller batches more efficiently and economically. Mr. Bihler, are you experiencing this trend in the field of metalworking?

Mathias Bihler: Only ten years ago, it was common practice for a company like an automotive manufacturer to award a yearly contract for millions of parts, which would be produced in one go and then sit in the supplier's warehouse. That's a huge amount of capital to have tied up, not yielding any return, and it's anything but economical. So there was a clear motivation to design more responsive equipment with shorter changeover times that would enable just-in-time production.

How can you shorten changeover times for machine tools?

Bihler: With a conventional cam-operated machine? Hardly. After all, the really time-consuming part is the fine tuning. It takes hours, if not days, to dial in the exact pressure to form a part just right. On top of that, it's a finicky task that requires highly specialized personnel. If the specialist you need isn't available, you can't start up your machine. That's simply not compatible with modern just-in-time production.

What's the solution?

Bihler: Our solution was to develop NC machines based on advanced control and servo technology from B&R. With these Bihler



"Companies that aren't working on ways to collect and analyze data from their machines are going to have a harder and harder time competing around the world." Mathias Bihler, Managing Partner, Otto Bihler Maschinenfabrik

NC machines, you define the force or motion profile once and save it on the controller. When you retool the machine, all you have to do is load the corresponding program.

Can you give us an example of how this works?

Bihler: Sure, let's say an automobile manufacturer orders 50,000 stamped parts from one of our customers. As soon as the order comes in, the machine is retooled. With our NC technology that means about fifteen minutes to an hour until they're ready to begin production. Once the run is complete, the machine is retooled again – maybe this time to fill an order from a medical engineering company. This responsiveness is currently revolutionizing the stamping and forming industry. If you ask me, we're going to see the market for traditional cam-operated machinery shrink rapidly over the next few years.

Mr. Sandhöfner, what solutions does B&R offer for the kind of responsive machinery Matthias is talking about?

Markus Sandhöfner: The performance of these machines doesn't come from any

one hardware or software product alone. It emerges from a kind of system integration you won't find in most suppliers' portfolios. An example of this is how B&R completely decouples hardware from software. Once software has been written, it can be used and reused on any generation or performance class of B&R hardware. Another thing that's really important are open interfaces that allow OEMs and system integrators to control all the necessary components with a single system.

Bihler: That's actually a very decisive factor for us. With B&R, we're able to control all the functions we need for automation and process design with one master controller. If you have multiple processing technologies in an integrated line, and each one needs its own controller, the running costs for maintenance and servicing quickly get out of hand, and eventually you run into performance limitations as well.

Speaking of performance: How do servo machines compare with quality cam-operated machines?

Sandhöfner: Today's servo technology far

outperforms cam technology. Just look at the new generation of Bihler machines: On one line they have 89 axes synchronized with a cycle time between 400 and 800 microseconds using our real-time POWERLINK network. This allows for an unbelievable level of precision.

Bihler: I can certainly attest to that. In efforts to optimize our machines, we push each process to the edge of what is physically possible. Our bending processes are so fast that we're just barely within the material's plastic deformation capacity.

How is that possible?

Bihler: To really explore the limits of our machines, we used to go through countless iterations of cam design – calculating, prototyping, evaluating and recalculating. With servo technology, I can tune a profile to the precise deformation capacity of a given material in a matter of minutes. But that's not all. Measurements are also performed during the bending process to identify any deviations from the intended angle – for example due to inconsistencies in the material. The combination of B&R



"Today's servo technology outperforms cam technology by far." Markus Sandhöfner, General Manager, B&R Germany

servo technology and Bihler instrumentation is so fast, you're able to make the necessary adjustments on the fly. Our customers get the best of both worlds: perfect quality and exceptional productivity.

Such an advanced control solution must require highly specialized software development.

Bihler: That it does. A large portion of our NC machines' success can surely be attributed to our expertise in the areas of stamping, bending and assembly processes. At the same time, though, when it comes to motion control, general closed-loop control and much more, we don't need experts. For these things we're able to rely on our automation partner. B&R gives us an ideal platform to make the most of our process know-how.

What does that platform look like?

Bihler: Well, it includes a multitude of hardware components, but of course also the development environment, Automation Studio. And in the future we'll be relying even more heavily on B&R's know-how, for example with the OPC UA interface we're

currently implementing. Since all of B&R's controllers can be operated as OPC UA clients and servers, this is astonishingly easy. We'll also be benefiting from B&R solutions when integrating robotics into our machines in the near future. We won't need a dedicated robotics controller, and programming the robots will be extremely simple thanks to mapp.

Mr. Sandhöfner, can you give us a little background on mapp?

Sandhöfner: mapp Technology encapsulates entire mechatronic solutions in easy-to-use software components, which are ready to go with just a few simple configurations. This enables customers like Bihler to control complex kinematic systems without having to write the motion control software themselves.

Mr. Bihler, you mentioned OPC UA. Is that an indication that you're focusing development efforts towards increased networking capability?

Bihler: Absolutely. Connectivity is the lifeblood of advanced manufacturing. It's what concepts like Industry 4.0 and IoT are all

about. We've actually made a great deal of progress in this direction. Bihler machines around the world are already sending data to our headquarters for analysis. We're at a point where we can call a customer and tell them a specific bearing in a specific machine is displaying signs of wear and needs to be replaced to avoid unscheduled downtime.

How are you able to pinpoint the problem so precisely?

Bihler: Every axis has a characteristic fingerprint, which we measure and document prior to delivery. If we notice a deviation from this fingerprint, we immediately know that a parameter has changed. This is a striking development. It used to be that when a Bihler machine went down, we'd have to send a service technician to troubleshoot all of its 40 axes. Once he identified the defective part, he'd have to either pick it up himself or have it shipped. There's one thing I'm sure of: Companies that aren't working on ways to collect and analyze data from their machines are going to have a harder and harder time competing around the world. ←

Robotic bottling solutions

Filling the need for simplicity



Benefits of POWERLINK

In FG Industries' Robofiller and Robocapper machines, POWERLINK transfers setpoint values to the servo drives every 400 microseconds and provides enough bandwidth to handle two entire robots as well as additional brushless and linear motor axes, analog and digital I/O, diagnostics and safety data as well as additional fieldbus interfaces. The open network allows flexible combinations of 3rd-party masters and slaves so that FG Industries' machines can be easily incorporated into existing IT infrastructures.

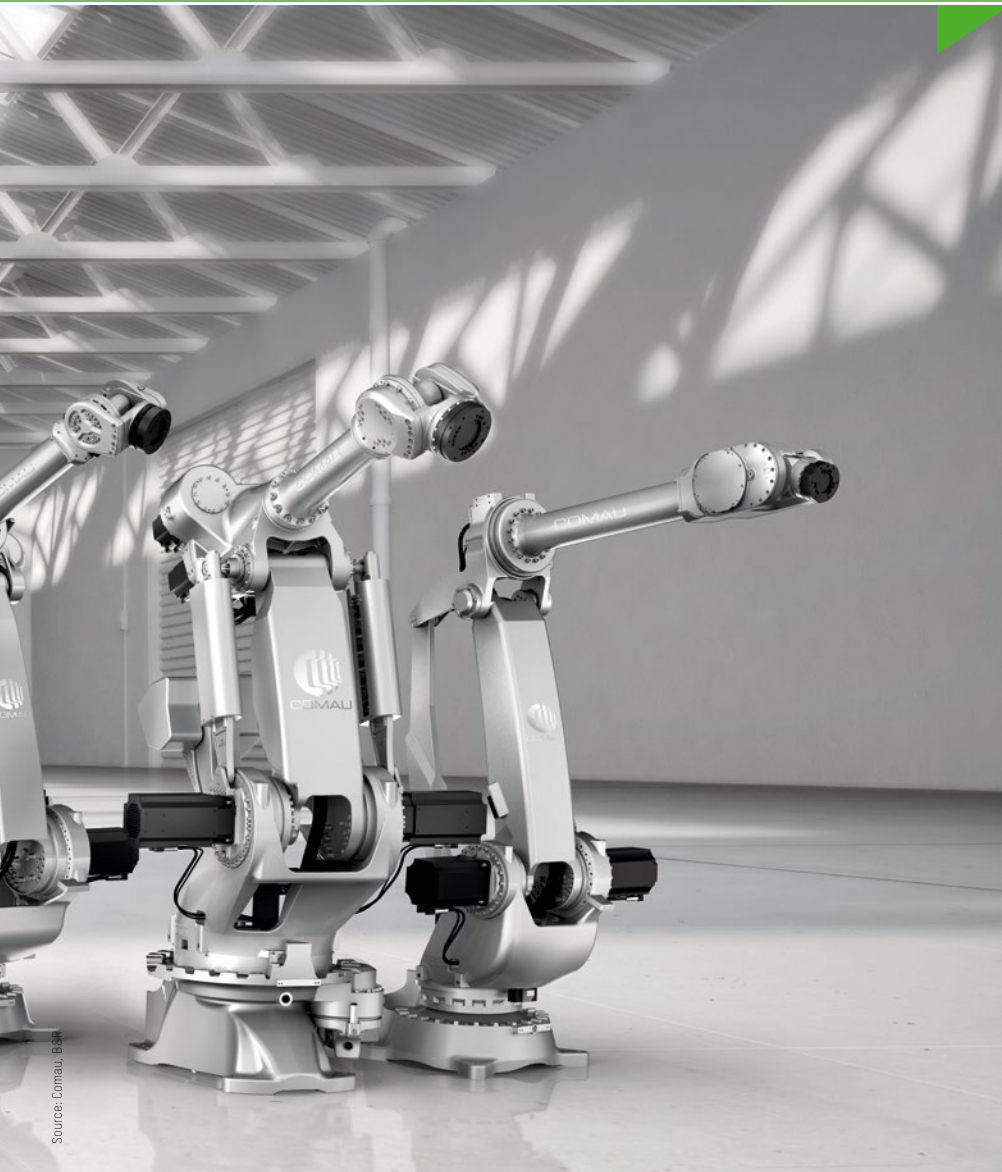
When a machine draws components from a variety of automation and robotics suppliers, the resulting complexity can hinder performance and usability. FG Industries, a pioneer of robotic filling and capping machines, found the answer in B&R's openROBOTICS solution, which seamlessly integrates COMAU robots into the B&R automation environment. The full-B&R solution brought a 20% increase in productivity, a streamlined new user interface, substantial energy savings and improved remote diagnostics.



A decade ago, FG Industries pioneered the introduction of robotic solutions for liquid filling and bottle capping. This approach yielded increased output and flexibility in bottling lines that feature feeders, fillers, sealers, labelers, cappers, case packers and palletizers. The company's first robotic fillers and cappers, however, required extensive integration work to coordinate a variety of automation and robotics components from different suppliers, as well as multiple engineering tools and bus systems. "The complexity was hard to manage and hindered the performance and usability of our machines," recalls Benedictus Tang, managing director of FG Industries. "Our systems were not optimally synchronized, and with different engineers responsible for robotics and automation, diagnostics were difficult as well."

Simple solution, powerful performance

FG Industries found the solution it was looking for with openROBOTICS. The result of collaboration between automation specialist B&R and industrial robotics powerhouse COMAU, openROBOTICS eliminates the cumbersome interfaces traditionally required between robot and machine controllers to create a seamlessly integrated mechatronic solution where the robotics are essentially a plug-and-play component of the automation environment. FG Industries'



Source: Comau, B&R



Comau offers a broad spectrum of articulated robots for handling, spot and arc welding, machine loading and countless other applications.

newly optimized topology features a single controller for the entire machine setup. The high-performance industrial PC from B&R provides plenty of computing power to handle both machine automation and path calculation for the robots. With its open-ROBOTICS solution, the user interface screens for managing the robots are integrated directly in the HMI application, so no additional operator panels are needed. The simplified automation architecture has improved both the usability and the performance of FG machines with continuous movement and continuous synchronization between the filling and capping processes, conveyors and robots. "The perfectly coordinated hardware and software has helped us improve filling and capping performance by 20% compared to our previous solution," notes Tang.

Energy-efficient motion control

B&R's modular ACOPOSmulti servo drive system is perfectly suited for FG Industries' robotics applications. The design allows side-by-side expansion and plug-and-play operation with minimal cabling. The advanced cooling system also allows optimization of the control cabinet temperature. Power is supplied via a stabilized DC bus, which further increases the efficiency of the overall solution. Power factor correction reduces the apparent power intake of the drive system to the effective power of the machine, while active regeneration further optimizes utilization. Better utilization of the existing power supply, lower overall power usage and elimination of reactive power all contribute to a substantial im-

Benedictus Tang
Managing director, FG Industries

"By reducing our engineering costs, this integrated solution has allowed us to invest more in innovation. The complexity was handled easily by the B&R system."

provement in energy efficiency. Further gains were achieved by replacing the pneumatic components with ACOPOSmicro servo controllers and LinMot linear motors.

Remote access for easy after-sales support

Operators can also access both the HMI application and the integrated System Diagnostics Manager (SDM) over a wireless network using a tablet or a smartphone. B&R's SDM tool allows maintenance personnel to perform local or remote diagnostics. The firmware-integrated diagnostic screens let them easily verify the functional status of any machine component. "The integrated diagnostics allow us to provide effective after-sales support and easy servicing so our customers experience minimal downtime," says Tang. With a single interface providing access to the entire machine, the robots, processing units, safety technology and HMI application can be diagnosed efficiently from anywhere on the planet. Diagnostic functions that used to require laborious programming come ready to use in SDM, simplifying the overall diagnostics process and shortening the amount of time needed to get the machines up and running.

Savings fuel new innovations

FG Industries has considerably reduced its number of suppliers, with all automation components now coming from a single source. "As a company, we challenge ourselves every day to be the world's most innovative robotic bottling and packaging systems designer," says Tang. "By reducing our engineering costs, this integrated solution has allowed us to invest more in innovation." And as for the complexity that does remain, he adds: "That's handled easily by the B&R system." ←



B&R's modular ACOPOSmulti servo drive system is perfectly suited for FG Industries' robotics applications.

Source: Comau, B&R

Automated pipe joining

Making ends meet

GF Piping Systems was looking to improve production quality by automating the pipe joining process. Finding just such a solution from automation specialist AVM Engineering using B&R products, the decision turned out to be an easy one.



The IR-110A pipe joiner offers increased precision at the push of a button.



The Panel PC 2100 provides added computing power while the display helps operators keep an eye on key processes and parameters.



For Patrik Reichmuth, project engineer at AVM Engineering, the objectives for the IR-110A pipe joining machine were clear. "More and more processes are being automated because it helps improve quality and productivity as well as relieving workers," he says. "Collection of operating data is also taking on higher priority, because it enables traceability and analysis." These trends certainly apply Georg Fischer's pipe joining machine. "Automating the process ensures consistent fusion quality and offers improved operator guidance with instruction videos. Recorded production data makes the joining process traceable and can be used to verify quality."

Compact design

Size was also a top concern for Reichmuth, since everything would need to fit in the interior of the machine. To achieve the compact dimensions, he selected an integrated safety solution, a Panel PC with an ARwin soft PLC and an X20 controller. The servo motors are controlled by a compact, versatile ACOPOSmicro. BSR's X20 is more than just a remote I/O system; it is also a complete, integrated control solution with a very small cabinet footprint.

Ease of handling

User-friendliness was high on the list of design priorities. The goal was to make safe, correct operation of the machine as intuitive as possible. To achieve this, the touch-screen user interface provides instructions in the form of videos and animations. As one of the first to implement BSR's new Panel PC 2100, AVM benefited from the considerable increase in computing power.

Modular construction

The IR-110A guides users intuitively through the process of joining together plastic pipes using a process of infrared butt fusion. The most important module is the clamping sled on top of the machine, which holds the pipe that is to be joined. A BSR servo motor moves this sled horizontally along a threaded rod to bring the pipe into position for the butt fusion process. The forces applied are measured by a load cell, and used to regulate the amount of force by adjusting the torque.

The module sled is used for tool selection and carries tool modules horizontally with the help of a BSR servo motor. Another servo



A machine operator executes a movement using two-hand operation (green button). The buttons for two-hand operation are connected to and evaluated by a B&R safety controller.



A bead of molten polypropylene joins two pieces of butt-fused 20-millimeter pipe clamped in place on the machine.

motor raises the edge facer and positions it between the two pipes. A DC motor rotates the blade to prepare the ends of the two pipe sections. The cutting speed, peak force and positioning are all defined by a recipe. The facer can be moved to various positions for cleaning or to free up additional space.

The heating element is also moved vertically between the two pipes. Without contact, but at a clearly defined distance, the ends of the pipes are heated to melt the material. It is important that the heating element can be lowered out of the way at any time to allow a quick transition between the heating and joining processes.

New possibilities

GF Piping Systems is very pleased with the increased level of automation and intuitive user interface. Among the many benefits of the new solution is that the automated production steps allow the operator to have two machines running simultaneously. It is also now possible to perform more complex fusion operations on the machine.

Easily expandable

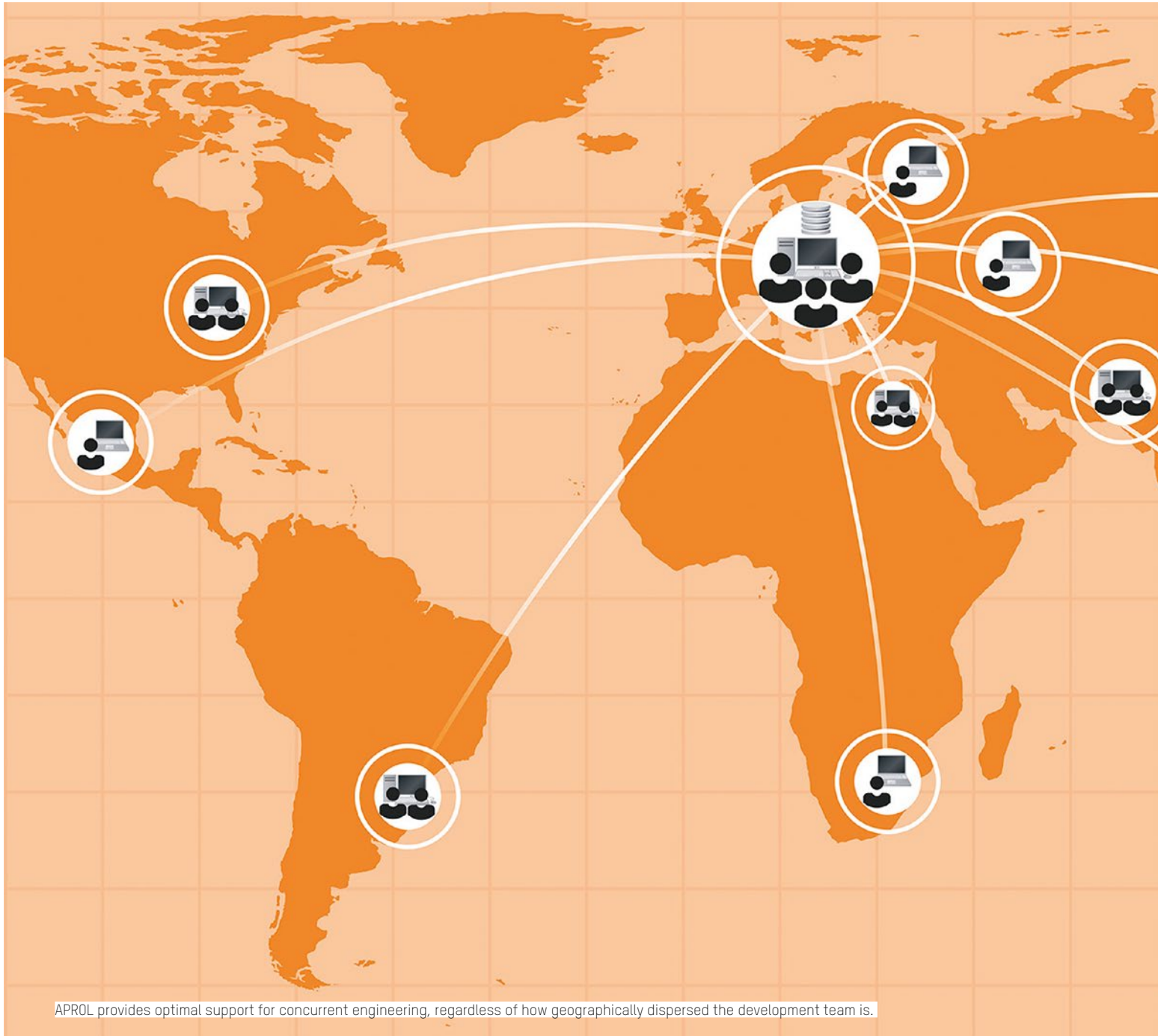
The IR-110A's modular design allows it to accommodate a variety of tool modules. "The next step will be to expand the product family," says Reichmuth, "but at the moment we're working on upgrades to the HMI application, such as the ability for operators to log on using barcodes." ←




Patrik Reichmuth
Project Engineer, AVM Engineering

"User-friendliness was high on our list of design priorities. The Panel PC 2100 from B&R helped us achieve that. Offering a considerable increase in computing performance, it guides the user with videos and animations."

Consistently simple engineering



APROL provides optimal support for concurrent engineering, regardless of how geographically dispersed the development team is.



Process manufacturing companies face ever increasing pressure to get new products to market quickly. Frequently, however, making a new product requires extensive reprogramming. With an open, object-oriented automation platform, plant operators are able to significantly reduce the time and cost involved in making the necessary changes.



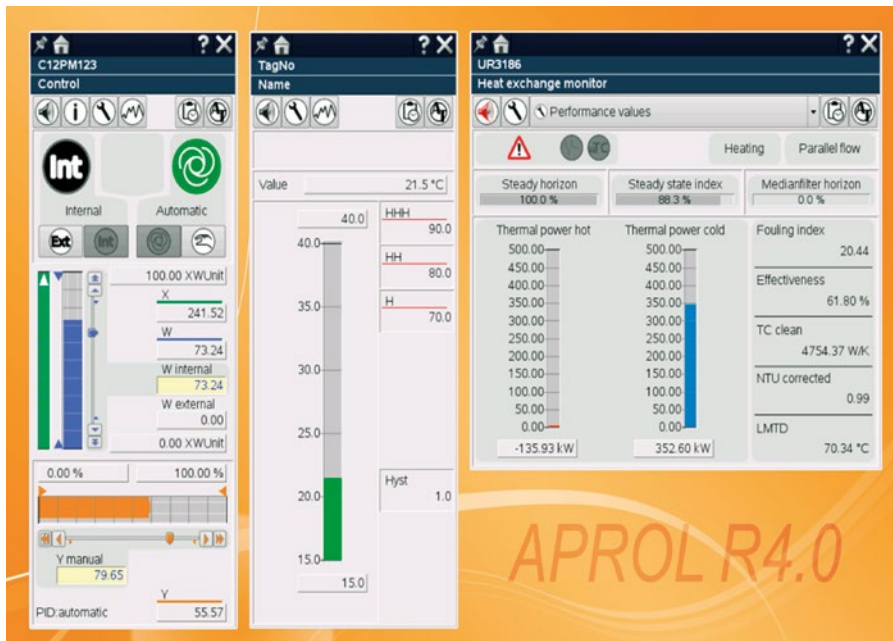
Process control engineers are under pressure to adapt mechanical and software systems to changing production volumes and new products and recipes in a shorter and shorter time. It's the only way process manufacturing companies can keep pace with the demands of their market.

Their aging process control systems, however, generally consist of hardware and software components from various manufacturers. On top of that, the changes often have to be made without interrupting operation and sometimes require contributions from engineers in different locations – a challenging situation for everyone involved.

Object-oriented engineering reduces complexity

"Object-oriented engineering has proven to be an effective tool for mastering these challenges," says Martin Reichinger, who heads B&R's process automation business unit. This approach allows you to design flexible systems with a low error rate.

In object-oriented software engineering, measurement and control elements such as sensors are each assigned a unique identification number, or tag. "Each data point only has to be defined once and is then available throughout the entire system," explains



APROL offers a broad selection of standardized control modules that can be customized or used as-is.

Reichinger. If the tag of a measurement and control element is changed, the change is automatically applied in all the core components of the process control system – including the alarm, graphics, reporting and trend systems.

Since each function is encapsulated in an object or module, changes to a function only have to be made in one location and are applied everywhere in the system. Not only does this speed up the programming process for new developments, but also for any changes that are made to it down the road.

Ready-made blocks

The BSR APROL automation platform is based on the concept of object-oriented engineering. The Process Automation Library (PAL) contains more than 100 standardized control modules that provide all the most important functions of a process control system, such as version management, security login, audit trail, change control and much more. The library also includes modules for advanced process control, model predictive control, performance mon-

itoring, condition monitoring and asset monitoring. All of these functions are fully programmed, field tested and ready to simply be added in and configured. This saves developers valuable time.

“When it comes to software blocks, quality is just as important to us as functionality,” emphasizes Reichinger. New and modified blocks are subjected to strict quality control in the form of unit tests, integration tests and field tests. Only when they have successfully completed all these steps are they ready to be included in an APROL release.

When software is updated at a plant, the integrated DownloadManager ensures that system consistency is maintained even while updating the individual controllers, operator stations and runtime servers.

Protect your know-how

Users are also able to incorporate their own technological know-how by modifying existing control modules or developing entirely new ones. “A USB flash drive with encrypted data transmission ensures copy protection,” says Reichinger. This prevents

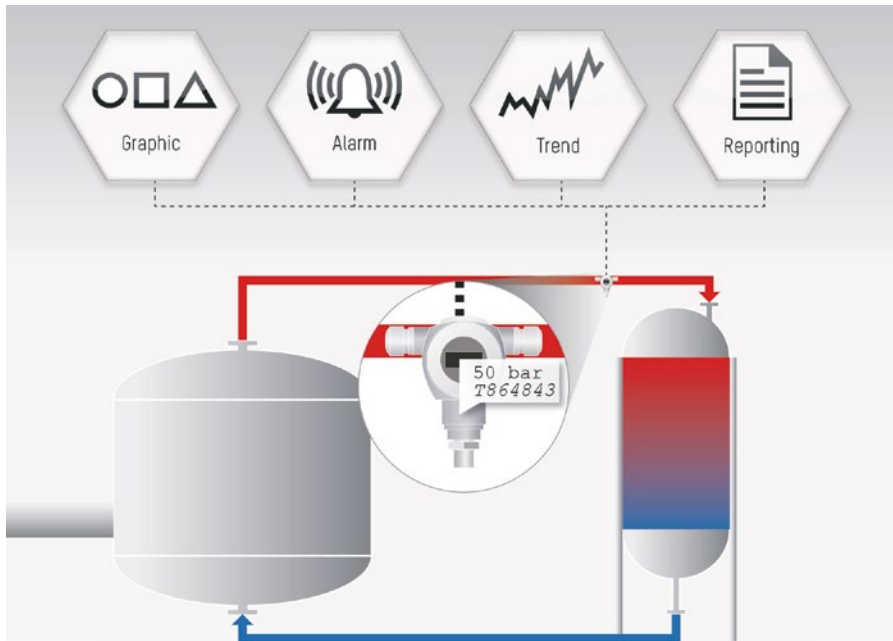
unauthorized access to the intellectual property these custom modules contain.

Customer-specific blocks are kept in separate user libraries. The libraries also include GUI faceplates, as well as all alarm and trend definitions. “Graphic modules and solution blocks can be created simply via drag-and-drop,” adds Reichinger, highlighting the efficiency of library-based engineering.

Global project engineering

Larger production plants typically have numerous engineers collaborating on a project. APROL is organized so that the configuration data for all objects is stored on a central engineering server – one of the core components of the automation platform. There’s no need to worry about access conflicts, because as soon as one engineer begins editing a certain part of the project, all others are restricted to read access only.

APROL also allows engineers to work on a remote computer instead of the engineering server. Known as offline engineering, this allows parts of the project to be devel-



Each sensor and actuator is assigned a unique ID that allows any component in the process control system to access its data. This prevents errors due to naming conflicts.

oped in China or India while the project manager coordinates things from Germany. "A well-structured workflow ensures consistency, even when individual tasks are delegated," says Reichinger.

When you get to the heat of commissioning, you can easily have 20 or more engineers on site. "If they're all working in parallel, conflict handling becomes essential," says Reichinger, "and that's another challenge that can be mastered with the APROL engineering server." The integrated change control feature, for example, documents all the changes made to each part of the project. A convenient version management feature makes it possible to revert parts of

the project to an earlier version, which speeds up development and commissioning considerably.

Full consistency down to the field device

In addition to providing highly efficient engineering, APROL is also easy to link with existing process control and SCADA systems. Supervisory-level communication is handled via fieldbus controllers and gateway servers that are also able to serve as OPC UA clients and servers.

"The platform is open to all the major fieldbus technologies," explains Reichinger, "and with integrated FDT/DTM technology and HART modems integrated in AI/AO

modules, APROL creates a completely uniform automation system from the field level to the management level."

High availability with standard hardware

Developing software for high-availability systems is notoriously complicated and expensive. "Not with APROL," says Martin Reichinger. With B&R's process control system, the required controller redundancy can be implemented inexpensively, even when added to an existing system.

In addition to the primary process controller, there is a second, inactive controller that stays synchronized and is updated cyclically with process data. If the primary controller fails, the previously inactive controller takes over within milliseconds in a completely bumpless transition.

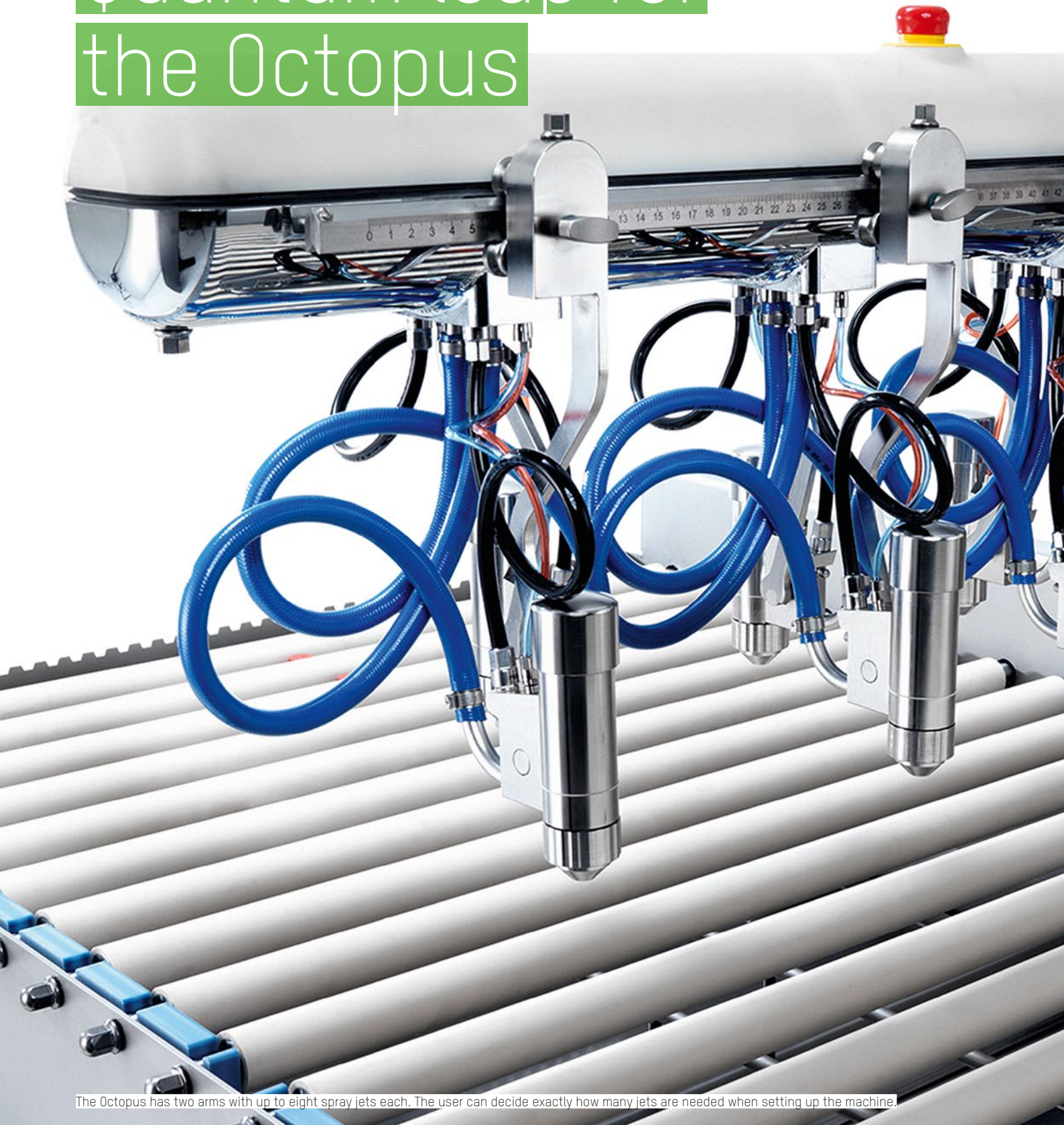
"What's special about this solution is that it relies exclusively on standard B&R hardware," notes Reichinger. Even the programming and project development are the same as with standard hardware. "That opens up the possibility of cost-effective controller redundancy even in smaller operations." ←



Martin Reichinger
Business Manager –
Process Automation, B&R

"Object-oriented engineering is optimal for flexible systems."

Quantum leap for the Octopus



The Octopus has two arms with up to eight spray jets each. The user can decide exactly how many jets are needed when setting up the machine.



If you've ever tried making your own baked goods at home, you may have encountered a familiar problem. Golden brown and taunting you with its delicious aroma, your bundt cake stubbornly refuses to leave the pan. A little butter and flour may have done the trick for your grandmother, but large industrial bakeries rely on release agents from Wito Dübör – applied with special spraying machines that are fully automated with B&R control technology.



"When it comes down to it, what we do is spray release agent into baking pans," explains Dübör's Managing Director Holger Nussbeck. A mid-sized family business in its second generation, Dübör is active all around the world as a leading producer of bakery release agents and the spraying machines used to apply them. Used to coat the pans and forms used in large bakeries, the Swiss company specially develops its spraying machines to meet its customers' unique needs. "Like the baked goods themselves, the bakeware used to make them is constantly changing. The machines we build today need to be flexible enough to adapt to different purposes in the future." To achieve this, Dübör developed the Octopus – a whole new generation of spraying machines with a B&R controller at its core.

Octopus: smart, clean and flexible

Spraying machines like the Octopus have their work cut out for them. On the one hand, they have to meet strict hygiene standards for equipment that comes into contact with food, including clean-in-place requirements. To compete on the market, they also have to be flexible, reliable and offer remote maintenance. In other words: they need an innovative, intelligent control solution.

When creating the Octopus generation of spraying machines to meet this demanding set of requirements, Dübör decided to focus on its core competences and rely on an external partner to develop the automation and HMI solutions. The hardware selection process led them to the compact control modules offered by B&R.



With their clean-in-place design, the spray jets of the Octopus meet the strictest hygiene requirements.



The versatile Octopus can quickly be rolled into position wherever it is needed.

"To my knowledge, B&R is the only manufacturer that can easily and reliably meet Industry 4.0 requirements," says Nussbeck. His decision was strengthened by many years of experience with B&R components and positive experiences from his time in the printing industry.

Collaboration between Dübör, B&R and Tophinke

Development and implementation of the control concept was handled by Tophinke. "Once Dübör had decided to use a B&R controller, B&R recommended us to Dübör. That's how the development constellation came together for this project," explains Ralf Reinhard, project manager at Tophinke. "Working with B&R was straightforward and unbureaucratic. When I submitted a technical support request via their online portal, I never had to wait longer than 24 hours for an answer. That's not something to be taken for granted."

The constellation of partners proved to be a model of success for Dübör as well. "We presented our vision to Tophinke, and they helped us make it happen. Whatever add-ons popped up along the way, it was always possible to implement them. Our project manager at Tophinke clearly understood our vision and always seemed a step ahead of potential new requirements throughout the course of the project," praises Nussbeck.

B&R hardware: hygienic, compact and safe

The Octopus spraying machine features a Power Panel 500 with a 15" touch screen display and integrated B&R controller, designed by B&R specially for foods and beverages and other sectors with

heightened hygiene requirements. Its stainless steel housing offers especially easy, thorough cleaning.

"To the Power Panel we connected peripheral X20 modules for all the sensors and actuators via POWERLINK," says Reinhard. "The flexibility of the X20 modules makes it very easy to implement additional hardware." The emergency stop buttons were wired to the safe inputs of an X20 SLX410 module, which functions simultaneously as a safety controller. This module was added directly to the existing X20 system, saving both space and costs.

Software: modular and scalable

In parallel to developing the new control technology, Tophinke also programmed and continuously optimized the HMI application. The result is a highly modular concept that can be easily expanded at any time. The programmers made versatile operation a top priority for the machine. Among other features, the number of spray jets can now be adjusted as needed.

"We created the Octopus as a modular system," explains Nussbeck. "That means the operator can decide how many jets they want to work with when the machine is being set up. The maximum is eight jets on each of its two arms – or sixteen in total. Not only can they be controlled individually, we also have separate utilization values for each jet. Regardless of how I scale my overall system, I always have the same control and HMI software. All that changes is the number of I/Os. That's an enormous advantage of this solution."



With SafeLOGIC-X, the functions normally provided by the hardware controller are shared by the PLC, safe input modules and HMI units. This is accomplished without sacrificing any of the advantages of B&R's integrated safety technology.



As a centralized operating and control unit, Power Panel devices combine control, visualization and motion control technology into a single package.

Machine operators also have access to a comprehensive file and recipe management system. Users can create and manage their own parameter sets for various baking forms without having to do any programming. "The recipe management system was nearly effortless to create," says Reinhard, "thanks to B&R's mapp Technology software framework, which provides solutions to frequently recurring programming tasks encapsulated in ready-to-use blocks."

Connected: Remote maintenance and machine pool management by B&R

Remote maintenance is provided by B&R's secure, reliable machine pool management system. On the plant side, SiteManager provides a connection to the company's LAN or WLAN network or directly to a mobile network. For service technicians, GateManager coordinates the various machines, user accounts and authorizations.

Both machine and technician connect to the Internet to establish an encrypted VPN connection that can be used to exchange data. Service and maintenance can be performed from anywhere in the world with the convenience and ease of a smartphone or tablet.

The added value for the equipment operator is immense. "We can easily collect data from the machine centrally, since we have the necessary server network and data connection," says Nussbeck. "In the future, we will get to a point where machine maintenance is performed digitally in centralized service centers. If they want, customers will be able to have their OEMs notify them when a ma-

chine is due for maintenance. As a market leader in innovation, we're pleased to now offer our customers this service with B&R."

A quantum leap with B&R control technology

After around 18 months of development, Dübör presented its new generation of Octopus sprayers at the 2015 IBA trade fair. "Our customers view the Octopus as a quantum leap," describes Nussbeck. "The innovative control concept with B&R technology is indeed leaps and bounds beyond the previous generation."

According to Nussbeck, B&R is the ideal partner for a midsized organization, offering highly skilled collaboration and support. "Regardless of where I call, I always get someone who addresses my needs right away. With B&R I've never felt like an anonymous customer," says Nussbeck. ←



Holger Nussbeck
Managing Director, Wito Dübör

"Our customers view the Octopus as a quantum leap, and the innovative control concept with B&R technology is indeed leaps and bounds beyond the previous generation."

Interview

“OPC UA unleashes a whole new dynamic”



Machine tool builder exeron is convinced that OPC UA is the way forward. The specialist in electrical discharge machining (EDM) has developed a communication solution based on the open IEC standard. We sat down with software specialists Michael Lamparth and Paulus Kolb from exeron and Sebastian Sachse, B&R's technology manager for open automation, to find out more about the OPC UA project and what plans and expectations they have for the future.



Why is B&R so committed to OPC UA?

Sebastian Sachse: OPC UA is the solution to one of the greatest challenges in modern manufacturing. Whether you call it Industry 4.0, Industrial IoT or Smart Factory – the advanced manufacturing systems we envision for the future will only be possible if all the components in a production line are able to communicate over a uniform network. From individual sensors up to the ERP and DCS level, the only way to achieve the level of transparency required for Industrial IoT applications is by bridging the gap between IT and OT.

With all the different networks, fieldbus systems and communication protocols already available – why add another one?

Sachse: That's exactly the point: there are too many protocols. On a typical plant floor, you've got machines from a variety of manufacturers, each with their own control systems and fieldbuses or Industrial Ethernet networks. Even if these machines are operating independently of one another, you're looking at added time and effort when it comes to commissioning and maintenance.

And, if you want the individual components to sync up and communicate...

Sachse: Exactly. In this scenario that would be virtually impossible. You'd need to hire expert personnel and spend time and money programming and maintaining countless gateways and interfaces. What's more, as soon as you need response times in the real-time

range – to synchronize a robot with an injection press, for instance – then you're completely out of luck.

Mr. Kolb, what do you hope to gain from implementing OPC UA?

Paulus Kolb: We're looking to cut down on the number of interfaces we have to support. Our first step was to focus on communication within the machines themselves, but the potential for OPC UA in our industry is much bigger than that. In the medium to long term, our goal is to play an active role in developing and promoting standard interfaces based on OPC UA for both M2M communication as well as for integrating with shop floor data collection and ERP systems.

What will be the benefit of that?

Kolb: Standardizing the interfaces frees up our internal resources and allows us to redirect that energy toward features that differentiate our EDM and milling solutions. We're not alone in this approach either – a uniform interface really is a win-win situation for everyone involved. With OPC UA, the right solution for implementing them is already available.

Where's the first place you'll be using OPC UA in your machines?

Kolb: The first application will be to connect the HMI system to the CNC controller on our EDM line. Certain requirements unique to EDM processing prevent us from using universal controllers. Instead we



Sebastian Sachse
Technology Manager – Open Automation, B&R

“OPC UA is the solution to one of the greatest challenges in modern manufacturing: system interconnectivity. OPC UA has the potential to unify the traditional control-level fieldbus systems and enable seamless communication all the way into the cloud.”

developed special CNC controllers and – for lack of a better alternative – created a proprietary interface to connect with our HMI systems. Over the course of 20 years, this approach has resulted in a whole range of interfaces that exeron has had to develop and support with our own resources. The same goes for the diagnostics and maintenance options.

How far along is exeron’s transition to OPC UA?

Michael Lamparth: Our first step was to analyze our proprietary interface and define the necessary data objects. Based on that, we evaluated how these objects and the required functionality could be implemented with OPC UA. We gained valuable insight by evaluating similar approaches taken with the CORBA standard and by the ISW at the University of Stuttgart. Then we looked into how the whole thing could be done with B&R solutions. The result of our collaboration was a functioning prototype.

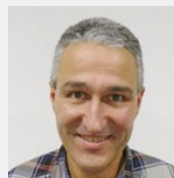
What other potential is there for OPC UA in your field?

Kolb: The increasing level of automation we’re seeing from our customers means the number of interfaces that potentially need to be supported – throughout the line and beyond – is growing as well. One example is the scanner module we developed to equip our tool/workpiece magazines for 24-hour operation. Over the years, we’ve defined numerous interfaces to accommodate different scanner units and magazine types in the machine control and DCS systems. We’d now like to unify those with OPC UA as well.

Lamparth: The other thing is that we’re not the only ones who offer these types of magazines. And since the other machines also use proprietary interfaces, manufacturers of cell control systems are forced to deal with a huge variety of scanner units and their respective interfaces. It stands to reason that all parties involved will benefit from an interface that provides information such as tool position in a uniform way. An OPC UA profile would lend itself to this.

Does such a profile exist?

Lamparth: We’ve taken on a pioneering role in this, and have developed a scanner interface based on OPC UA that we use internally. It could serve as a blueprint for a profile, which ideally would then be standardized by the OPC Foundation. We’re convinced that

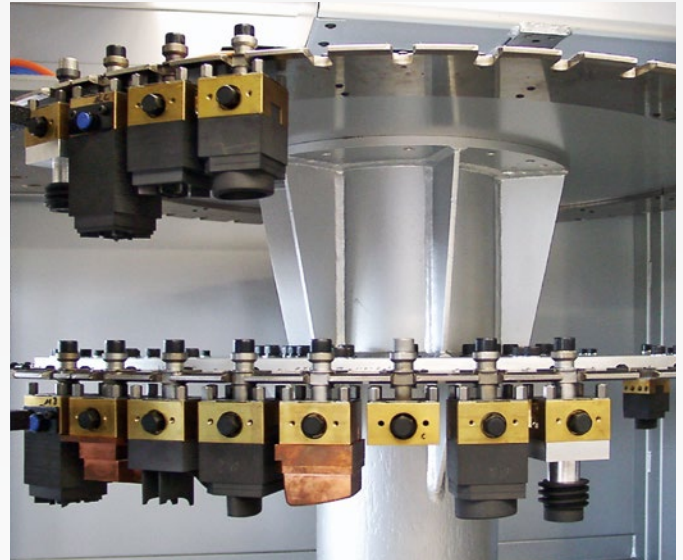


Michael Lamparth
Software specialist, exeron

“Standardizing the interfaces frees up our internal resources. With the OPC UA connectivity provided by B&R, the right solution for implementing them is already available. The result of our collaboration was a functioning prototype.”



With full integration of all the systems and assemblies involved in the process, exeron's EDM line has a remarkably small footprint. It is also possible to connect a variety of automation systems - for the first time providing a uniform interface for the tool and workpiece magazines offered by exeron and other machine tool builders.



Each magazine for tools and workpieces is equipped with a scanner unit. exeron has defined an interface based on OPC UA to replace the multitude of proprietary solutions and hopes to see it standardized by the OPC Foundation.

this would be met with great interest on the part of control system manufacturers. Existing systems can of course be connected via a gateway, but going forward our devices' internal communication will all be OPC UA. We realize, of course, that machine operators aren't going to start listing this kind of interface in their specifications until it's been around and has established itself. But then they'll start asking for it.

There are plenty of real-time protocols around.

Why does it have to be OPC UA?

Sachse: There are a number of reasons. For starters, OPC UA is an independent and widely-recognized standard that connects the worlds of production and IT. It also offers built-in security functions that ensure data is transferred securely and reliably. And then there is one very decisive difference: OPC UA doesn't just transmit data, it transmits information.

Mr. Kolb, how do you view OPC UA's prospects in general?

Kolb: Excellent. Current trends like Industry 4.0 and IIoT and the ongoing OPC UA developments - like open sourcing the stack - are dialing up the pressure to develop and implement standardized interfaces at every level of the automation pyramid. Prior to OPC UA there was no standard that was simultaneously open, secure, hardware independent, cross-platform and scalable. So, for the first time, OPC UA makes it possible to have uniform interfaces from the ERP level down to the fieldbus level. That unleashes a whole new dynamic.

Speaking of the fieldbus level - what do you think about the real-time TSN extension for OPC UA?

Lamparth: It's hard to make a real assessment there, because the standard is still evolving. We would love to see that field-level determinism though. It would be great to see it in standard interfaces for drives that would allow us to switch effortlessly between drives from different manufacturers. For now, we will continue to rely on protocols like POWERLINK that are able to transmit 150 bytes of cyclic process data highly deterministically and synchronously within 400-microsecond cycle times. OPC UA can't do that yet, but we'll see where the ongoing developments take us. ←



Paulus Kolb
Software specialist, exeron

"Prior to OPC UA there was no standard that was simultaneously open, secure, hardware independent, cross-platform and scalable. For the first time, OPC UA makes it possible to have uniform interfaces from the ERP level down to the fieldbus level. That unleashes a whole new dynamic."



Label printing

Single-source, print to finish

As self-adhesive labels find increasing use as a design element for product differentiation, label makers have to produce a wider variety of labels in smaller batches. Rising energy and raw material prices mean the machines also have to allow shorter setup times, less paper waste, and reduced energy consumption, all while ensuring high print quality. Machine manufacturer Codimag solves this complex equation with future-proof solutions based on a proven semi-rotary offset technology, innovative ink transfer control systems, and the latest automation technology from B&R.



Beyond their primary function of indicating the brand and the nature of a product, self-adhesive labels have increasingly become a design factor used for product differentiation. In addition to elevating quality expectations, this forces label makers to produce smaller batches of increasing variety. Additional constraints like energy and raw material prices mean the machines must also be quick to set up, produce minimal waste, and operate energy efficiently – all while ensuring high print quality. Just outside Paris in the French town of Bondoufle, machine manufacturer Codimag solves this complex equation with future-proof solutions based on proven semi-rotary offset technology, innovative ink transfer control systems and the latest automation technology from B&R.

The right technology for the market

Compared to other printing methods like flexo or digital, offset offers better print quality with lower start-up costs. Offset plates are faster to produce, so new jobs can be started very quickly. The disadvantage of rotary offset is the fixed printing size, which Codimag has dealt with by implementing a semi-rotary process known as intermittent feed. This method results in lower speeds than a full-rotary press but enables faster format changes without having to exchange cylinders, making it particularly well-suited for short and medium runs. “Although batch-size-one production will remain quite rare in the label market, the trend is clearly in the direction of smaller batches,” notes Codimag CEO Benoît Demol. The European average was 4900 meters per batch in 2015 – 1000 meters shorter than the previous year.

By 2020, the average is expected to approach 2500 meters. “As print runs grow shorter and shorter, flexible automation systems from B&R help our machines meet our customer’s needs with fast setup and changeover paired with unbeatable quality.” The ink



Label makers like Estrabrol rely on Codimag machines featuring B&R automation to produce labels with distinctive finishing options that meet the high requirements of export-oriented winemakers like Ollieux Romanis.



ACOPOSmulti servo drives helped Codimag successfully implement its modular machine design.



Built around a complete automation solution from B&R, Codimag's VIVA offset label presses ensure quick setup, reduced material waste and maximum print quality.

transfer technology used in the print units is also a key factor in label quality and machine efficiency. Codimag has successfully implemented waterless offset technology for color stability and predictability. Here, printing plates are covered with a layer of silicone to repel the ink in the non-print areas, and ink viscosity is controlled by temperature controllers. Compared to wet offset, this technique saves the time spent on finding the right balance between water and ink, and the resulting material waste. Codimag also developed Aniflo inking units, which use temperature control to ensure consistent ink coverage. This innovation allows ink density to be adjusted quickly and precisely to the user's needs. Codimag's VIVA offset label presses also come with finishing units for stamping, screen-printing, flexography, laminating, die-cutting, or embossing.

Single-source efficiency and flexibility

The VIVA presses are built around a single-source automation solution from B&R, featuring a powerful Automation PC as a core control unit and a 15" Automation Panel and T30 Power Panels as HMI units. The cylinders and rolls are all driven by ACOPOSmulti servo drives and B&R servo motors, and synchronized machine-wide via the hard real-time POWERLINK network. A typical VIVA machine has around 30 B&R brushless motors. The highly integrated automation solution – with a single programming tool for all components – allows Codimag to program everything efficiently in-house. Label format changes and registration controls are all performed electronically with X20 stepper modules. Single-sourcing the entire automation solution from B&R helps Codimag reduce costs and

respond more flexibly to customer requirements. "Thanks to the many mechatronic functions included in B&R systems, we're able to implement a new machine function on customer request in only a few weeks, and we can standardize our developments across our entire portfolio," explains Demol.

Automation for a new generation

In the fall of 2016, Codimag launched a new generation of VIVA machines based on a fully modular design. The redesign aimed to build entirely customized label production lines in the most flexible way possible, with printing and finishing units mounted and assembled like Lego pieces. B&R and Codimag worked together closely on this new machine concept. B&R's flexible and scalable automation architectures as well as the modular ACOPOSmulti servo drive system with one-cable motor connections made implementation a success both technically and economically. "The one-cable connections greatly simplify cabling and reduce costs," notes Alexandre Morin, head of automation engineering at Codimag. For the new VIVAs, Codimag also redesigned its HMI system using B&R's mapp View software technology to create web-based multi-touch visualizations. Operators now enjoy a totally new experience with 3D views of all printing and finishing units, easy two-finger zooming, video wizards for settings, interactive maintenance assistance and more. Other new features will enable detailed analysis of machine performance. Using X20AP energy measurement modules together with the mapp OEE software component, the new VIVAs provide users valuable KPIs such as paper consumption, power consumption, label quantities and output rates. ←



Benoit Demol
CEO, Codimag

"As print runs grow shorter and shorter, flexible automation systems from B&R help our machines meet our customer's needs with fast setup and changeover paired with unbeatable quality."



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