

# automation <sup>09.17</sup>

The B&R Technology Magazine

Process control

## Protecting process control systems from cyberattacks

OPC UA "No digitalization without standard interfaces"

SuperTrak Boost productivity with anti-sloshing

PERFECTION IN AUTOMATION  
A MEMBER OF THE ABB GROUP





Control performance monitoring



Plant automation



Advanced process control



Process control



# Aspire higher APROL process automation

[www.br-automation.com/APROL](http://www.br-automation.com/APROL)

## Scalable

50 to 500,000 channels

## Reliable

High-availability at every level

## Flexible

For primary and secondary production

## Integrated

Same system software for all tasks



ETHERNET  POWERLINK

open  SAFETY

PERFECTION IN AUTOMATION  
A MEMBER OF THE ABB GROUP



# editorial

## publishing information

automation:  
The B&R technology magazine, Volume 17  
[www.br-automation.com/automation](http://www.br-automation.com/automation)

Media owner and publisher:  
B&R Industrial Automation GmbH  
B&R Strasse 1, 5142 Eggelsberg, Austria  
Tel.: +43 (0) 7748/6586-0  
[automation@br-automation.com](mailto:automation@br-automation.com)

Managing Director: Hans Wimmer

Editor: Alexandra Fabitsch  
Editorial staff: Craig Potter  
Authors in this edition: Torben Svane Christensen,  
Franz Joachim Rossmann, Olivier Rambaldelli,  
Adrien Spinassou, Carmen Klingler-Deiseroth,  
David Löh, Martin Reichinger, Sebastian Sachse

Graphic design, layout & typesetting:  
Linie 3, [www.linie3.com](http://www.linie3.com)  
Printing: VVA Vorarlberger Verlags-  
anstalt GmbH, Dornbirn  
Edition: 100,000  
Published at: B&R Strasse 1  
5142 Eggelsberg, Austria  
Cover photo: iStock

All articles published in this magazine are protected by copyright. Translation, reproduction and duplication are prohibited without the expressed permission of the publisher. B&R assumes no liability for any errors they may contain.

Follow us



**Dear Reader,**

Smart technology, cloud solutions, big data, seamless connectivity. These new topics have woven their way into our day-to-day work and increasingly dominate our discussions with customers. In the end, they all point to the IIoT: the Industrial Internet of Things.

The IIoT is analogous to the Internet we all know and love – except that here the focus is on industrial machinery and equipment. Sensors on the machine, for example, enable us to detect component wear and calculate condition parameters for optimized maintenance scheduling. Solutions like this give us more comprehensive and detailed control over machines and processes. The increasingly intertwined worlds of information technology (IT) and operational technology (OT) create fertile ground for innovative new products and solutions. Unprecedented connectivity gives every link in the value chain immediate access to information generated throughout the value creation process, resulting in dynamic B2B supply chains that self-organize and self-optimize in real time. Industrial IoT solutions empower even small and midsized enterprises to respond to the rapidly changing conditions of global markets.

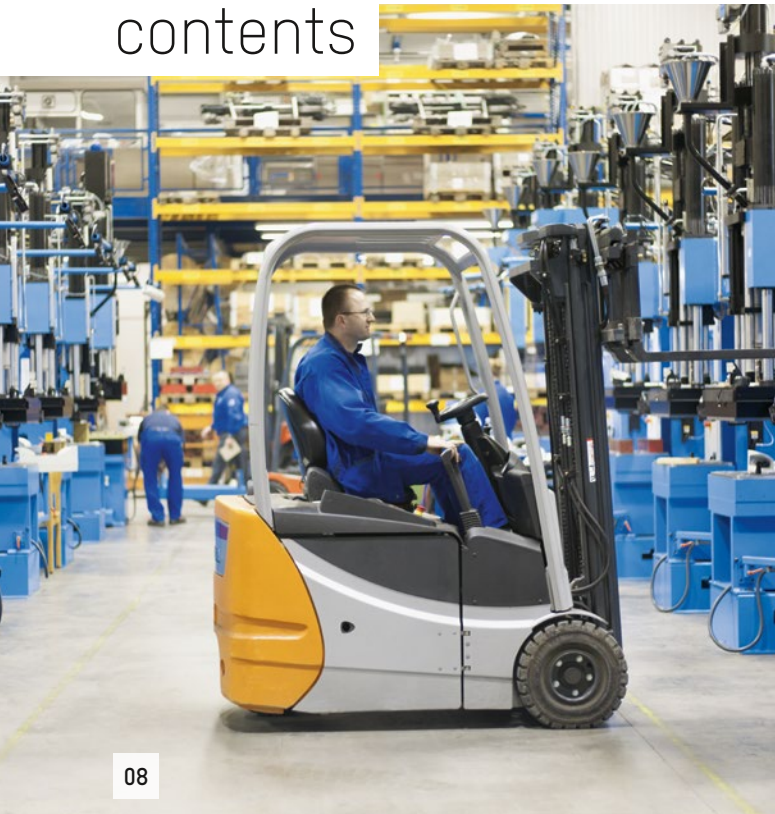
The goal of these solutions is to make effective and profitable use of data as a strategic resource by mining large volumes of data to identify logical correlations. B&R's hardware provides numerous technical features that help customers collect the data that forms the common language binding individual assemblies and processes. Advanced software transforms the masses of collected data into valuable information that can be visualized and utilized.

One of the IIoT topics we're currently working on intensively at B&R is predictive maintenance. This approach allows users to monitor the current condition of their machine based on real data. By using this data to calculate the next maintenance interval, they are able to prevent unscheduled downtime and significantly improve machine availability. B&R's particular expertise lies in the collection of high-quality data and in the technology needed to share it with other participants in the process. This all sounds good in theory, but what do real-world Industrial IoT applications look like? Find out in this issue of *automation*.

Happy reading!

Ralf Pühler  
*Open Automation Technologies*

# contents



## → cover story

**04 Protecting process control systems from cyberattacks**  
Virus scanners, firewalls and passwords alone no longer offer sufficient protection against hackers. Effective cybersecurity requires custom-tailored solutions.

## → interview

**30 "No digitalization without standard interfaces"**  
The biggest obstacle facing Industry 4.0 is the absence of a uniform interface. So why is it so difficult to develop an interface standard that lets you connect any peripheral device to a machine the way USB does for PCs? Dr. Harald Weber of the VDMA and B&R's Patrick Bruder and Sebastian Sachse explain.

## → report

**08 Injecting flexibility into machine design**  
**LWB** laid out demanding requirements for its new injection press. B&R's mapp Technology delivered the smartphone-like operation, rapid software development and easy management of machine variants they were looking for.

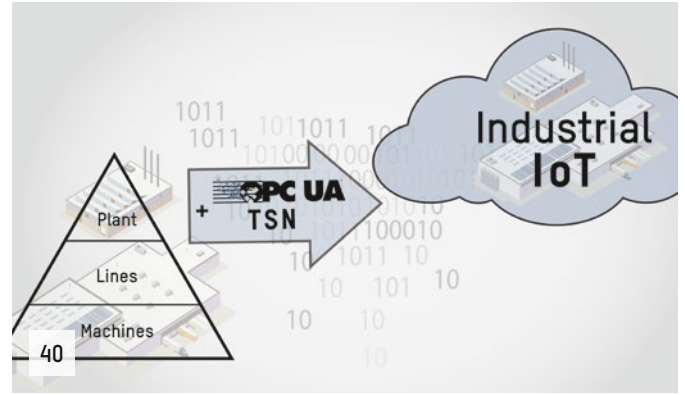
**22 Finally, a flexible feeder**  
A feed module is typically designed for a specific product, and any changes come at the cost of productivity. With an openROBOTICS solution from B&R and COMAU, the versatile new FlexiFeed from **Elettrosystem** brings long-awaited benefits.

**36 Perfect partnership for precision printing**  
Danish flexography specialist **TRESU** delivers highly customized printing lines to clients all around the world. The company manages its development resource juggling act through close cooperation with B&R.

**44 Sowing the seeds of smart manufacturing**  
To handle the increasing demands on quality faced by seed processors, **Dynavia** developed a smart seed processing line equipped with a full B&R solution and APROL factory automation.



26



40



36



44

➔ **technology**

- 14 **Reduce costs through optimized maintenance**  
Equipment operators need to improve quality and availability while minimizing maintenance overhead. Advanced strategies make it possible.
- 18 **Over the edge and into the cloud**  
Operators of machinery and equipment have their sights set on the Industrial Internet of Things. Edge computing will give them the cloud connectivity they need to make the most of it.
- 26 **Safety technology – Seamlessly scalable**  
In the past, machine builders have had to develop separate safety concepts for each machine variant. B&R's freely-scalable integrated safety is available at prices that can compete with conventional relay technology.
- 40 **OPC UA TSN – From the field to the cloud**  
Automation suppliers are poised to clear the first hurdle on the road to a promising future of Industrial IoT solutions: seamless communication based on open standards.

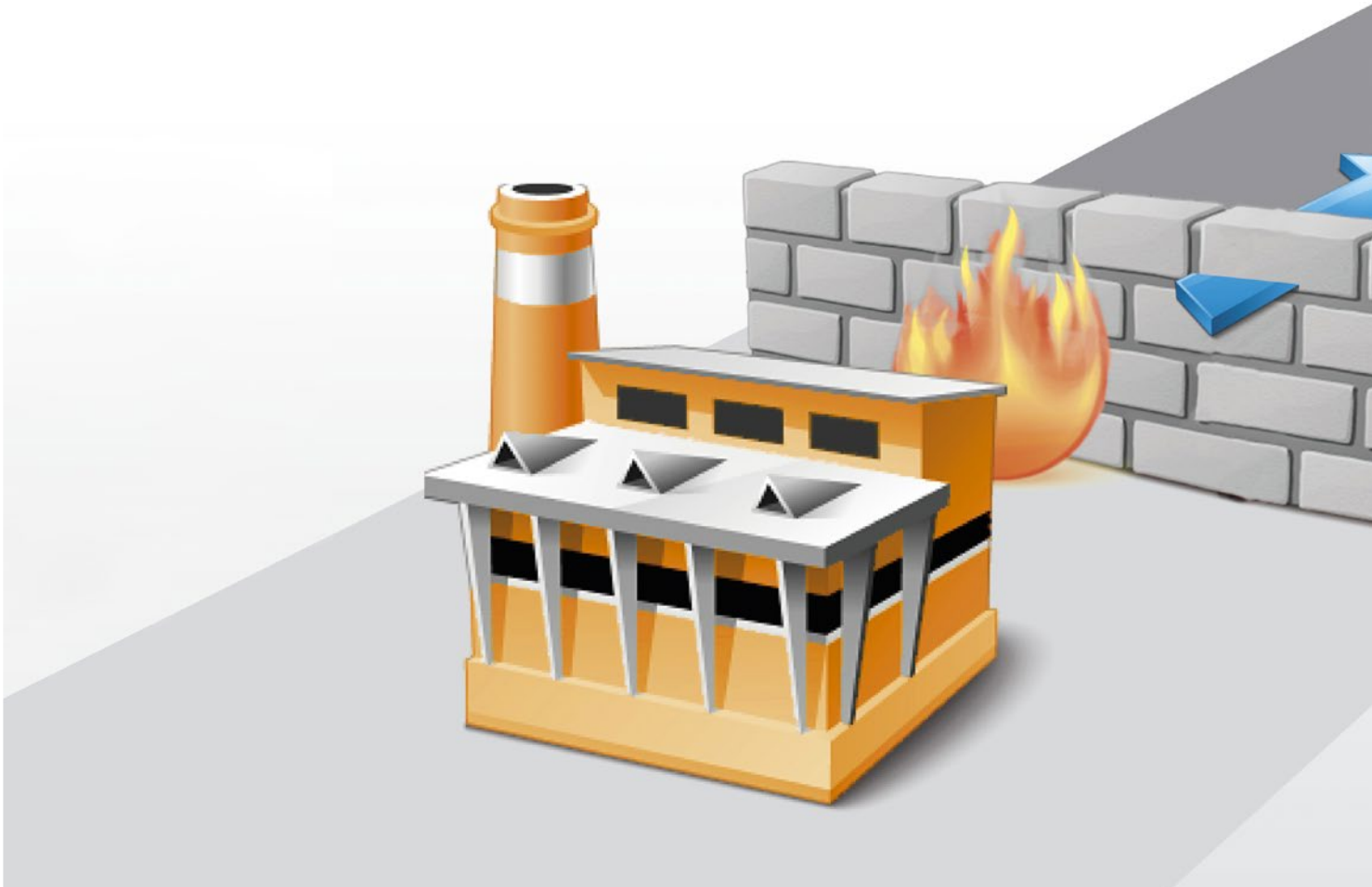
➔ **news**

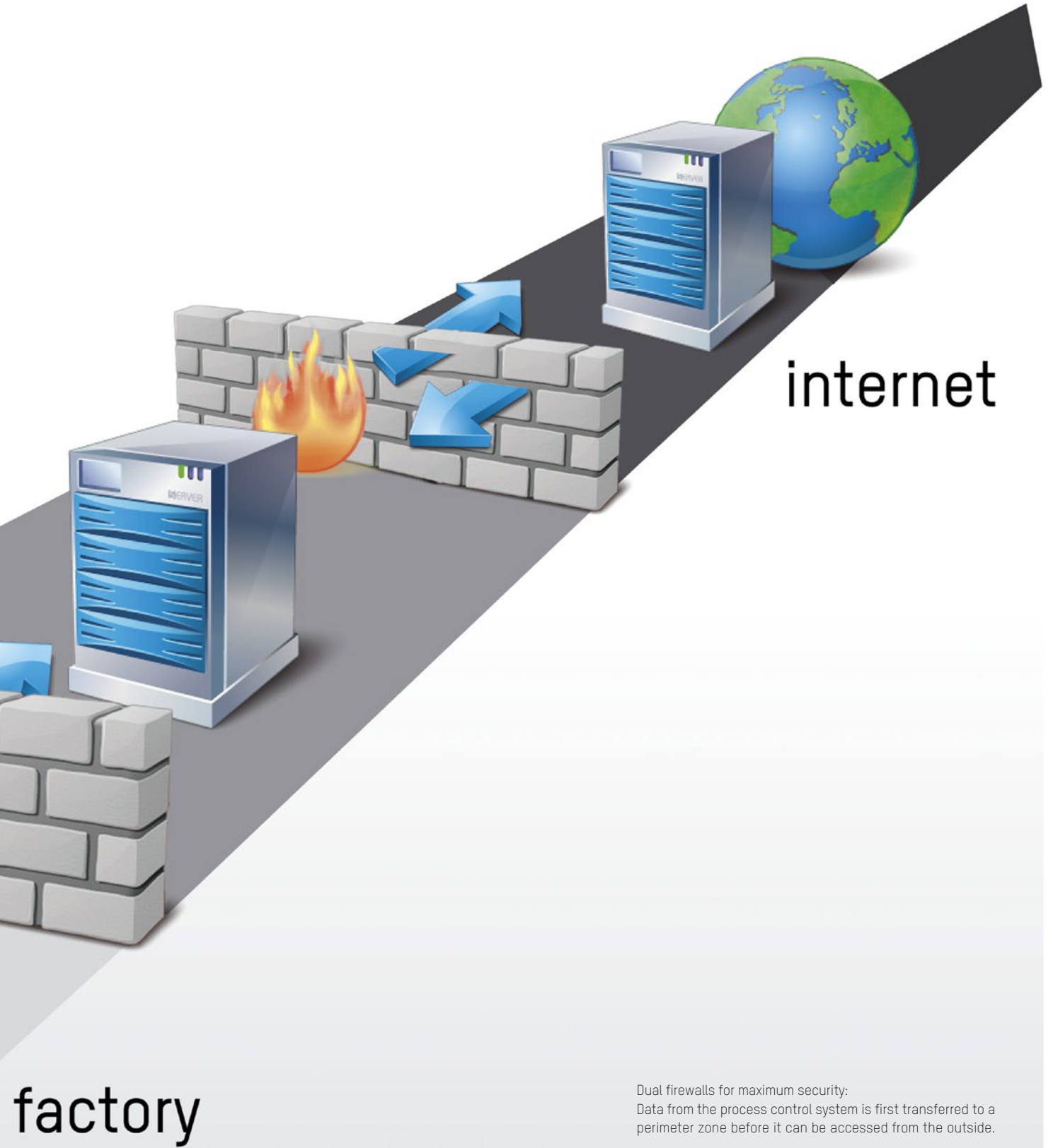
- 13 **Advanced rotational control**  
New software package suppresses skew oscillation.
- 17 **Advanced service functions for machinery and equipment**  
B&R further expands mapp Technology framework.
- 21 **Two operating systems on one device**  
B&R is introducing a hypervisor for its automation system.
- 48 **Boost productivity with anti-sloshing**  
SuperTrak offers anti-sloshing technology that suppresses the formation of surface oscillations when transporting liquids.

# Protecting process control systems from cyberattacks

Cybersecurity is becoming an increasingly urgent concern for process manufacturing companies. Virus scanners, firewalls and passwords alone no longer offer sufficient protection against hackers. What they need is a comprehensive security solution tailored to their unique situation.

perimeter zone







Particularly serious security risks are posed by weak passwords, failure to install software updates and easy access via USB flash drives.



The production and automation levels of process manufacturing plants are increasingly interconnected, both with each other and with the Internet. The advantages of connectivity, however, are accompanied by heightened susceptibility to sabotage and tampering through malicious software like viruses, trojans and worms. As these threats continue to grow, companies are on the search for the best way to protect their systems.

At the 2016 Hannover Messe trade fair, Germany's digital industry association, Bitkom, revealed just how high the risks already are. A survey of 504 manufacturing companies conducted by the association showed that 69% had fallen victim to data theft, industrial espionage or sabotage in the past two years. Accounting for more than a third of the incidents, the most common offense was the theft of smartphones, computers or tablets. A further 18% reported acts of sabotage aimed at disrupting or crippling business operations.

#### Planning and risk assessment

Virus scanners, firewalls and passwords are already standard components of any IT security solution. "To protect a process control system from cyber attacks, however, these measures alone are not enough," says Martin Reichinger, manager of B&R's process automation business unit. According to Reichinger, the design process for any new processing plant should include a risk assessment that can be used to develop a comprehensive plan for cybersecurity. After all, the right security strategy depends on the processes, infrastructure and other local conditions. "There is no one-size-fits-all solution when it comes to cybersecurity," emphasizes Reichinger.

#### Security cells for maximum availability

One component of a security concept might be to isolate processing steps into task-specific cybersecurity cells. This helps ensure the availability of the system as a whole, as Reichinger explains: "In the event that certain infrastructure elements are affected by an attack, the other cells are able to continue operation. A threat within any one cell is restricted to that cell alone."

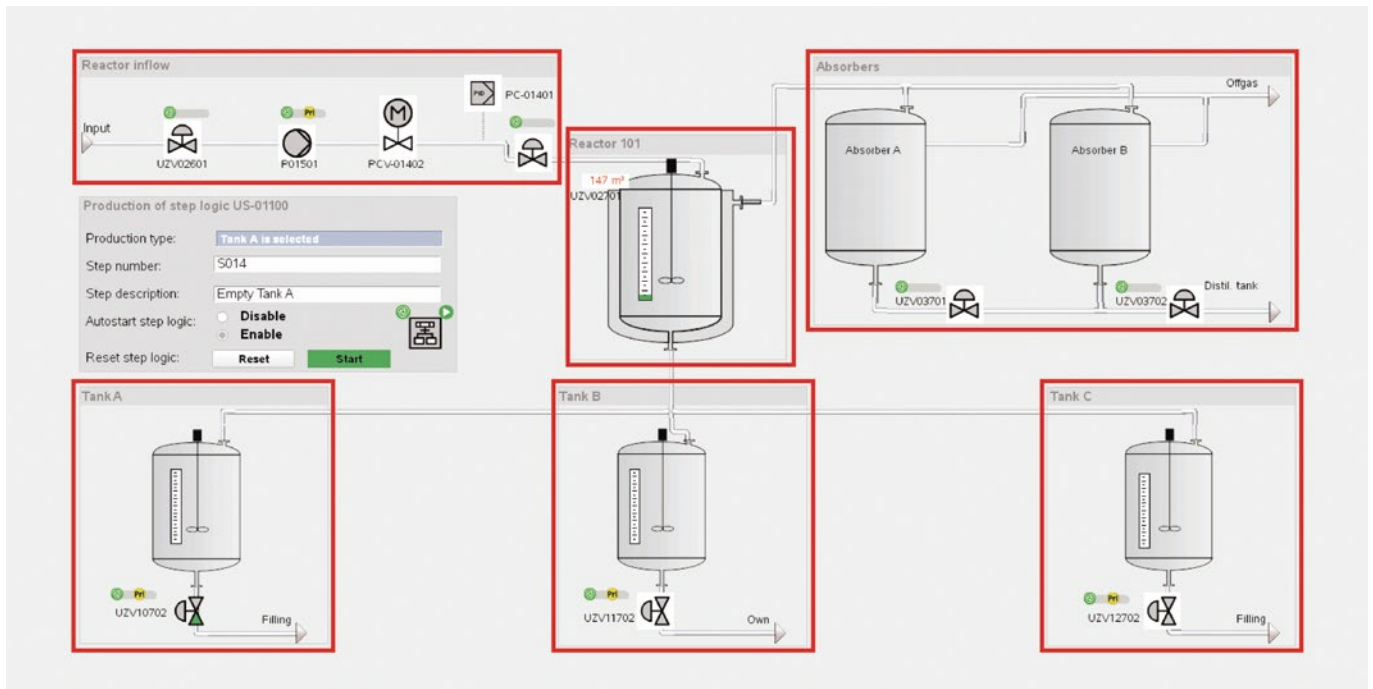
If a process is unsuitable for division into cells – due to a lack of buffer containers, for example – the system can alternatively be safeguarded by assigning task-specific user rights for access and operation. "What's important is that you define these areas of responsibility under consideration of all production levels," says Reichinger. As a fundamental principle, access permissions should only be established where they are absolutely necessary.

#### Dual firewalls for double protection

"There are numerous methods for protecting process control systems from cyber attacks," says Reichinger. Tamper resistance is always an important feature. The security architecture must be designed to provide maximum protection against manipulation of important data.

The foremost rule for process control systems is that they are isolated from higher-level systems by a secure perimeter network, known as a demilitarized zone or DMZ. Data from the process control system is first transferred to this perimeter network before it can be accessed from the outside. The perimeter network is guarded by either a triple-homed firewall, which enables it to be connected separately, or two firewalls from different manufacturers.





Dividing individual processing steps into security cells helps contain the impact in the event of a successful attack.

“In most cases, this solution provides sufficient time to detect and block an attack in the event that the first firewall is breached,” says Reichinger. Deep packet inspection technologies are also used to detect unauthorized operations in real time.

### SQL databases particularly secure

Among APROL’s most significant benefits, according to Reichinger, is that its SQL server grants external networks exclusively read-only access. This severely hampers the ability of hackers to manipulate data on the servers from the outset. Additionally, all APROL servers are equipped with an integrated firewall. “The firewall is installed and configured automatically at the first startup,” says Reichinger. To offer the best possible security, APROL is based on the operating system SUSE Linux Enterprise Server 12 SP4.

### Minimizing points of attack

Germany’s Federal Office for Information Security (BSI) stipulates that system software be hardened – a requirement that B&R satisfies with APROL 4.0 and higher. These versions contain only software components and functions that are essential to the program’s ability to fulfill its intended task. Often, attackers are able to gain access to a server by misusing a program that never needed to be there in the first place. “Similarly, it is also important to close up unused ports and hardware interfaces that would otherwise allow someone to insert a flash drive and upload malicious software,” notes Reichinger.

He concludes with one final consideration: “Not even the best security design can protect you against everyday carelessness.” Particularly serious risks are posed by weak passwords, poorly

maintained user permissions and failure to keep software up to date. “Security must be a top priority for plant operators over the entire lifespan of the system.”

### Safety and security

Safety and security are two critically important aspects of industrial manufacturing. Safety technology prevents humans from being harmed by the equipment they are operating. Before an accident is able to occur, the safety technology must guarantee that the machine or line shuts off automatically or slows down sufficiently to eliminate the risk. Security technology, on the other hand, prevents systems from being intentionally manipulated by humans. In the field of IT, security threats include trojans, viruses and hacker attacks. As humans and machinery operate more and more closely together, both safety and security are taking on increasing significance. ←

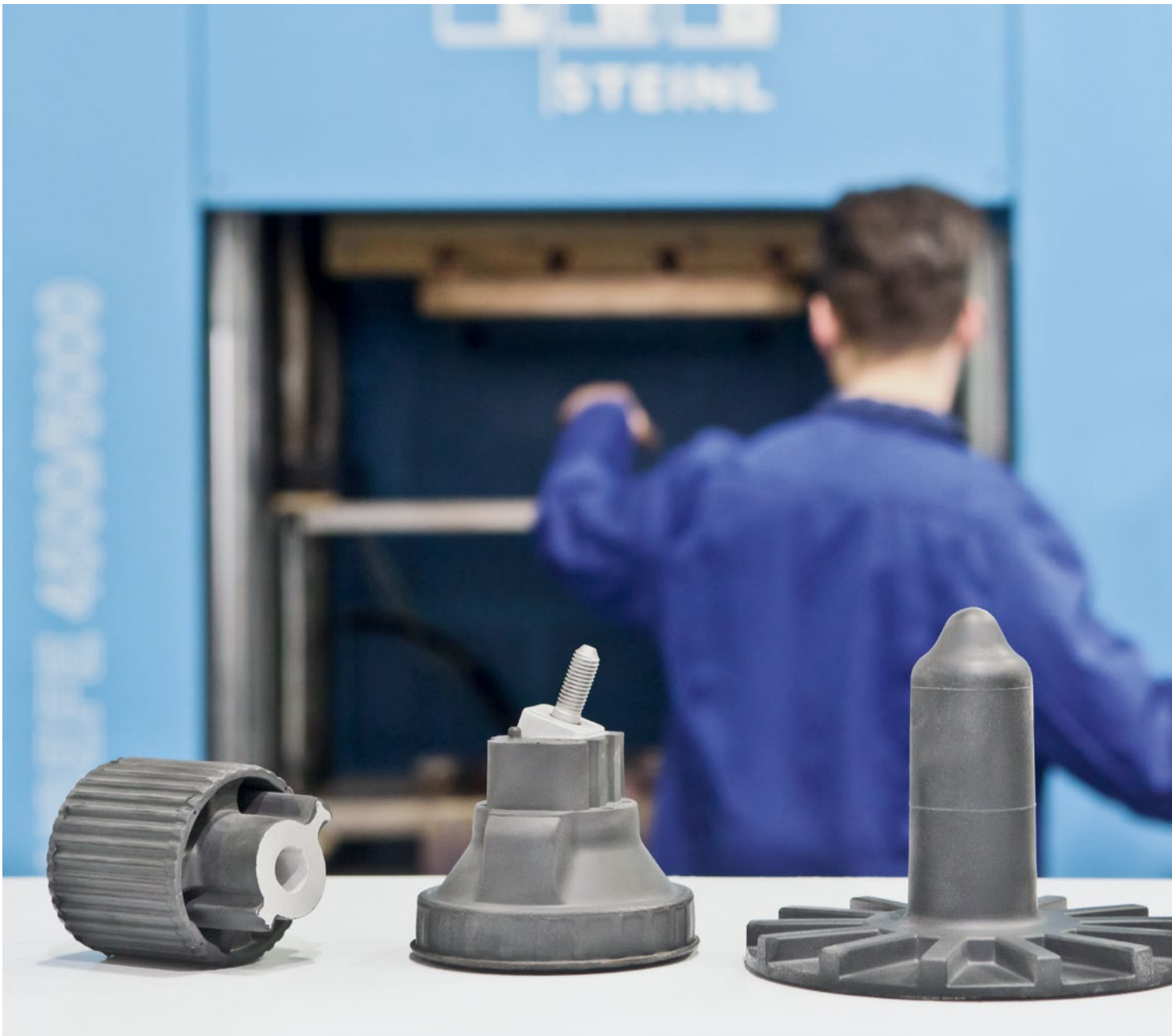


**Martin Reichinger**  
Business Manager  
Process Automation, B&R

“There is no one-size-fits-all solution when it comes to cybersecurity. The solution must always be tailored to the circumstances at hand.”

Elastomer injection molding

# Injecting flexibility into machine design



The requirements LWB laid out for its new generation of rubber injection presses were both demanding and innovative: smartphone-like operation, rapid software development and easy management of machine variants. With B&R's mapp Technology, the company has achieved these goals successfully and sustainably.



No car can do without them – there are hundreds in every vehicle. They cushion, insulate, filter, divide, connect and seal: molded parts made of rubber and thermoplastic elastomers. And it's not just cars that rely on them, but nearly any machine you can think of – from washing machines to crude oil pump stations. With new compounds being developed all the time and parts becoming increasingly intricate, these materials and their potential uses are growing more widespread and diversified by the day.

"The more varied the range of applications, the more specialized the requirements that these elastic components place on production systems," says Peter Radosai, LWB's head of sales for the European market. "We've created a broad palette of standard and specialty solutions for injection systems, clamping units and entire injection molding machines that allows us to accommodate any set of requirements."

#### **A variant-rich machine portfolio**

In the 50 years since the first LWB injection press was completed, the company's original portfolio of horizontal and vertical variants for rubber has expanded to include systems for producing molded parts from thermoplastic elastomers as well. To meet the diverse needs of its primary market – automotive suppliers all around the world – LWB machines need to cover the full spectrum from low-cost to high-end solutions. For more than a decade, the company got by with only two controller variants, both based on proven B&R technology.

"Despite making continual improvements to the controller over four generations, the time had come to take a more daring leap in innovation," explains Radosai. One particular innovation that LWB had in mind was to model the new design after modern smartphones in terms of operation and usability – which would be revolutionary in the field of rubber injection molding.

#### **Smartphone-like usability and operating philosophy**

"We're seeing more and more users wanting to navigate by swiping and pinching – like they do on their smartphones," reports Radosai. "At the same time, there are heightened expectations for faster response times, new control algorithms, more extensive process monitoring and data acquisition, more in-depth diagnostics and help systems, and integrated energy management."



Source: LWB



Molded parts made of rubber or thermoplastic elastomers are growing more intricate, and injection molding specialists like LWB are helping them conquer a rapidly expanding range of applications.

Following an intensive and impartial evaluation of the market, B&R emerged victorious over a well-known supplier of application-specific control solutions. "It was the total package that convinced us," recalls Radosai.

A key part of that total package: mapp View. Based entirely on web standards like HTML5, CSS and JavaScript, B&R's new HMI solution gives developers all the benefits of web connectivity right in the automation software – without requiring any training in the underlying technology.

#### **mapp View for flexible HMI solutions**

Another benefit of B&R's HMI solution is the fact that – with content and layout handled separately – design changes can be implemented with minimal effort and easily transferred to other machines. mapp View also offers maximum flexibility in terms of HMI hardware. Any device that can run a web browser can be used as a display terminal. What's more, it was easy for LWB to integrate web-based user interfaces for third-party components directly into its own HMI application. "When rubber parts leave the mold, they have a temperature of 160°C and are slow to cool," explains Radosai, "so it is particularly important that the terminal is easy to use even with gloves on."

LWB selected an HD TFT multi-touch display unit with an 18.5" diagonal, in combination with a Panel PC 2100, which is suitable for either swing arm or control cabinet mounting. The modular Panel PC allowed LWB to achieve another of its core objectives. All LWB injection presses – even those for the most cost-sensitive markets – now use the same control hardware.

#### **One software project for all machine variants**

In terms of software architecture, the changes were even more fundamental. With B&R's mapp Technology, LWB has only a single software project to manage. "Before, 10 machines meant 10 different software projects. With different hardware configurations and custom adaptations, we'd have to get into the code and make changes every time," says LWB process engineer Markus Zabel, the main author of the requirement specifications for the new controller.

With B&R's mapp Technology, all the standard modules available for an LWB injection press are managed in a single project. During commissioning, the technician simply opens configuration screen in the HMI application and enables whichever modules are actually being used. Without writing a single line of code, the necessary software can then be generated at the push of a button.

"Many of our customers choose to add modules to their machine later on. Now, adapting the software to these expansions is child's play. You just open the configuration page, enable the newly added module with a click, restart the controller and you're done," praises Zabel. "And now it's also just as easy to synchronize the software versions of machines that have accumulated over time, or to perform software updates."

#### **Custom solutions, quickly integrated**

The adaptability of the control software isn't limited to machine modules designed in advance, however. mapp CodeBox makes it possible to integrate future options, customer-specific machine modules, custom safety technology or handling systems without having to modify the machine's main project. This HTML5 application



**Peter Radosai**  
Head of Sales – Europe, LWB Steinl

"Thanks to mapp Technology, we were able to stay on schedule and have the new controller ready for series production in time for K 2016. To do that with a conventional approach would have required significantly more personnel and financial resources."



LWB has relied on B&R control and HMI solutions for its plastic and rubber injection presses since 2001.



Each year, more than 400 rubber injection presses leave the production floor of LWB's headquarters in Bavaria.



**Markus Zabel**  
Process Engineer, LWB Steint

"Adapting the software to later expansions is child's play. You just open the configuration page, enable the newly added module with a click, restart the controller and you're done. And now it's also just as easy to synchronize the software versions of machines that have accumulated over time, or to perform software updates."

allows LWB to offer custom tailored solutions without the software overhead this would normally entail. As always, users don't need any training in web technology. All programming is done in the HMI development environment using Ladder Diagram (LD) or Structured Text (ST).

#### User-defined sequence control

LWB was even able to bring added flexibility to the injection process itself using mapp Technology. An integrated mapp component makes it possible to integrate user-defined sequence controls into the control software. At any time, directly on the HMI panel, users can adapt the process to the specific requirements of the compound being injected or the part being molded. The sequence is defined via the graphical interface, and the PLC program is automatically updated in the background.

As impressive as the extensive functionality and countless innovations is perhaps the fact that LWB was nevertheless able to meet its ambitious deadline. The LWB process engineer has no doubt what was responsible for this success. "Thanks to mapp Technology, we were able to stay on schedule and have the new controller ready for series production in time for K 2016. To do that with a conventional approach would have required significantly more personnel and financial resources."

#### mapp components for the plastics industry

Some of the biggest reductions in development time came from one particular mapp component B&R developed specially for the plastics industry. It encapsulates all the standard elements of an

injection molding machine, including the injection unit with its worm drive and the clamping unit with its hydraulic cylinders. The developer only has to define the necessary movement profile, and can concentrate more time on implementing the unique processes that differentiate the machine from the competition.

"The fantastic thing about it is that we're able to simulate the entire machine, even before it physically exists," explains Radosai. "Not only does that mean fewer errors when we switch over to the real machine, it also allows us to show the customer what their machine will be capable of during the decision-making phase."

#### Alarm handling and recipe management included

The real highlight of mapp Technology is that - in addition to the countless proven functional components - B&R also provides a standardized infrastructure for linking and diagnosing those components, as well as alarm handling, recipe management and energy management. When you add a new mapp component to your project, mapp AlarmX, for example, immediately begins handling its alarms. Thanks to the standardized interfaces between the modules, mapp components can also simply be copied from one controller to the next. The same applies to user-developed blocks, as long as they comply with the standardization requirements.

"For manufacturers of injection molding machines, mapp Technology offers a solution for creating modular, reusable machine software through simple configuration and minimal - if any - programming," concludes Radosai. "We're able to focus our attention and resources on the application itself." ←



# More drive. ACOPOS P3.

[www.br-automation.com/ACOPOSP3](http://www.br-automation.com/ACOPOSP3)



## More speed

3-axis servo drive with  
50  $\mu$ s sampling time

## More intelligence

Safe Motion up to  
SIL3 / PL e / Cat.4

## More precision

Virtual sensors for more  
precise control

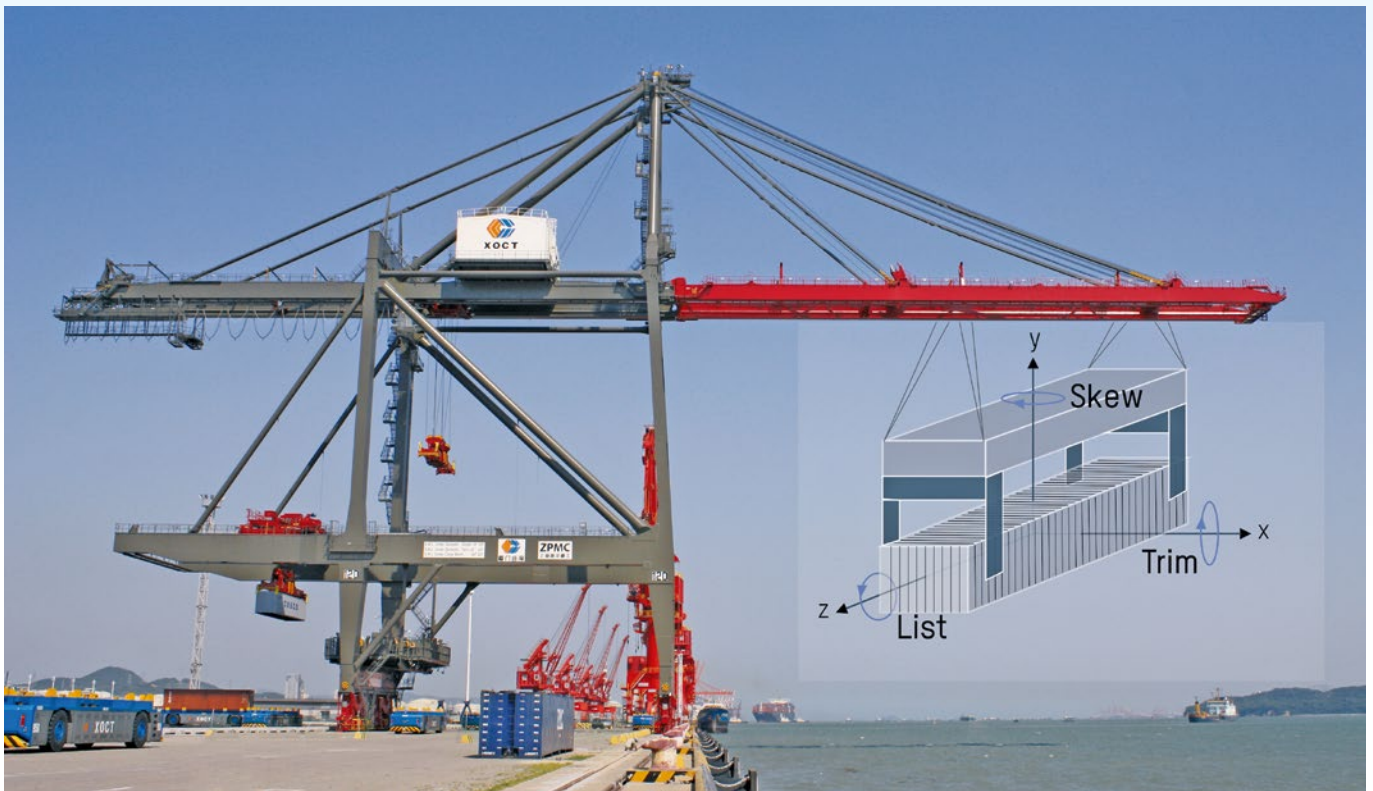
## More power

Highest power density  
in its class

PERFECTION IN AUTOMATION  
A MEMBER OF THE ABB GROUP



# Advanced rotational control



mapp Crane actively controls rotation about the vertical axis to prevent skew oscillation.



## New software package suppresses skew oscillation

B&R has introduced a new function for crane control. Cranes that transport payloads suspended from sling systems can be particularly sensitive to rotation about the vertical axis. If left unchecked, this can lead to uncontrollable sustained oscillations. The new mapp Crane solution successfully damps this effect.

## Fast and safe payload delivery

It is also possible to execute a controlled rotation, which can be helpful in cases where a payload needs to be positioned at a specific angle. With simultaneous control of both skew and sway,

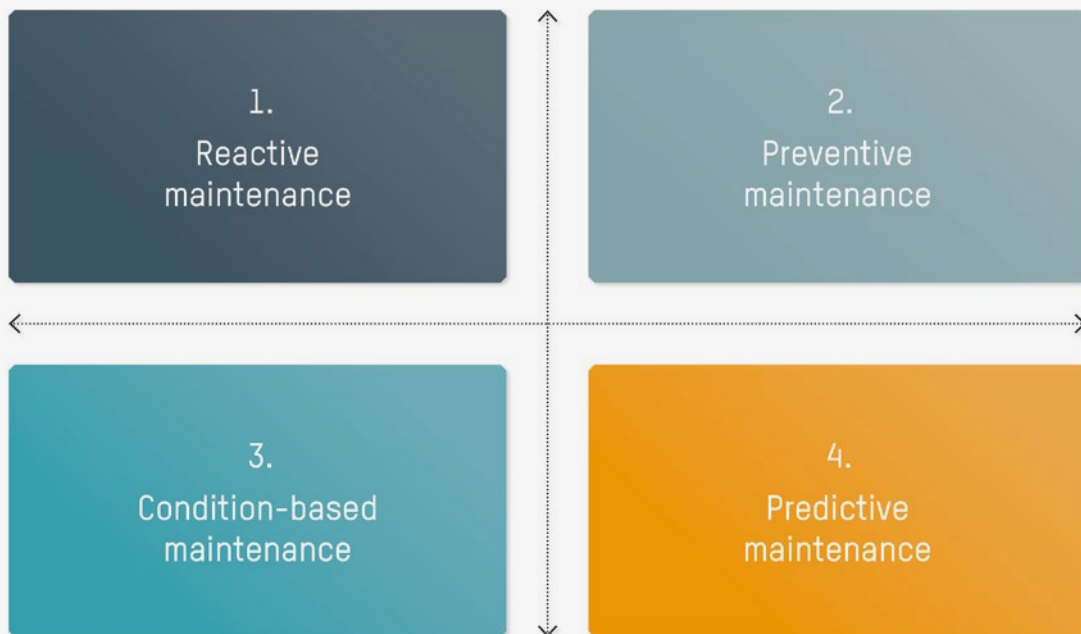
payloads can be brought to their destination with maximum speed and precision.

## Automatic path correction

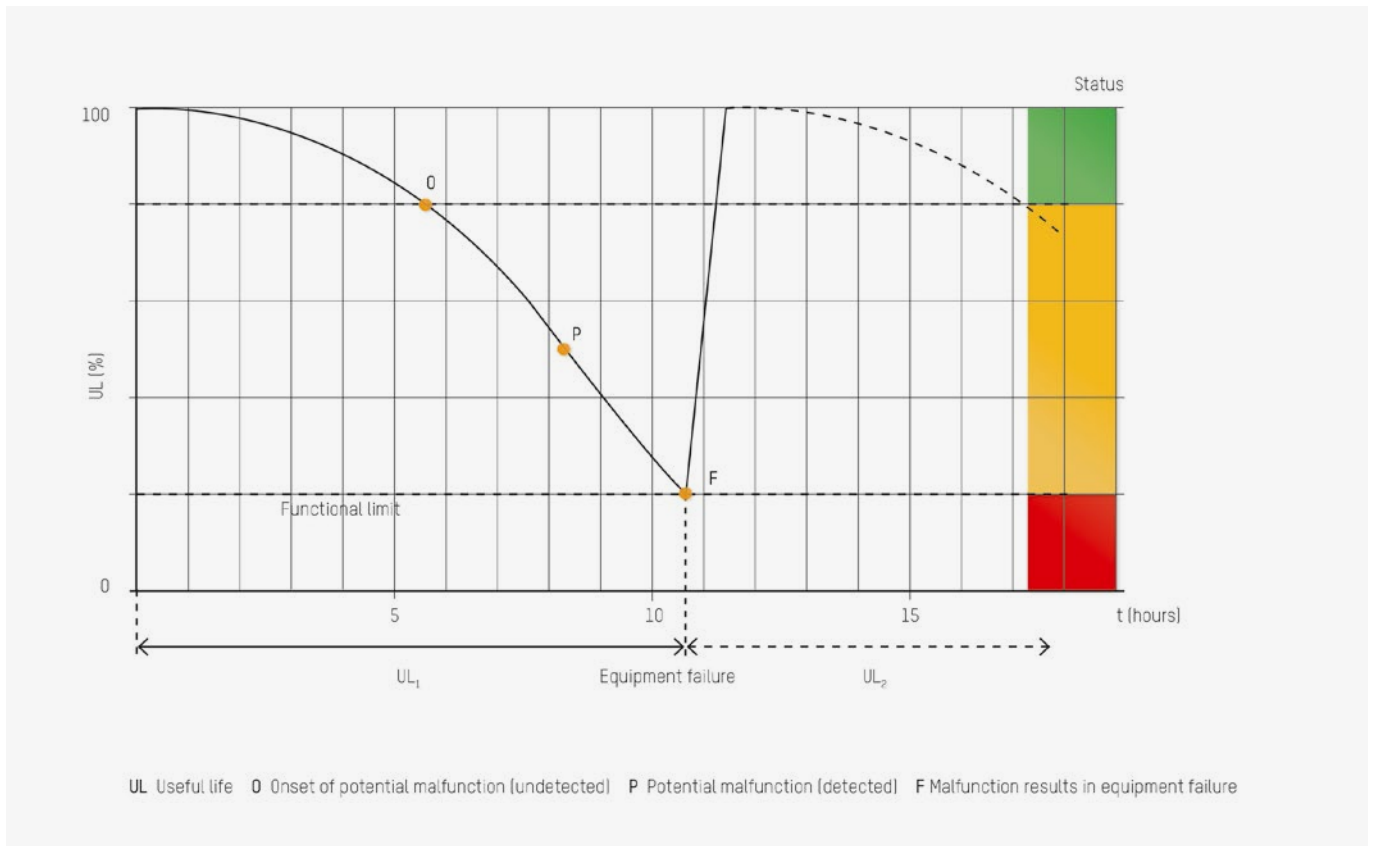
mapp Crane also offers automatic path correction, which adjusts for changes to the end position while the crane is in motion. This is an especially challenging task with regard to path planning, because the recalculations must account for the system's oscillation dynamics in addition to its axis boundaries. With mapp Crane, this function can now be implemented with very little programming. ←

# Reduce costs through optimized maintenance

Operators of production equipment are all too familiar with the dilemma: How do you improve product quality and increase system availability while at the same time cutting back on maintenance costs? The answer lies in advanced strategies like condition-based and predictive maintenance.







Predictive maintenance allows optimal utilization of components' full useful life.



These days, most companies still rely on reactive or preventive maintenance strategies, which pose serious limitations in terms of how much they can be optimized. To achieve real long-term improvements in efficiency, new approaches are needed.

Cost and complexity have thus far deterred many companies from pursuing more advanced maintenance strategies. With the rise of intelligent sensors, however, these solutions have become much more affordable and easier to implement.

### Maintenance strategies

A closer look at the four most common types can help to highlight the advantages of advanced maintenance strategies.

#### 1. Reactive maintenance

An approach that is still frequently used is reactive maintenance. Machines or systems are only repaired in the event of a failure or defect. The result is often unexpected production outages, as well as severe damage to machinery and equipment.

#### 2. Preventive maintenance

With preventive maintenance, machines or plants are shut down at predefined intervals to check and/or replace components. This

type of maintenance often leads to fully functional components being replaced before their full service life has been utilized. Unnecessarily high costs are the result.

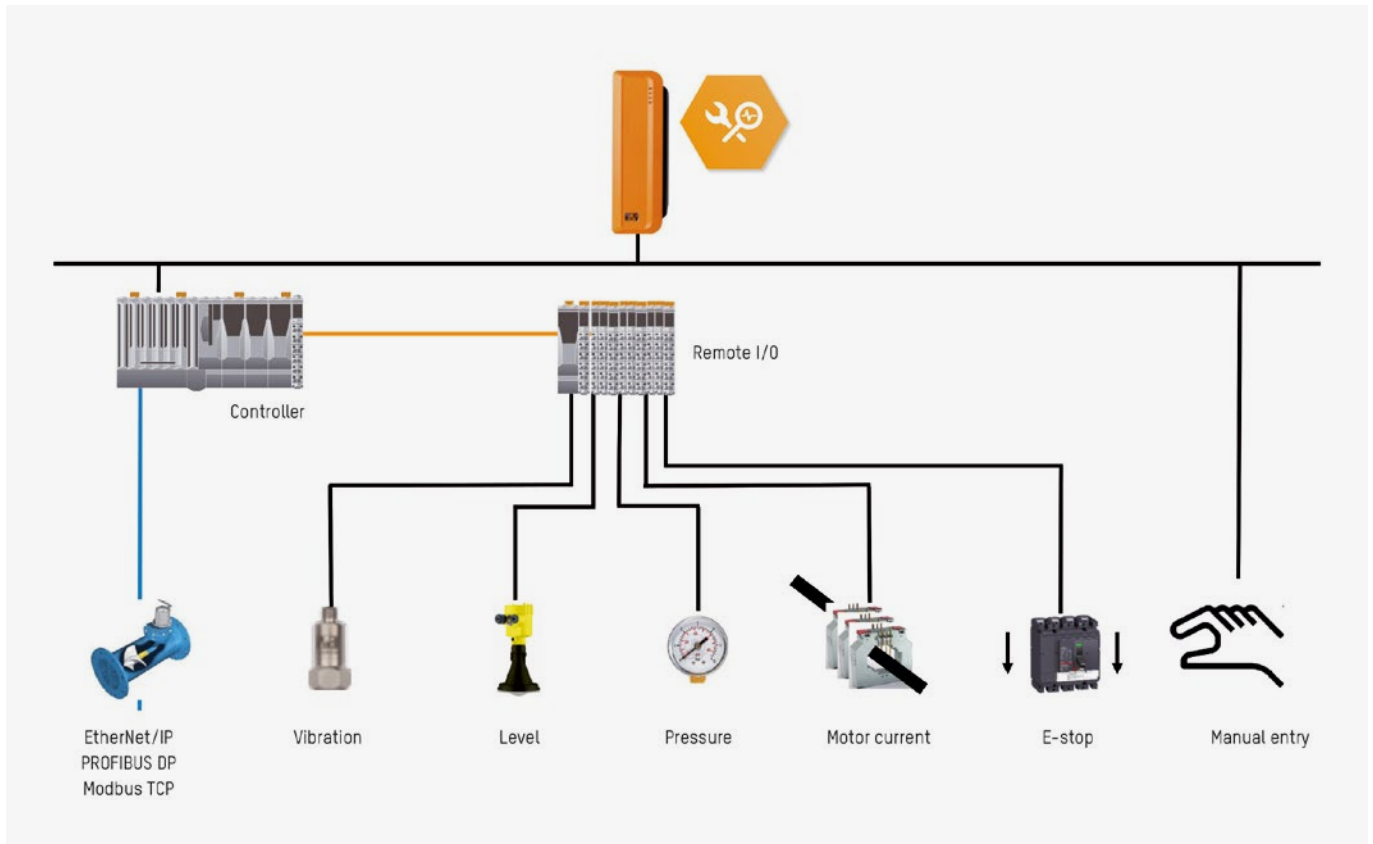
#### 3. Condition-based maintenance

Modern instrumentation makes it possible to acquire, process and assess data related to the health of machinery and equipment – continuously and with a high degree of precision. This information helps identify potential sources of malfunction and damage in advance so that corrective action can be scheduled for a time when it is convenient.

Components provide value for nearly their entire useful life, even while preventing the majority of primary (and therefore also secondary) damage. For detailed information about implementation of condition-based maintenance, see VDI guideline 2888.

#### 4. Predictive maintenance

Whereas condition-based maintenance involves evaluation of isolated data, such as vibrations, predictive maintenance goes a step further. All available data is pooled together and processed automatically to make even more precise predictions about the remaining service life of components.



APROL ConMon collects relevant production data.

This is done using big data analytics, where hundreds or even thousands of parameters from a variety of sources are aggregated and evaluated. Data mining techniques are used to examine historical data to uncover previously unrecognized – and often very complex – correlations. In combination with manufacturer data and information from measuring transducers, it becomes possible to make very precise predictions about when components are likely to fail.

This knowledge can be used to make more informed maintenance decisions, such as deferring tasks of lower importance to allow for prompt replacement of components where failure is imminent. It also allows for identification of systematic error patterns and their root causes, so that machine parameters can be adjusted to reduce wear.

### Condition monitoring with APROL ConMon

Condition Monitoring Systems (CMS) monitor the health of machinery and equipment. This makes them the ideal basis for implementing condition-based and predictive maintenance. APROL ConMon from BSR makes it possible to acquire, process and assess relevant condition parameters and can be set up with minimal effort. It makes implementation of condition monitoring systems and plant asset management solutions considerably easier.

### Choosing the right strategy

Despite the many advantages of modern maintenance strategies, it is still best to evaluate which approach is the best fit for each application. This evaluation needs to take into account both technical and economical considerations as well as any applicable legal and regulatory requirements.

### Ready to use

APROL ConMon comes preinstalled on an industrial PC and is immediately ready to use. In addition to the engineering and operator software, the system also includes a high-performance database with an SQL interface. It is based on the extremely stable SUSE Linux Enterprise Server operating system and maintains a history of all required data.

Typically installed in the control cabinet without a monitor, the industrial PC is accessed over the network from workstation computers using a web browser or VNC client.

### Perfectly scalable

APROL ConMon is completely scalable and can be implemented on standalone machines or large plants with numerous production lines. APROL ConMon can easily be paired with APROL EnMon for energy monitoring and APROL PDA for process data acquisition. It can even be scaled up to a full-fledged process control system at any time without sacrificing any of the previously invested engineering work. ←

# Advanced service functions for machinery and equipment

B&R continues to expand its mapp Technology software framework. The new mapp Tweet function allows a machine application to send information via text message or email. The increased intelligence boosts machine availability.



## Automated text messaging

The new software block mapp Tweet allows a machine application to send text messages and emails triggered by specific events. Set up with just a few clicks, mapp Tweet can easily be connected to other mapp components. This enables the mapp AlarmX component, for example, to automatically notify a maintenance technician when an alarm requires immediate action. mapp Tweet can supplement the message with additional information, such as troubleshooting instructions that allow the technician to quickly and efficiently resolve the cause of the alarm. This is an effective way to achieve a targeted reduction in machine down-time.

## Fast maintenance response times

If the service technician isn't on site, they can quickly connect via B&R's remote maintenance solution in order to run diagnostics, adjust parameters and resolve the error – all in a matter of moments. The solution utilizes the latest IT and security standards and allows for significant savings with low investment costs. ←



B&R continues to expand its mapp Technology software framework. Functions are now available for sending automatic notifications that enable advanced maintenance concepts.

# Over the edge and into the cloud



Edge devices sit on the threshold between operational technology (OT) and information technology (IT).

Operators of machinery and equipment continue to intensify their focus on the Industrial Internet of Things. To take full advantage of their connected factories, the machinery and equipment must provide a connection to the cloud. This is achieved using what are known as edge devices.



Industrial processes are expected to achieve ever-increasing levels of effectiveness and efficiency. Energy consumption must be tracked, equipment must be quicker and easier to service, and it must be possible to measure and compare asset performance. The Industrial IoT promises all this and more with highly automated, ultra-connected machinery and production lines.

#### **Making effective use of data**

Industrial IoT solutions allow users to extract information from their machinery and equipment that extends far beyond simple alarms and event notifications. "Users can be informed when a component is showing signs of wear and when it will fail", says Ralf Pühler, Industrial IoT product manager at B&R. "Currently, only about one percent of the data a plant generates is actually utilized," he emphasizes. B&R aims to increase this rate using a modular solution package consisting of hardware and software components that can be adapted to meet customer requirements.

The modular software components of mapp Technology enable data from machinery to be collected, processed and visualized. To set up an energy monitoring system, all the automation engineer needs to do is drag and drop the mapp Energy component into their project in Automation Studio. The software component automatically collects consumption data from all of the machine's axes and then calculates and visualizes the corresponding parameters. "There are many other components in addition to mapp Energy, including one to calculate overall equipment effectiveness," adds Pühler.

#### **Virtually limitless storage capacity**

Previously, machine data was only saved intermittently before being overwritten with new data. "If we want to further analyze and utilize this data, we need somewhere to store it," says Pühler. This can be a local database or a cloud-based data center.

In the age of the Industrial IoT, however, it's not just what the data can tell us about individual machines that is interesting. "I want to be able to compare machines and lines against each other, or even different production sites around the world," explains Pühler. The volume of data required for this can, in principle, be analyzed and evaluated using local computers. "However, it often makes more sense to take advantage of the virtually limitless processing and storage capacity offered by the cloud," notes the Industrial IoT specialist.

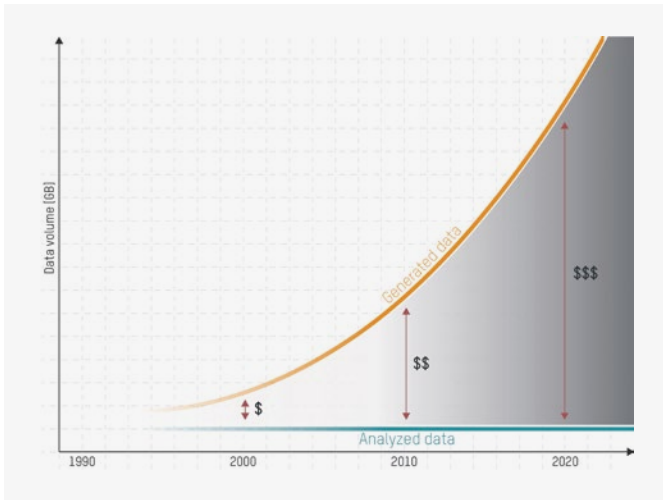
#### **OT meets IT**

The hardware that sends the aggregated data to the cloud is known as edge devices. Edge devices? "We call them that because they are the last physical entity on the way to the cloud," explains Pühler. These devices form the interface between the operational technology (OT) at the machinery level and the IT solutions in the cloud. OT includes hardware and software components that monitor and control devices, processes and events in real time.

Data collected at the OT level can be transferred to the cloud in different ways, depending on the respective application and volume of data. "That's why we offer three types of edge devices to ensure that we have a solution to fit every situation," says Pühler.

#### **The three edge variants**

If a sensor receives a signal once per hour, it makes practical sense to send the data directly to the cloud. Pipe-lines that are monitored for leaks using sensors are a good example. "Cases like that don't require real-time control, so there is no need for local control logic." Furthermore, it is sufficient for the maintenance team to check the pipeline within a few days. For simple applications such as this, a B&R bus controller suffices. This transmits unprocessed I/O signals to the cloud in encrypted form via OPC UA. "We call this option Edge Connect," says Pühler.



Many operators of machinery and equipment collect data but do not analyze it. In failing to do so, they miss out on huge potential for optimization.

Where larger volumes of data are involved, it is worthwhile to aggregate the data on the machine first. This has two advantages: firstly, it reduces bandwidth requirements and costs for cloud services; secondly, it provides a sufficient buffer to prevent data from being lost in the event of a connection error. "In this case, our standard control systems can be used," notes Pühler. "We call this an Embedded Edge, and it executes real-time machine logic as well as transmitting data to the cloud."

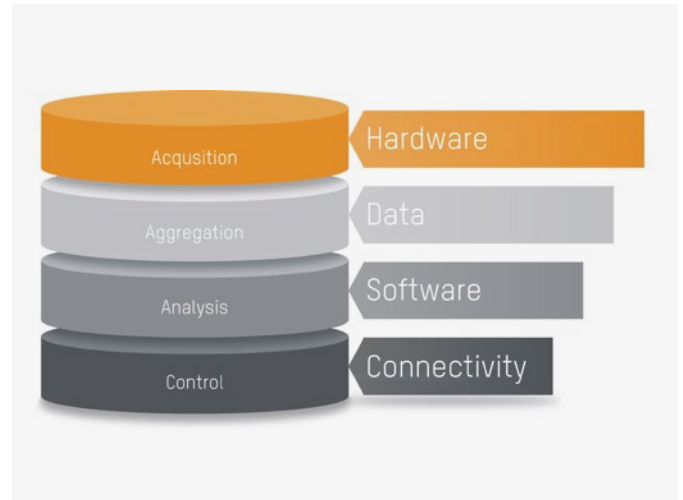
### Machine learning systems

To monitor entire production lines, data from hundreds of I/Os must be preprocessed before being sent to the cloud. In these cases, a standard controller is no longer enough. Pühler has a solution for this as well. "Here a BSR Automation PC can be combined with a comprehensive Industrial IoT platform create what we call an Edge Controller." Owing to its high processing power and storage capacity, the industrial PC can perform more advanced preprocessing and analysis than the other two edge options. Moreover, it can calculate complex algorithms such as, for example, those used in machine learning systems.

With a variety of edge architectures to choose from, it's easy to equip newly built plants for the Industrial IoT. "Edge computing isn't just for new equipment," stresses Pühler. "It also offers huge benefits for legacy equipment that until now has been operating in relative isolation." With Orange Box, BSR also has a solution for brown-field equipment. As a flexible combination of software and hardware components, the Orange Box is connected to an existing machine and can be integrated seamlessly into an edge architecture.

### Protocols for a robust connection

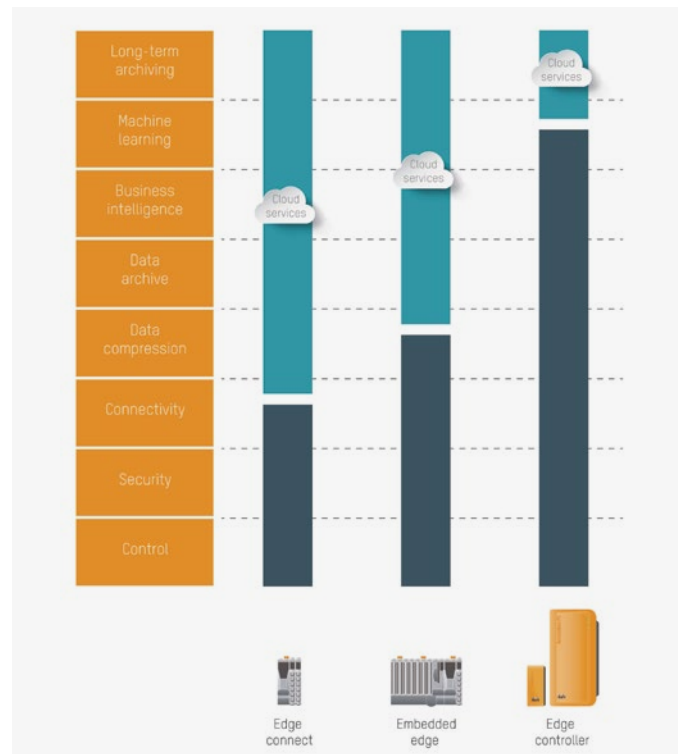
Data is transferred from the edge to the cloud using special protocols that support the transmission of large volumes of data. BSR offers familiar queuing protocols like MQTT (Message Queue Telemetry Transport) and AMQP (Advanced Message Queuing Protocol), which allow data packets to be transferred reliably, even in cases where there the network connection is poor or intermittently unavailable.



There are four fundamental aspects to Industrial IoT implementation: the hardware used for data acquisition, the data itself, the software used to analyze the data, and finally the connectivity - in other words, the network that ties together all the other aspects.

They do this by saving data packets in a queue, where necessary, to be sent at a later time.

Other protocols, including OPC UA, can be transferred over MQTT and AMQP. "OPC UA has the advantage that it is understood by all types of hardware and software in both the IT domain as well as the control system level, regardless of the manufacturer," explains Pühler. This ensures a robust connection between the machine level and the cloud, independently of which hardware is used. ←



With three types of edge architecture, BSR offers a solution for every situation.

# Two operating systems on one device



The B&R hypervisor allows multiple operating systems to run in parallel on a single device and communicate with each other via a virtual network.



## **B&R is introducing a hypervisor for its automation system**

B&R is introducing a hypervisor for its automation system. This software allows Windows or Linux to run alongside B&R's own real-time operating system in a way where the operating systems function independently and do not influence each other. That enables you to combine the control and HMI applications on a single PC, for example, or have an industrial PC double as both a real-time controller and an edge controller that sends preprocessed data to higher level systems and the cloud via OPC UA.

### **Virtual network**

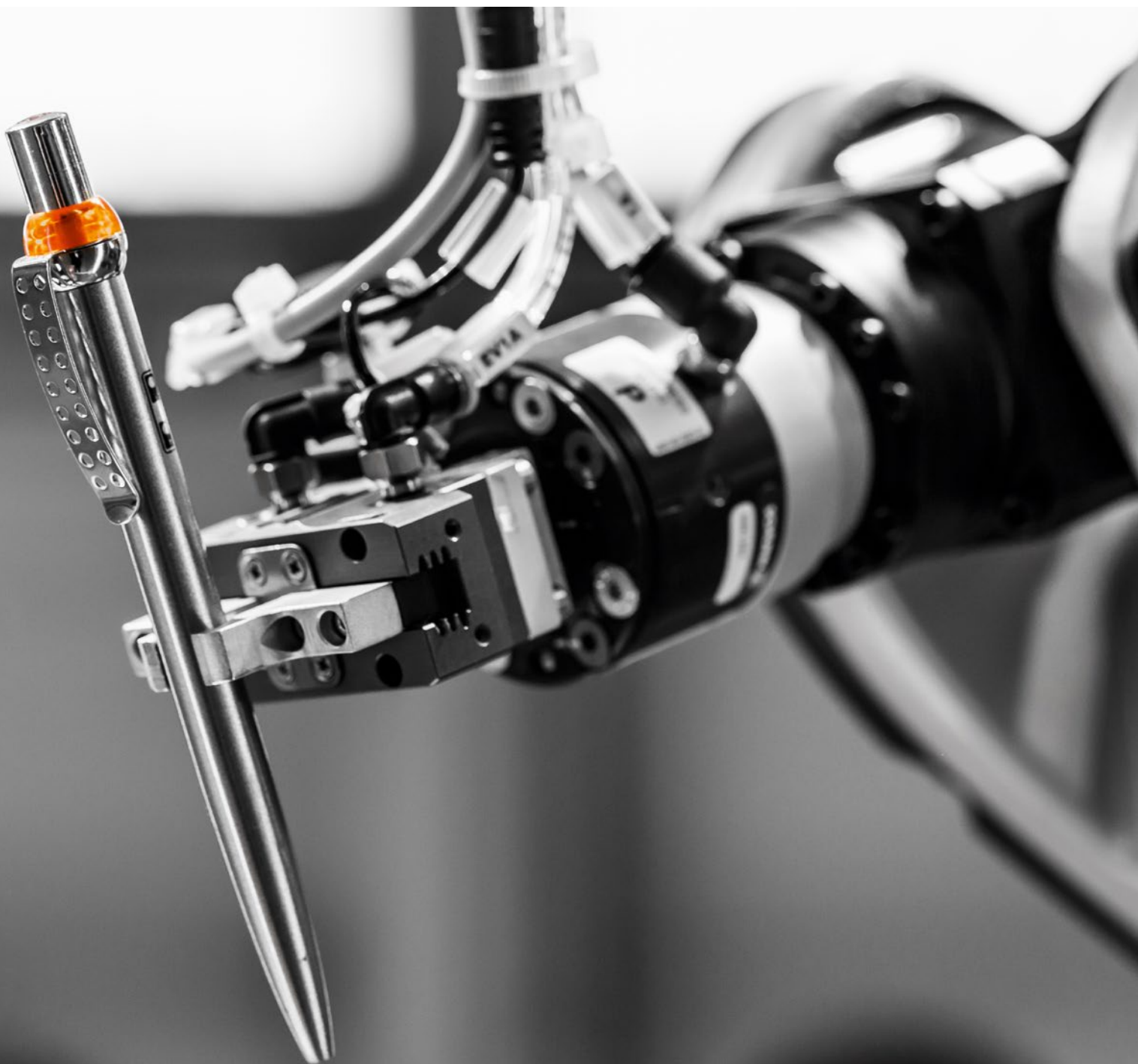
The hypervisor provides a virtual network connection that allows applications to ex-

change data between operating systems. Like with the usual Ethernet interface, this is done using standard network protocols. In place of a cable, there is a reserved memory area that is not assigned to either operating system.

### **Maximum flexibility**

The user configures the hypervisor and allocates hardware resources in the B&R Automation Studio software development environment. The configurations are defined separately for each system, providing maximum flexibility in how resources are utilized. Whereas previous parallelization solutions were tailored to a specific Windows version, B&R's hypervisor is completely independent of which operating systems are used. ←

# Finally, a flexible feeder



With openROBOTICS, Elettrosystem's know-how is copy protected, while the system remains open for configuration and programming by integrators and end users to give their production processes their own personal signature.

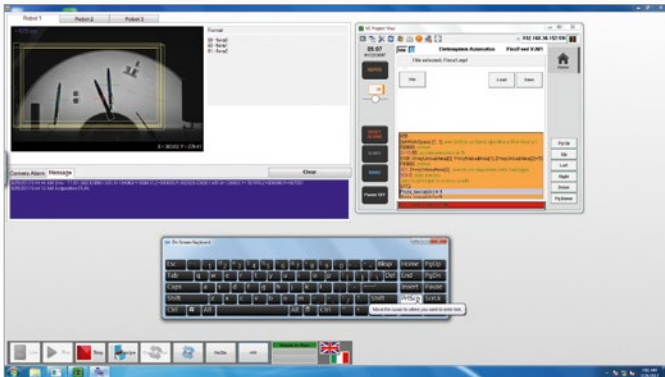




A feed module for an assembly line is typically designed to produce a very specific product. Any changes to the product during the design and commissioning phase send developers back to the drawing board and add substantial delays to machine delivery. With an openROBOTICS solution from B&R and COMAU, the versatile new FlexiFeed from Elettrosystem brings long-awaited benefits to OEMs, system integrators and end users alike.



To build a feeder module for an assembly line, you normally need to have a clear definition of all the parts of the machine and a fixed product to be assembled. Commissioning of the machine alone can take from 8 to 12 weeks, and in the event of changes to the product during the development phase, you would need to redesign the machine to adapt it to the new application, adding time and cost to the project.



Robot paths can be programmed in standard ISO G-code and perfectly smoothed in B&R Automation Studio.



With industries demanding ever more compact manufacturing equipment, reducing the number, size and complexity of automation components becomes an important design challenge. The COMAU control cabinet solves this challenge with advanced B&R products like the ACOPUS P3.

With the innovative FlexiFeed concept developed by ElettroSystem, this inflexibility is now a thing of the past. As its name suggests, FlexiFeed is able to supply an assembly line with items that vary in shape and geometry. The same machine can be set up for a variety of different products without having to be designed specifically for each one.

### Benefits for integrators, OEMs and end users

Founded in 1980 in the hills of Italy's Piedmont region, ElettroSystem specializes in turnkey assembly line solutions. With its range of patented materials and assembly processes, the company has earned a reputation as a global industrial engineering partner for automation. In addition to its primary market in the automotive industry, ElettroSystem's extensive experience in assembly, vision inspection, handling and functional testing is also highly valued in the electromechanical, measurement and instrumentation, general purpose and biomedical fields.

With the company's innovative new feeder, system integrators can start developing the machine before the product is even available in its final release. This reduces the overall machine delivery time and helps achieve lean manufacturing objectives. OEMs are now able to use the same machine for different products by simply changing out the gripper fingers. For end users, eliminating unnecessary downtime brings a significant increase in production capability.

For the new feeder to be successful, ElettroSystem needed a robotics and automation solution that was up to the challenge. Many international brands were evaluated in search of a partner with not only the best products, but with a high level of technical expertise and experienced engineers in the field.

### One feeder, many products – openROBOTICS

ElettroSystem found what it was looking for with the openROBOTICS solution from partners B&R and COMAU, which combines B&R's full array of intelligent automation components – from PLC, I/O and HMI to machine vision and open communication – with COMAU's high-precision robotics.

"B&R and COMAU have become more than just suppliers – they are two reliable partners who have joined us on a continuous path of shared growth," says Daniele Buttaci, ICT manager & controller at ElettroSystem. openROBOTICS offers a completely uniform solution with highly integrated programming for every component in the line, including the robotics. Thanks to B&R's Automation Studio software development environment and the mapp Technology package, customers simply select the desired COMAU robot in the project environment and it is effortlessly incorporated in – and perfectly synchronized with – the machine's automation software.



**Daniele Buttaci**  
ICT Manager & Controller, Elettrosystem

"B&R and COMAU have become more than just suppliers – they are two reliable partners who have joined us on a continuous path of shared growth."

Unlike the traditional solution, where robotics and machine control rely on separate controllers or gateways, the open technology from COMAU and B&R allows customers to benefit from a coordinated, holistic approach to operation, diagnostics and maintenance.

#### Perfect integration in assembly lines

FlexiFeed is available in three variants: FF3, FF6 and FF9, for processing items with maximum dimensions of 30, 60 and 100 millimeters, respectively. FlexiFeed processing begins when the operator fills bulk items into the hopper, which releases them gradually onto the turntable to prevent jams. The turntable separates and transports the items to the picking area. Here, a camera determines the position and orientation of each item so that a COMAU robot (anthropomorphic, SCARA, delta or Cartesian) can manipulate them correctly for subsequent processing.

Conventional solutions typically require dedicated controllers for CNC and robotics, whereas B&R's integrated solution features a single X20 controller for all of the FlexiFeed's automation – including not only PLC, HMI, communication and vision, but CNC and robotics as well. "This is one of the main highlights of the FlexiFeed," notes Buttaci. "To set up the process, you have only one operator HMI for the robot, camera and turntable." One B&R X20 controller can manage up to three FlexiFeed modules at a time.

B&R's Automation Studio software development environment allows programming in all IEC 61131 languages, as well as C, C++, G-code

and robotic languages. "We're able to program the robots in G-code with perfectly smoothed movements – which is normal for a robotics environment, but not common in CNC controllers," explains Buttaci. "With so much freedom in the choice of programming languages, we're able to come up with the exact right solution for any task."

#### Smaller footprint with maximum power density

With industries demanding ever more compact manufacturing equipment, reducing the number, size and complexity of automation components becomes an important design challenge. The COMAU control cabinet solves this challenge with advanced B&R products like the ACOPOS P3.

Since each ACOPOS P3 device can control up to three axes, COMAU needs only two drives to handle a 6-axis robot. Thanks to the short cycle time of 50 microseconds for current, speed and position control, in combination with the high bandwidth and determinism of POWERLINK, the ACOPOS P3 offers highly dynamic and precise performance for robotic applications.

#### Flexible assembly done right

With its openROBOTICS solution, the FlexiFeed offers end users numerous advantages – from its compact footprint and easy integration into existing lines to its significantly reduced downtime, easy diagnostics and unmatched flexibility. "Traditional bulk feeding systems, particularly for light plastic parts, have an intrinsically low production efficiency of around 75 to 85 percent," says Buttaci, "so by boosting efficiency to as high as 97 percent, the FlexiFeed offers an immense advantage in terms of production capacity."

OEMs benefit from reduced design and commissioning times thanks to COMAU's wide range of fully interoperable openROBOTICS mechanics and B&R's versatile portfolio for perfect control of any COMAU robot, fully integrated in the same environment and controller as all other automation components. "What's also important to us," adds Buttaci, "is that – although the system is open for integrators and end users to configure it for their particular production process – all of Elettrosystem's technological know-how is securely protected." ←

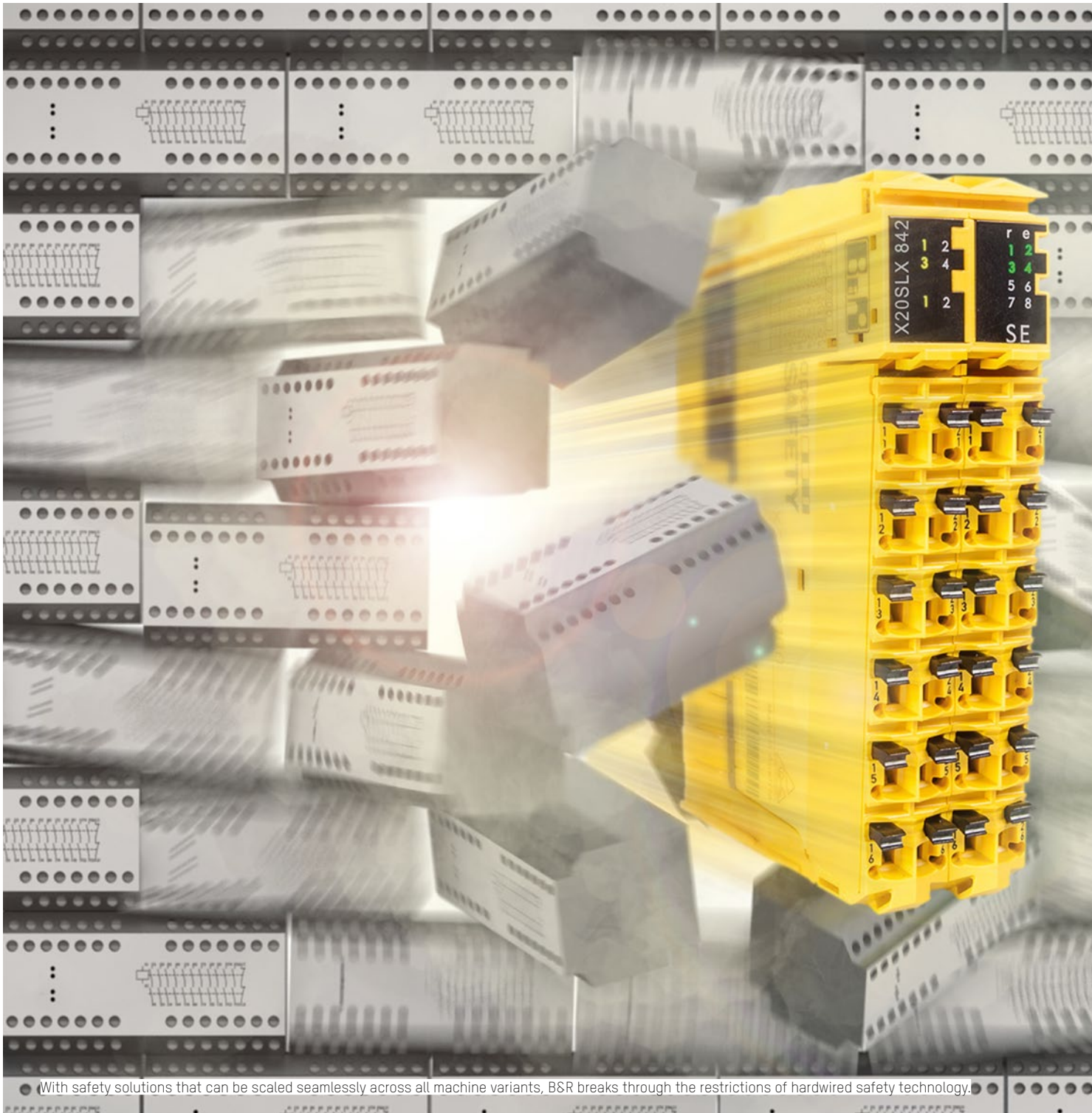
### ETHERNET POWERLINK

#### One network for all systems

POWERLINK provides a single, consistent and integrated solution for handling all of the FlexiFeed's communication tasks with a single network – from PLC, I/O and sensors to the machine vision system and of course the COMAU control cabinet.

Safety technology

# Seamlessly scalable



● With safety solutions that can be scaled seamlessly across all machine variants, B&R breaks through the restrictions of hardwired safety technology. ●



Author: Carmen Klinger - Deisroth, Heilance | Journalist

To implement safety solutions economically at different scales, machine builders have generally been forced to develop entirely different concepts for each machine variant. Not anymore, however. BSR's freely-scalable integrated safety is available at prices that can compete with conventional relay technology.



Long gone are the days of the traditional series-built machine with identical units produced cookie-cutter style in large quantities. To compete, today's machine builders must instead offer multiple variants of each machine, typically taking the form of high-end, entry-level and midrange configurations. A given machine is then often further specialized with custom options and adaptations for specific markets.

"What you generally have," explains Franz Kaufleitner, B&R's product manager for integrated safety, "is an original machine design, which then becomes the basis for an array of variants and options." This requires extensive additional work, even for the standard control technology. "It becomes even more problematic when it comes time to design the safety technology for the many different configurations," emphasizes the safety expert.

#### **Affordable hardware**

For low-end machines with limited functionality, machine builders still frequently rely on hardwired safety technology. For variants with more demanding requirements, on the other hand, programmable safety technology is standard. That means that a machine builder who wants to adapt a high-end machine for a cost-sensitive



There is virtually no limit to the scalability of B&R safety controllers. The same software can be used regardless of what hardware is selected.

market would need to switch from a programmable solution to a hard-wired one.

“That approach sends them all the way back to the drawing board to develop a new safety application,” says Kaufleitner. Not only that, but they now have multiple safety concepts to be documented, archived and kept up to date. Clearly, the more efficient and cost-effective solution would be to have a single safety application that can be used with every machine configuration.

For that to work, however, there are two criteria that must be met. “First, you need

to have affordable hardware for implementing integrated safety at the smallest scale,” notes Kaufleitner. “Second, you need full system continuity, so that the software runs equally well on whatever hardware is selected.” These were the challenges Kaufleitner and his team faced in developing B&R’s ultra compact, software-compatible safety controller.

SafeLOGIC-X now makes it possible to implement integrated safety technology at a price that compete with hardwired relay technology or compact safety devices. But how is that possible? “We distributed the tasks normally performed by a safety con-

troller across components already found in the automation system,” says Kaufleitner. “That’s why we also call the solution a virtual safety controller, because it doesn’t rely on a physical safety controller.”

SafeLOGIC-X is a safe I/O module with additional processing resources and offers all the functionality of a full-fledged SafeLOGIC controller. The safety application runs on the SafeLOGIC-X module, while safe parameter handling and configuration management – both certified for SIL3 / PLe / Category 4 – run on the standard controller.

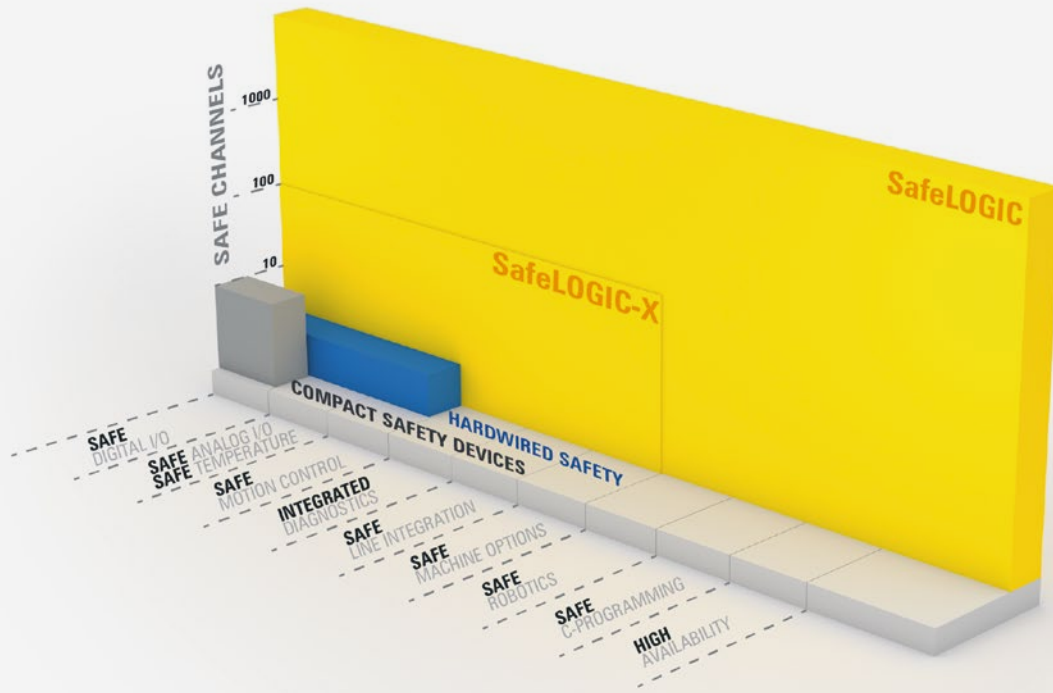
#### Enthusiastic user feedback

Integrated safety technology has a reputation for being complex and expensive. With its easy-to-use software tools and SafeLOGIC-X controllers, however, B&R has proven that it can be anything but. “The first time our customers use the virtual safety controller,” reports Kaufleitner, “they’re amazed by all the possibilities it opens up for them.”



**Franz Kaufleitner**  
Product Manager for Integrated Safety, B&R

“The first time our customers use the virtual safety controller, they’re amazed by all the possibilities it opens up for them.”



With complete system continuity, B&R safety technology can be scaled from the smallest safety application to the most complex and extensive operations with hundreds of safe I/O channels.

### Safety technology for high availability

Integrated safety technology makes machines more flexible as well as safer. "After all, they're no longer being tampered with," says Kaufleitner. It's a topic many are reluctant to talk about, but when briefly opening a safety door brings production to a halt, operators are tempted to manipulate the door contact. With programmable safety, on the other hand, production can continue even while the door is open – at reduced speed if necessary. It is even possible to allow direct intervention without triggering a cutoff. This not only increases the machine availability, it removes the motivation to manipulate the safety equipment.

SafeLOGIC-X also supports all the advantages of modular machine design and integrated diagnostics.

With all these possibilities, the only limit to what new solutions developers can create is their imagination. It's even possible to combine the virtual and standard safety controllers – as has been done with under-stage lift systems, for example. "These systems have numerous elements that need to function autonomously," says Kaufleitner, "but on the other hand, they also need to perform precisely coordinated movements."

Whereas hardwired safety technology offers a single reaction – cutoff – SafeLOGIC-X also supports B&R's extensive safe motion control functions and ultrafast response times. "It makes small machines both safer and more flexible," emphasizes Kaufleitner. The machine doesn't have to react to a safety event by shutting down, but instead can perform much more nuanced responses that are fine-tuned to the defined safety requirements (see text box). Until now, the

cost factor has reserved this type of sophistication for larger applications.

### One tool is all you need

With B&R's scalable solution, every machine and variant can be programmed in the same development environment. The programming interfaces, functions and module configuration are all the same, regardless of which safety controller is used. Developers only need to learn one system.

It can also be that an end customer requests a machine configuration that exceeds the capabilities of an existing SafeLOGIC-X solution. In this case, the machine builder can simply switch to a more powerful SafeLOGIC controller. "All of the existing programming can still be used," says Kaufleitner. B&R's solution makes integrated safety technology consistent and scalable across all machine types and variants. ←

Interview

# No digitalization without standard interfaces





The biggest obstacle facing Industry 4.0 is the absence of a uniform interface. This is the only way machines and devices from different manufacturers can be connected company-wide. But how does this connectivity benefit the processing companies themselves? And why is it so difficult to develop an interface standard that lets you connect any peripheral device to a machine the way USB does for PCs? To find out, we sat down with Dr. Harald Weber, responsible for interface standardization at the German Engineering Association VDMA; Patrick Bruder, B&R's global technology manager for the plastics industry; and Sebastian Sachse, B&R's marketing manager for open automation technology, which includes interfaces and protocols.



***Why does industry need a standard data interface?***

**Patrick Bruder, B&R:** The requirement comes from our customers: the machine builders. They face the challenge of having to join together multiple machines and components, so a standardized interface would naturally be a great help. They are likely to have been encouraged in this respect by their customers, the users, who have difficulty connecting a dosing device to both Machine A and Machine B when each uses a different control system.

***So, what has changed? Plastics processors used to simply order a system from a machine manufacturer and then hook it up to their dosing or handling equipment.***

**Sebastian Sachse, B&R:** True, and now their factory floors are a hodgepodge of disparate system solutions. In the age of digitalization, we talk about seamless communication between systems. That's hard to do when each system speaks a different language. Together with VDMA and EUROMAP, we're trying to find an effective solution to harmonize these languages.

***How does this additional connectivity benefit a processing company?***

**Sachse:** I can give you a good example. Imagine we have a massive production hall, and from the very start of a production cycle, one CNC machine is producing nothing but waste. Unfortunately, the user doesn't notice this until final inspection. He's left wondering

"How do I figure out which machine is to blame and what went wrong?" At present, his only option is to test his way through, one machine at a time. Meanwhile, the unusable product ends up in the bin and the entire value is lost. If it were possible, however, to localize the fault in the CNC mill right away – maybe the cutter is going too deep and damaging the outer casing – then all you throw out is one small piece of metal. The rest of the investment in value creation that goes into the final product has not yet taken place and is therefore saved. This is the efficiency boost that so many are looking for, and it's something that can only be achieved with a connected system.

**Dr. Harald Weber, VDMA:** That's not the only way that increased connectivity can improve efficiency. For example, it gives machines the ability to share additional data that is useful for subsequent units. If the drying unit, for example, passes on information about how much it has preheated the material, what the moisture content is and so on, then the next unit can make adjustments to optimize energy consumption without even requiring its own sensors. The potential savings extend to maintenance work as well. If the drying unit knows that an instrument will be changed on the injection molding machine in half an hour, it can adjust itself accordingly. It can ease off a bit to conserve material and then heat back up after 20 minutes so it is ready right on time.

### **What role do you play in this as an automation supplier?**

**Sachse:** OPC UA has its roots in the IT world and has evolved into an open, cross-industry standard over the years. Its information models enable a large volume of data to be represented in a structured manner and transferred in a standardized form between widely varying systems. Today, OPC UA enjoys widespread industrial use, for example transferring data from control systems to IT systems. If we want to exchange process-critical data between machines, however, we need consistent timing – we need deterministic system behavior. If we send a signal from Machine A, it must be guaranteed to arrive at Machine B after exactly 10 milliseconds. If it arrives after 20 milliseconds, the robot arm may still be inserted in the machine when the mold closes.

### **Why is it important to combine OPC UA with TSN?**

**Sachse:** OPC UA has its roots in the IT world and has evolved into an open, cross-industry standard over the years. Its information models enable a large volume of data to be represented in a structured manner and transferred in a standardized form between widely varying systems. Today, OPC UA enjoys widespread industrial use, for example transferring data from control systems to IT systems. If you wish to exchange process-critical data between machines, however, you need consistent timing – you need deterministic system behavior. If we send a signal from Machine A, it must be guaranteed to arrive at Machine B after exactly 10 milliseconds. If it arrives after 20 milliseconds, the robot arm may still be inserted in the machine when the mold closes.

### **Is it possible to retrofit machines and devices that are not suited to the EUROMAP interface?**

**Bruder:** If we stick with the example of injection molding machines:

these had EUROMAP 63 relatively early on. This may not allow for quite as much data to be transferred as the new EUROMAP 77, but it was a very good start. So, based on that, you can consider whether a modification or upgrade is necessary. If it is, the user has the option of replacing their old control system. Making it OPC UA capable, however, is likely to be somewhat more difficult. It would also be possible to work instead with gateways, which have the EUROMAP 77 interface in their top layer. Then it becomes a question of cost versus benefit, but a retrofit is definitely feasible.

***If the injection molding machine builders go and create a new interface for their machines, that brings us back to the problem of heterogeneous solutions. After all, there are likely to be extruders, thermoforming machines or machine tools that will need to connect to the same peripheral devices. How can you prevent this?***

**Bruder:** Whereas there was nothing at all in the past, individual industries are now starting to come up with their own solutions. I expect the next ten years to bring a lot of changes in this arena. In my opinion, the a more generic approach is the way to go – where you start by representing a machine with the typical data and then gradually expand it with additional functions.

**Dr. Weber:** We've noticed these same trends at the VDMA. In the area of plastic and rubber machines we're working on EUROMAP 79 as an interface between injection molding machines and robots. At the same time, the VDMA professional association of robotics and automation is now also starting to develop interfaces. They say, of course, we're not only connecting robots to injection molding machines, but also to machine tools, wood processing machines and whatever else. Robotics manufacturers then rightly say, of course, that they don't want a separate model for each



**Dr. Harald Weber**  
Technical officer – Plastics and rubber machinery, VDMA

“My name is Harald Weber and I am a technical officer at the VDMA professional association for plastics and rubber machinery. Standardization plays a major role in my work, including both safety standardization and the rapidly growing area of interface standardization. The spotlight is currently on OPC UA, where the focus is on developing information models and bringing companies together to reach a common understanding as to which data should be exchanged and how.”



**Sebastian Sachse**  
Open Automation Technologies,  
B&R

"As open automation technology manager, I am responsible for the global marketing of POWERLINK, openSAFETY and OPC UA TSN."

type of machine. When you have an injection molding machine working together with a robot, you're really dealing with tool position, core position and ejector. That is very specific to injection molding machines, so of course a corresponding model will have to be developed. In terms of the higher-level, generic matters, we had to start by defining a few things ourselves, since we were the first ones and didn't have anything else to build on. Now the robotics manufacturers are very active. We can exchange ideas and look at what they are developing that might be of use to us.

***This brings me to my question about the role of B&R with regard to development and implementation. Where will your strengths come into play?***

**Bruder:** We supported EUROMAP interfaces 27 and 63 early on to the extent that they were relevant for us. In these cases, we implemented them as software modules or libraries. The fact that EUROMAP is moving towards OPC UA really helps us, as we have had OPC UA on our control systems for quite some time. So we've already got some great depth in this area and are now in the process of adding real-time capability to OPC UA with TSN. This allows us to assure our customers, the machine builders, relatively early on that they are betting on the right technology. As soon as the EUROMAP specification is finalized and published, we will also offer software solutions that make implementation easier for our customers.

**Sachse:** With regard to our portfolio, we already offer a large number of products with both an integrated OPC UA server and client. Our OPC UA bus controller is a good example of an OPC UA device with server functionality. Users can integrate these controllers into their system, connect the sensors they need and access production

data directly via an IT network using any OPC UA client. This enables seamless communication of data from the sensor to the cloud.

***What is the current status of EUROMAP 77 development, and when can we expect comprehensive implementation and realization of EUROMAP interfaces on OPC UA?***

**Dr. Weber:** We published the EUROMAP 77 interface in October of last year as a first release candidate. Some adjustments were needed, so a second release candidate will be published soon. It is important that the interface is implemented as a prototype and tested before the final release. Manufacturers are already in the process of doing so, but then we will have to follow up with the corresponding adjustments. So it is simply a question of how long it takes until the manufacturers have tested and approved their products.

***And once the specification is ready, when can the interface be implemented?***

**Bruder:** Once the specification is released, implementation will be possible right away – in part due to the fact that we already have OPC UA on our control systems. We are also working on a solution to make implementing the EUROMAP recommendation easier for machine manufacturers.

***What will be the next device categories to get a EUROMAP interface after injection molding machines and robots?***

**Dr. Weber:** The first session for extruders took place in mid-June. The purpose of this was to look at the fundamental scope of what we want to focus on. After all, we could be talking about anything from a simple extruder – a cylinder with a worm screw inside – up to a complete processing line. Since we cannot tackle everything

## EUROMAP and B&R controllers

As a leading supplier of automation for plastics machinery, B&R has been active in the EUROMAP workgroups for years. Recommendations like EUROMAP 27 and 63 are implemented as libraries and function blocks in the B&R system. New recommendations are based on OPC UA, which is already available on all B&R controllers. B&R has been a leading participant in the development and specification of the OPC UA TSN extension. Through these efforts, B&R ensures its ability to continue serving its customers with fast, easy implementation of the latest EUROMAP recommendations.

at once, we're starting at the center with the extruder and what data it should output. The next step will likely be the blow molding machines. There is no fixed timeline for that yet, but it will of course be addressed in the near future. We will also soon be dealing with peripheral devices. However, the major issue to begin with is the extruder.

### **What are the most significant recent advances made towards EUROMAP 77?**

**Dr. Weber:** I think the essential thing now is to build a high-level structure. That doesn't mean we're putting blinders on and saying we only care about injection molding machines and host computers, and what happens outside of that narrow focus is of no concern to us. Instead, we are saying that there is a lot that can be reused for other machine combinations and we are identifying those things. We may have to formulate a few things a bit more generally, but then what remains is only that which is truly specific to EUROMAP 77, and the rest are higher-level object types that can easily be reused elsewhere. So, when it comes time to start with blow molding machines, you find that there are indeed already a lot of general types and we can simply use those. Then we simply have to look at what else needs to be added for blow molding machines – how do they differ from injection molding machines – rather than starting over from scratch.

### **Is there a point where OPC UA will be in competition with POWERLINK?**

**Sachse:** For now, the TSN protocol is still being developed, so we will have to wait until the end of the year to see what kind of performance can be achieved. There will certainly be areas of overlap in applications where the performance of OPC UA TSN and POWERLINK

or comparable protocols will be enough. At the moment, TSN is not able to match POWERLINK's performance, for example, in a motion application.

### **Is there anything you would like to add that we haven't covered already?**

**Sachse:** The most important thing is uniform standardization. There was an attempt at this back in 2000/2001 with Ethernet. Unfortunately, what emerged was an array of different protocols instead of a universally compatible industrial standard. We now once again have the chance to standardize something uniformly. We have to make the most of this opportunity. Companies have also learned a lot in the meantime, so we are optimistic that this time we will be able to create a uniform communication standard for Industrial IoT applications.

**Dr. Weber:** From our perspective, the good thing is that we are operating in a pre-competitive environment. Competitors really are coming together and jointly developing a standard interface. They do not all wish to be "Apples" that only have their own proprietary interfaces and woe to anyone wanting to connect to another system. They have realized they have nothing to gain from that. And they are not afraid of becoming interchangeable, because ultimately they differ in terms of performance, cycle times and precision anyway. None of that is affected by the data being shared externally in a standardized way.

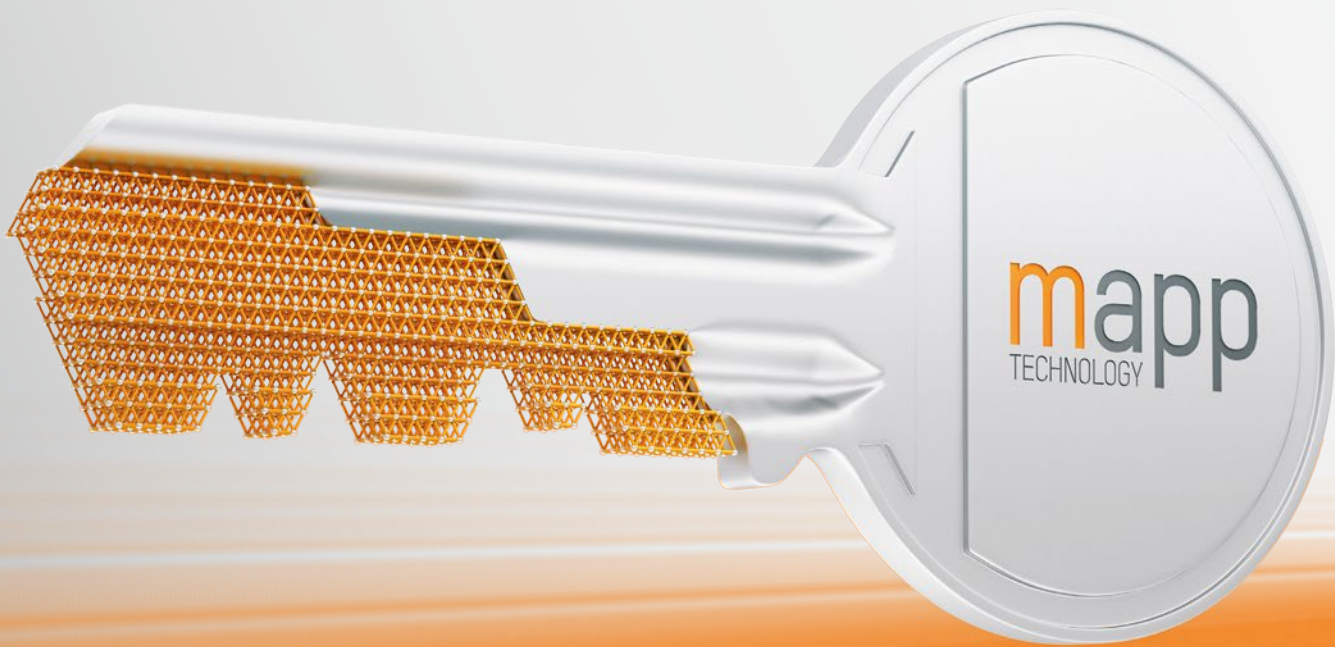
**Very exciting – thanks for your time! ←**

*Interview conducted by: David Löh, Plastverarbeiter trade magazine, david.loeh@huethig.de*



**Patrick Bruder**  
Global Technology Manager - Plastics Industry, B&R

"As a global technology manager in the business development department, I am responsible for the plastics industry. I am also a representative on several committees, including EUROMAP."



# 3x faster development. Experience **mapp**. TECHNOLOGY

[www.br-automation.com/mapp](http://www.br-automation.com/mapp)

- More time for innovations
- Increased software quality
- Lower maintenance costs
- Reduced investment risk
- Increased machine availability



[www.br-automation.com/mapp](http://www.br-automation.com/mapp)

**PERFECTION IN AUTOMATION**  
A MEMBER OF THE ABB GROUP





High-end packaging conversion

# Perfect partnership for precision printing

Perfect plan: When TRESU's developers are away completing a course, the company is able to rely on highly skilled developers from B&R.



Danish flexography specialist TRESU takes great pride in its ability to offer highly customized printing lines to clients all around the world. Managing the development resources necessary to create specialized mechanical and software solutions for its rapidly growing clientele is a juggling act that TRESU has been able to master through close-knit collaboration with B&R and its modular portfolio of automation hardware and software.



With data from B&R motors and drives directly integrated in the B&R control system – TRESU machines are easier to produce. The single-cable solution also significantly reduces installation times.



According to VP Allan Sander, the fully integrated B&R solution gives TRESU printing machines valuable flexibility and fast changeover times while guaranteeing high print quality.



**Søren Maarssø**  
CEO, TRESU

“The cooperation with B&R plays a significant role in our development process and thus our time to market. We work very closely with them and can draw on

their highly skilled developers while our own receive excellent training through B&R’s courses.”



Whether it’s carton packaging for takeout food, six-packs of beer or one of the numerous other possible substrates – TRESU’s exceptionally modular Flexo Innovator printing lines offer highly customized printing and finishing performance with an array of added-value options including back-side printing, cold foil, die-cutting, laminating, coating, embossing and sheeting.

The software platform and motors in these lines come from B&R, but that’s not all the Danish flexography specialist gets from its

Austrian automation supplier. Due to the extensive customization involved in each project, TRESU relies on a close and highly transparent cooperation with B&R that includes both project development and training.

Bringing together TRESU’s 35 years of flexo know-how and B&R’s automation expertise, this collaboration is a key element in TRESU’s ability to provide its customers with innovative printing technology tailored to their specific needs.

#### **Modular solutions – worldwide**

TRESU delivers its modular printing solutions all over the world, fully customized to meet the end user’s needs in terms of software and mechanical components. Increasingly, the company relies on B&R to supply these solutions. On the one hand, this is because B&R technology has proven the best suited to satisfying the customers’ most important parameters, which include uptime, speed, flexibility, available features and, not least, competitive prices. Beyond that, though, they also benefit from the worldwide recognition of B&R’s products as well as its global support and service network.

According to Morten Støhs, Director of TRESU’s R&D design and service department, when a new order comes in for a Flexo Innovator, they immediately go to work with developers from B&R to design and assemble it. “Not only do we look at the specifications required to complete the project, we also look at how we can optimize the machine to bring down the overall price,” he explains.





Coordinated by its Automation Academy, B&R offers both standardized and customer-tailored seminars at all of its locations worldwide. Visit the Academy section of the B&R website (<https://www.br-automation.com/en/academy/seminars/>) for information about scheduling and locations. Custom training courses are best planned together with your B&R sales representative.

"Through consultation with B&R, we're often able to reduce the size of the motors used in the press, for example."

#### Support for a new department

Dennis Flint Greve stands at the helm of TRESU's recently formed electrical and automation department, responsible for developing new solutions. According to Greve, one of the greatest advantages of working with B&R is that the two companies speak a common language in terms of product development philosophy.

With twenty system designers, software and electrical engineers dedicated to making TRESU's processes more efficient by standardizing its portfolio of printing components and options, collaboration with B&R helps TRESU achieve competitive advantages in a market notorious for intense competition for customers.

"Our machines are built with fully-integrated B&R solutions and are easy to program using Automation Studio," says Greve. "Our customers benefit from the flexibility this brings to their production."

#### Design advancements

Over the years, the partnership with B&R has developed far beyond the relationships TRESU has with other suppliers. "B&R has a product portfolio that stands out in a positive way, with flexible I/O modules that perfectly suit our needs," explains Greve. "Among other things, B&R has helped us minimize the size of our control cabinet," he adds, "which in turn has made it easier for us to come up with some great product designs for our customers."

#### Developing developers

With a rapidly increasing number of clients requesting TRESU machines, scheduling developer training around projects can be something of a logistical juggling act. Among the required initiatives is the intensive 10-week "Applied Automation Engineering Seminar" held at the headquarters of B&R Denmark.

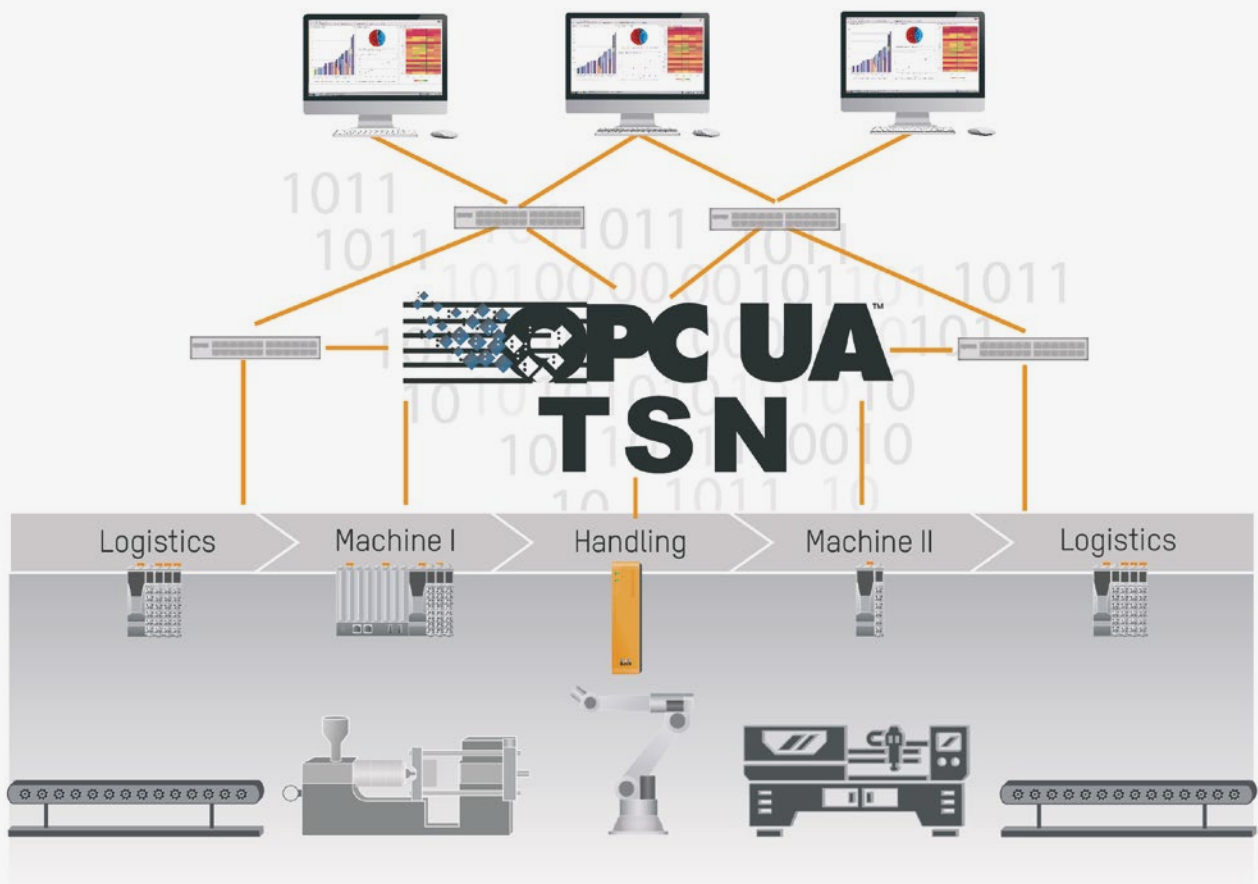
When TRESU's developers are away completing a course, the company is able to rely on highly skilled developers from B&R. "This is helpful in several ways," says Greve. "It provides them with insight into our projects, while at the same time our developers become familiar with B&R's products." With the two companies' developers so well synchronized, they are able to engage in constructive back-and-forth to solve difficult challenges.

#### TRESU pleased by ABB acquisition

The strategic cooperation between TRESU and B&R has resulted in, among other things, a high level of transparency throughout project planning and execution. "We operate with a shared pool of resources, and we're in constant dialog on how to make the best use of it," says TRESU CEO Søren Maarssø.

Maarssø sees the acquisition of B&R by ABB as a very positive development. "B&R joining ABB is advantageous for us – particularly in the American market. B&R emerges as a stronger supplier of both hardware and software," he says, pointing to B&R's full lineup of drive technology, controllers and integrated safety his company relies on to create compact, high-quality solutions. ←

# OPC UA TSN – From the field to the cloud



OPC UA TSN fulfills all the communication requirements of today's most demanding manufacturing applications.

There's no denying the tremendous value that the Industrial IoT holds in store for the future of manufacturing. Efforts to tap into this potential, however, have thus far only begun to scratch the surface. Spurred by demand from their end customers, automation suppliers are poised to clear the first hurdle on the road to IIoT solutions: seamless communication based on open standards. Time-Sensitive Networking (TSN) in combination with OPC UA provides precisely timed horizontal access to data from machines, controllers and I/O systems – regardless of who built the individual devices.



As an open protocol, OPC UA has already found widespread use in a diverse range of industrial applications. Nearly all manufacturers offer OPC UA in their controllers and other products. The technology is developed and promoted by many different manufacturers under the oversight of the OPC Foundation industrial consortium. Operators of machinery and equipment no longer have to worry that the simple act of selecting communication technology will lock them in with a specific vendor.

With standardized system connectivity, they enjoy equal access to the technology and are able to focus on solving new challenges. Where we've been accustomed to seeing 30 or 40 nodes in a network, we'll eventually be seeing 1,000 or more.

#### **Growing number of nodes**

The challenge will be to find a way to manage and control this increased number of nodes effectively. Within this challenge, however, lies an opportunity for automation suppliers to differentiate themselves by offering their customers added value. Software tools that streamline the setup and configuration of complex networks with large numbers of nodes will become substantially more important. These tools will also need to be designed for users without extensive IT training.

It's not only the number of nodes that is increasing so rapidly, however; the volume of data will also continue to grow exponentially. Managing the flood of big data with conventional industrial protocols is becoming increasingly difficult, and this is where OPC UA promises substantial improvement.

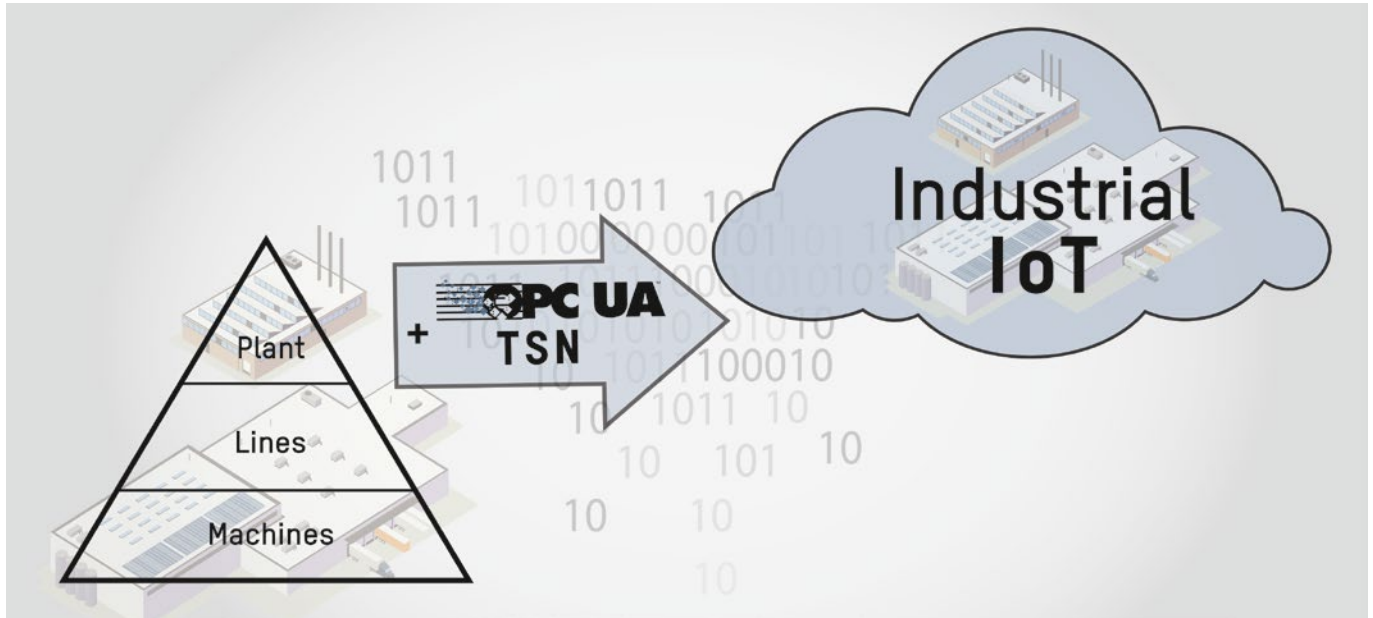
#### **Information, not data**

Among the greatest advantages of OPC UA are its information models. Traditional bus systems transmit dimensionless data – simple numbers unaccompanied by units or any other information. The application running on the controller knows how to interpret these numbers using what is known as a semantic data model.

There is absolutely nothing wrong with this approach, of course, as long as machines are operating independently of one another. However, as soon as it becomes necessary to use the data elsewhere – be it on other machines, in SCADA systems or even in cloud-based ERP systems – the semantic meaning is lost, and all that remains are the dimensionless numbers.

#### **Fewer errors**

In the past, the semantic context has been transmitted to other systems in lengthy tables or even in handwritten form. This pains-



OPC UA TSN will enable seamless horizontal manufacturing connectivity.

takingly tedious undertaking – a notorious source of errors – is eliminated entirely with OPC UA, making it considerably easier to implement more agile and responsive manufacturing solutions.

With its information models, OPC UA transmits not just data, but information that can be correctly interpreted by any node on the network without any further explanation. Say, for example, we have a sensor that measures a temperature of 5°C. Coming from a traditional protocol, the controller would receive this as an integer data type with the value “5”. The fact that the number represents a temperature value measured in degrees Celsius, and the fact that there are certain limits to be applied, is defined in the application running on the controller.

OPC UA takes a different approach. The value “5” is provided along with all of its semantic context – in this case, that it is a temperature value measured in degrees Celsius and that it has limit values that should be applied.

#### Information on demand

Since other nodes on the OPC UA network are able to query this information, it can be used in a much wider variety of ways. If you want to generate a new ERP report, for example, the ERP system can browse the network for appropriate information. Once found, this information can be collected in a database and viewed in the report. It used to be necessary to program this data transfer manually, and the semantic information for each individual value would need to be stored in the ERP system. With such a static structure,

changes to variables on the machine would also require reprogramming in the ERP system.

This example highlights just how much OPC UA simplifies communication from the control layer up to higher-level systems. With that, however, we arrive at the next hurdle: When higher-level IT systems are sending queries down into the machine network – referred to in this context as operational technology, or OT – the network load inevitably increases.

For an IT network, delays in the millisecond range are generally no big deal. For a precisely synchronized manufacturing process, on the other hand, sub-millisecond accuracy is absolutely essential. Here, a delay in the millisecond range can shut down a machine, reduce output quality or even cause significant harm to equipment and personnel. This is why nearly every manufacturing facility has traditionally maintained a clear separation between its IT and OT networks. IT networks have historically lacked determinism and cyclic data traffic – two deal breakers at the OT level.

#### A single shared network

IT networks follow a principle known as “best effort delivery”, which means that data packets all share the same level of priority and are transmitted as quickly as possible. If capacity is exceeded at any point, there will be a bottleneck – something that cannot be permitted in a machine network. Until now, there has been no way to implement both best-effort and deterministic cyclic traffic on the same infrastructure. With Time-Sensitive Networking (TSN),

that's about to change. TSN is a group of extensions to the Ethernet standard that will allow both general and time-critical data to be transferred over the same network.

The first step toward equipping a network with deterministic behavior is to ensure all of its nodes are on the same page with regard to timing. The IEEE 802.1 AS-Rev standard was developed for this purpose. It describes a mechanism for synchronizing the clocks of all the nodes in the network to establish a uniform network time.

The next step is to guarantee that deterministic data traffic is given priority on the network. This is covered by the standards IEEE802.1 Qbv and Qba, which specify that network switches must operate in such a way that deterministic data traffic is transmitted within a guaranteed time frame, even if this means that other traffic must wait.

To establish a uniform approach to configuring this type of network, the Stream Reservation Protocol (IEE-E802.1Qcc) provides standardized interfaces and mechanisms for configuration. NETCONF over TLS is used as the configuration protocol.

### Bye-bye bandwidth blues

If you combine the mechanisms described above in a network, it becomes possible to transmit time-critical and cyclic data on the same physical layer as non-time-critical data. Since modern production networks rely on Gigabit Ethernet transfer rates or higher, this simultaneously resolves the bandwidth bottleneck issue that currently plagues not only fieldbus systems, but industrial Ethernet protocols based on 100 Mbit/s transmission as well.

The combination of OPC UA and TSN will set the stage for entirely new industrial automation architectures. One of the most notable features of these new designs will be the disappearing borders between IT and OT networks. This applies not only to new plants built

with full connectivity from the ground up, but brownfield plants as well. With the B&R Orange Box, legacy equipment can be integrated into production networks via OPC UA without any changes to the existing machines.

### I/O devices with OPC UA TSN

B&R is actively involved in the development of OPC UA and TSN in addition to being a leading participant in the testbeds exploring the potential of combining the two technologies. For operators of machinery and equipment, B&R sees vast potential in OPC UA TSN, which is why it is working to move implementation forward in great strides.

Prototypes have already undergone extensive interoperability testing with devices from other IT and OT suppliers in setups like the TSN testbed organized by the Industrial Internet Consortium (IIC). The extremely promising results thus far provide a glimpse of what's to come once the technology reaches its full potential. In addition to its current capabilities, OPC UA will very soon offer fast cycle times and low jitter in the transmission layer. ←



Sebastian Sachse, Technology Manager – Open Automation, B&R

### Protocols for a robust connection

Data is transferred from the edge to the cloud using special protocols that support the transmission of large volumes of data. B&R offers familiar queuing protocols like MQTT (Message Queue Telemetry Transport) and AMQP (Advanced Message Queuing Protocol), which allow data packets to be transferred reliably, even in cases where the network connection is poor or intermittently unavailable. They do this by saving data packets in a queue, where necessary, to be sent at a later time.

Other protocols, including OPC UA, can be transferred over MQTT and AMQP. "OPC UA has the advantage that it is understood by all types of hardware and software in both the IT domain as well as the control system level, regardless of the manufacturer," explains Pühler. This ensures a robust connection between the machine level and the cloud, independently of which hardware is used.

Seed processing

# Sowing the seeds of smart manufacturing

A mature market and tightening regulatory constraints have increased demands on seed processing quality. Recognizing that these demands could no longer be met with the digitally isolated machinery typical of the industry, Dynavia developed a smart seed processing line equipped with a full BSR solution and APROL factory automation.



Seeds require a lot of care. Once they have been harvested and checked against specifications for varietal purity, sanitary quality and germination potential, they need to be dried, sorted, cleaned, treated with phytosanitary products and packaged. The various machines required to complete these steps have traditionally been grouped into complex, heterogeneous processing lines with little connectivity between them.

As a result of the complex, rigid architectures of these conventional lines, seed quality has relied heavily on the skill of experienced operators to perform the necessary checks and adjustments. To reduce human-factor risks, seed processing plant builder Dynavia broke with tradition to implement a smart new line concept featuring a complete B&R solution and the APROL factory automation system.

#### **A totally new approach**

Recognizing that conventional seed processing lines were approaching their limits, Dynavia developed a groundbreaking new solution with seamless communication between the equipment, controllers and sensors. The new line, unprecedented in the seed processing industry, has already brought substantial gains in productivity and flexibility for end users.

The new line also features a fully automatic cleaning system that enables machines to clean themselves with no operator intervention. When the machine detects a soiled flowmeter, for example, it will allow the current batch to complete and then switch to self-cleaning mode. This self-contained, automatic cleaning process reduces pollution both on the fields and at industrial sites while also decreasing sanitary risks.



Decentralized motion control with B&R's ACOPOSmotor servo actuators allows Dynavia to offer modular machinery with reduced cabling and simplified architectures – giving its customers the flexibility to adapt to future demands.



Dynavia's smart equipment, featuring APROL factory control, now supports mass customization with multiple seed varieties.

### All the info at a glance with APROL

"The APROL factory control system and the completeness of the B&R portfolio were decisive factors for us to rely on this company as our automation supplier and partner," says Dynavia President Steven Le Garrec. "Having all the components from a single source gave us the full benefit of their integrated systems allowed us to implement our concept of smart lines in the most efficient way."

The smart processing line Dynavia recently implemented for a major customer is fitted with three thousand I/O points and numerous controllers from B&R's X20 range, all controlled by two redundant APROL runtime servers running on B&R industrial PCs. This line comprises several units for storage and dosing of the phytosanitary products and recipe handling, as well as various mixers, a packaging machine and a palletizing robot.

"APROL integrates control of all the equipment and displays the data in such a way that we can understand and analyze phys-

ical phenomena very quickly," reports Le Garrec. "The APROL TrendViewer has allowed us to record process data during the liquid and gas phases and thereby fine-tune the machines faster than ever." Integrated analysis and reporting based on Jaspersoft provides powerful insight into the line's chemical processes.

### Precision guaranteed by IO-Link and POWERLINK

Because of heightened quality requirements and the tightening regulations on usage and dosage of chemical products, high precision and repeatability have become essential requirements for seed processing lines. In the application described above, regulatory authorities require that chemical products are dosed with a precision as low as one gram per hectare. To achieve this consistently, Dynavia has developed advanced dosage algorithms and taken full advantage of its B&R systems.

"The IO-Link modules in B&R's portfolio allow us to benefit from the added precision of

digital sensors," explains Le Garrec. Measurement data delivered by IO-Link sensors only goes through one A/D conversion instead of three with conventional sensors, and the fully digital connection offers extended diagnostic capabilities and easy sensor configuration. "IO-Link connectivity allows us to configure sensors and actuators dynamically, giving us total control over temperatures, levels and pressures at all times, which is essential to meet the new demands on seed quality."

At the control level, the real-time network must guarantee that sensor signals are handled quickly enough to allow the actuators to respond without any loss of precision. In the solution already running at Dynavia's customer, the real-time POWERLINK network ensures exceptional output rates and has reduced control loop times to 4 milliseconds. The high performance of this network also allows Dynavia to use brushless motors instead of conventional induction motors, thus ensuring faster actions on the actuator side.

"Our solution achieves a dosage precision of less than one gram, which is very close to the limit of the sensors themselves," reports Le Garrec proudly. B&R's single-cable ACOPOSmotor servo actuators bring Dynavia all the benefits of B&R's decentralized motion technology in terms of reduced cabling and simplified architecture.

### Plug-and-play maintenance

"Without a doubt, POWERLINK and IO-Link are a perfect match," confirms Le Garrec,

## ETHERNET POWERLINK

### Advantages of POWERLINK

The combination of the real-time POWERLINK bus system and IO-Link has allowed us to break new records of speed and precision. The high performance of this network also allows Dynavia to use brushless motors instead of conventional induction motors, thus ensuring faster actions on the actuator side.





With the combination of POWERLINK and IO-Link, Dynavia's equipment ensures fast and precise control for optimized seed treatment.

**Steven Le Garrec**  
**President, Dynavia**

"The APROL factory control system and the completeness of the B&R portfolio were decisive factors for us to rely on B&R as our single-source automation supplier. The combination of POWERLINK and IO-Link has allowed us to break new records of speed and precision. The unmatched competence and responsiveness of the local B&R team helped us complete our complex project amazingly fast."

noting that both standards offer plug-and-play features that make maintenance much easier and safer. "It's no longer necessary to travel to the customer's site to switch out a component, which is a major advantage for our export activities. Operators only need to exchange the faulty component and reconfiguration is handled automatically."

Beyond the plug-and-play features, and in line with the concept of smart machinery, Dynavia is developing spare parts utility software based on B&R's fully integrated Automation Studio software environment. This tool will run directly on the machines, and the user interface will indicate which

parts need to be replaced and allow users to place the necessary order.

**Mass customization with flexible automation**

Dynavia's newest installations allow seed producers to implement recipe changes on the fly to handle varying requirements for seed type, quantity, treatment and more. "Our customers are now able to customize their production to an increasing variety of requirements in a highly productive and profitable way," says Le Garrec.

"With the complex, heterogeneous architectures they used in the past, our cus-

tomers would avoid making any changes to the automation system once it had been set up. The risk of destabilizing the process was just too high," says Le Garrec. "With B&R's integrated solutions, they can now safely and easily adapt the automation solution to their needs."

**Cloud-based analytics for predictive maintenance**

Dynavia is also working on a predictive maintenance solution to be completed in the near future. On their installations, APROL continuously records around 11,000 pieces of data. To make efficient use of this big data volume, Le Garrec is looking to implement a private cloud solution offered with APROL.

"At the installation level, our big data solution will consist of local APROL systems recording the event history and pushing data - 100 megabytes a week in our case - to a private cloud. An APROL instance located at our premises will store and manage this data. Thanks to the OPC UA and MQTT standards used, all data exchanged with the private cloud is secure." ←

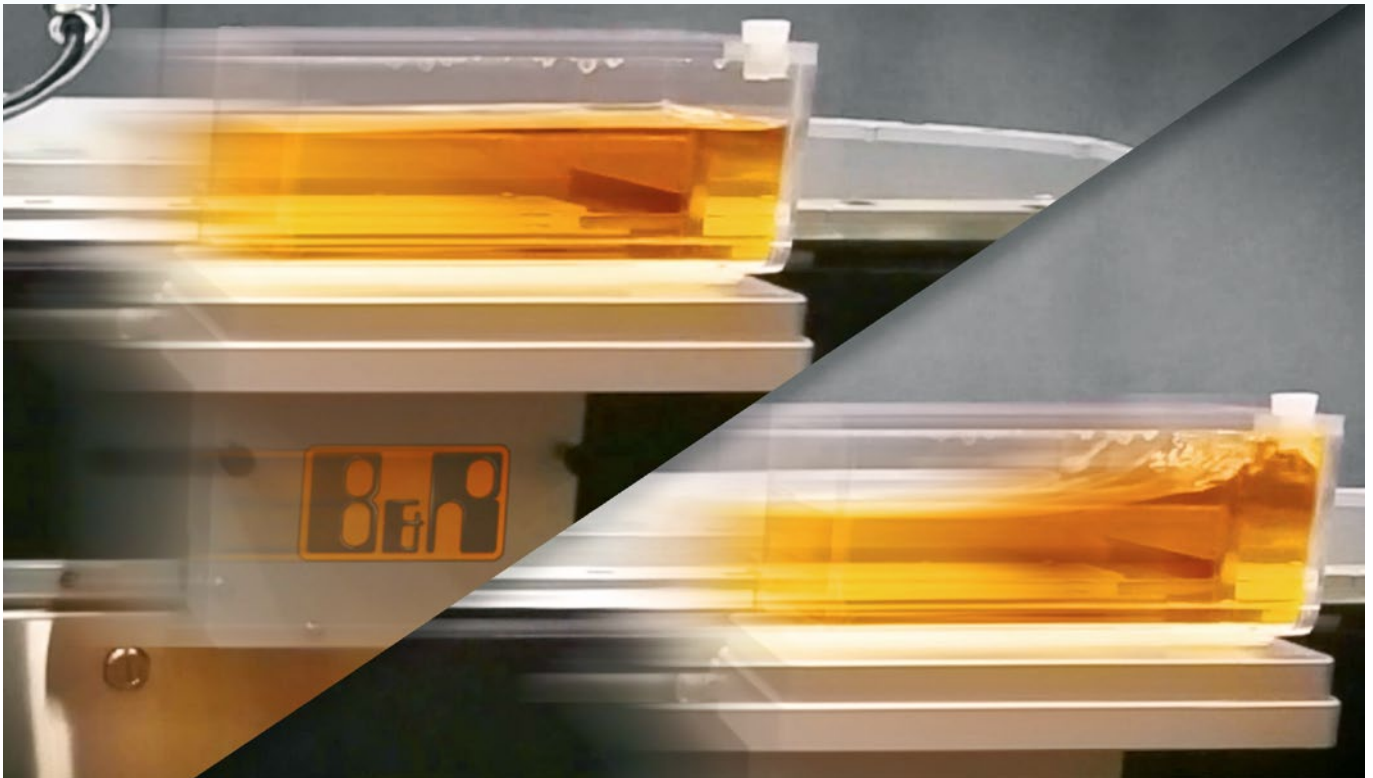


**Spare parts utility software based on Automation Studio**

Dynavia developed spare parts utility software based on B&R's Automation Studio software environment. It indicates which parts need to be replaced and allows users to place the necessary order - saving both time and money.

SuperTrak

# Boost productivity with anti-sloshing



As the only system on the market, SuperTrak offers anti-sloshing technology that suppresses the formation of surface oscillations to prevent liquids from spilling during transport.



## Transport liquids faster without spills

With B&R's industrial transport system, it is now possible to transport liquids quickly with no spills. SuperTrak is the only system on the market to offer anti-sloshing technology. This technology suppresses the formation of oscillations on free surfaces to prevent liquids from spilling over container edges during transport.

## No spills from open containers

The term slosh is used to describe the behavior of liquids in moving containers. Specially designed movement profiles prevent the development of positive feedback loops on the surface of the liquid

so that it remains calm during transport. This minimizes downtime and increases productivity when handling open containers.

## Higher production speeds

Minimizing oscillations on the surface of liquids is particularly important in the packaging industry. The better you are able to control sloshing, the faster the products can be transported. B&R's sophisticated anti-sloshing technology also prevents the formation of air bubbles and foam. The downtime otherwise required to allow the liquid to settle is reduced drastically or eliminated entirely for a substantial improvement in packaging line productivity. ←

Efficient production  
of any batch size

# NEXT GENERATION INDUSTRIAL TRANSPORT TECHNOLOGY

[www.br-automation.com/transport-technology](http://www.br-automation.com/transport-technology)

*Integrates into any process*

→ Synchronizes perfectly with CNC and robotics

*Field proven*

→ Best-in-class reliability

*Easy maintenance*

→ Industrial-grade quality, service-friendly design

ETHERNET   
**POWERLINK**

open   
**SAFETY**

**PERFECTION IN AUTOMATION**  
A MEMBER OF THE ABB GROUP



Integrated automation  
Global presence  
Solid partnership



ETHERNET  
**POWERLINK**

open  
**SAFETY**