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The B&R Technology Magazine

Interview

One system is all you need

Mobile automation From a single source

X90 mobile The future of mobile automation

POWERLINK High speed for mobile equipment

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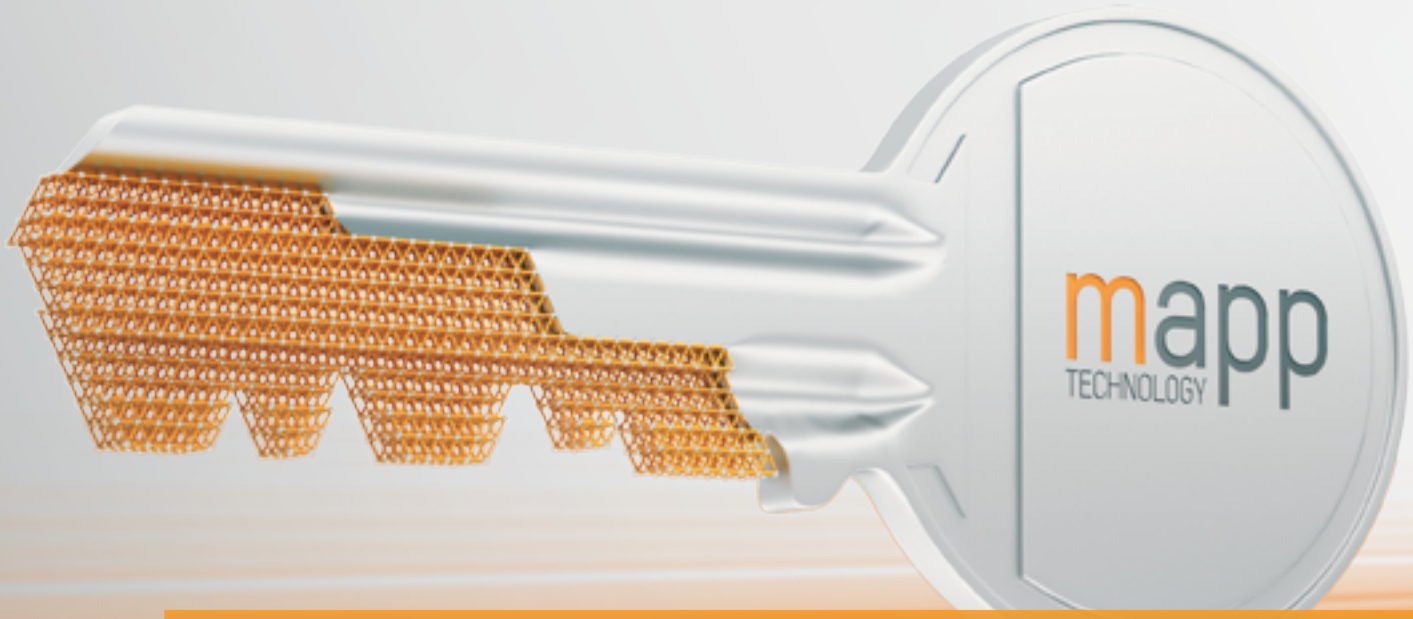

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editorial

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Dear Reader,

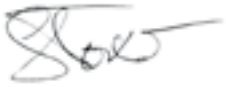
Over the years, the automotive industry has seen rapid development in terms of functionality, convenience, safety and environmental friendliness. Similar advances have been made with mobile equipment for agriculture and construction.

As recently as the early 90s, a combine harvester would have had virtually no automation electronics at all. Since then, heightened requirements for productivity, quality and convenience have fueled hefty upgrades in feedback control functionality and driver assistance systems based on electronic controls. This trend will continue in the years to come. Currently, OEMs are investing heavily in communication networks and operator assistance systems.

Guided by our motto of "Perfection in Automation", B&R has served a diverse range of industries with automation solutions for 35 years. This abundance of automation know-how is reflected in the mobile solutions we'll be unveiling at this year's bauma in Munich and at the Hannover Messe. Brought to life with the powerful Automation Studio engineering environment, B&R's mobile automation lineup is the ideal "chassis" on which you can build your future innovations.

Come visit us at bauma from April 11–17 in Munich (Hall A3, Booth 314) and at the HMI in Hanover from April 25–29 (Hall 9, Booth D28). We look forward to seeing you there!

Happy reading!



Stefan Taxer
Product Manager - Mobile Automation

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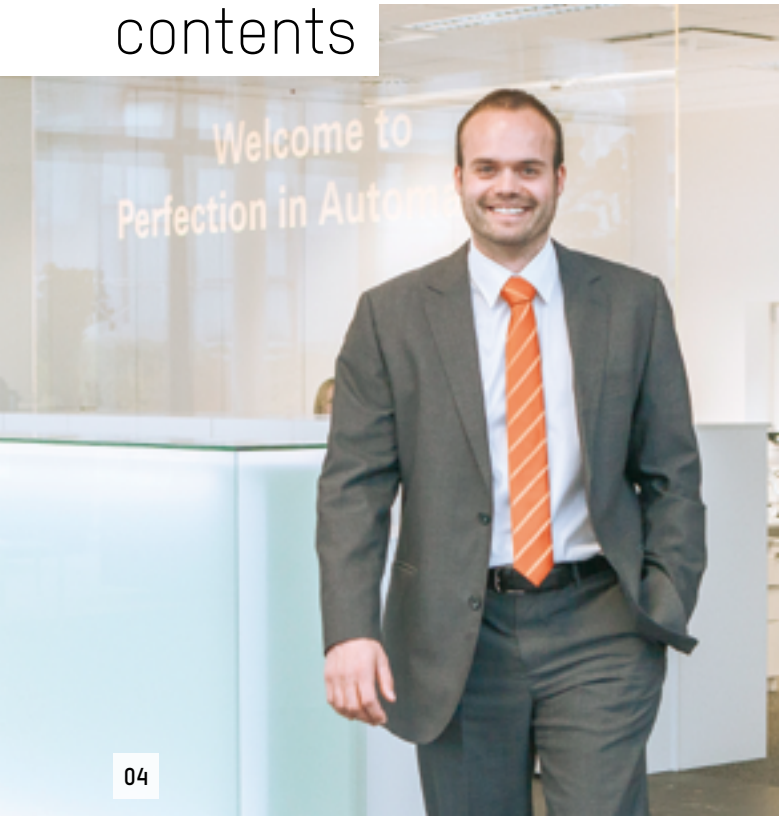

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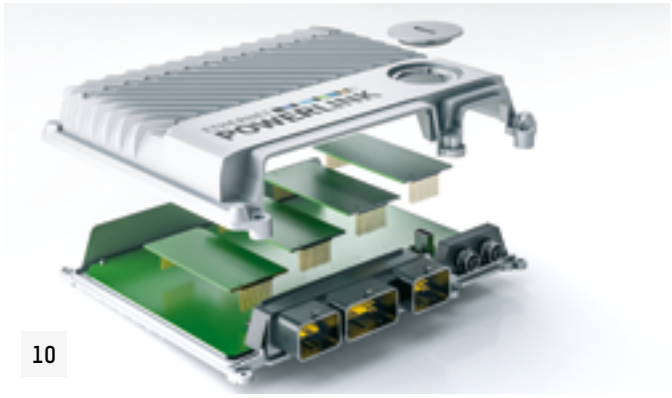

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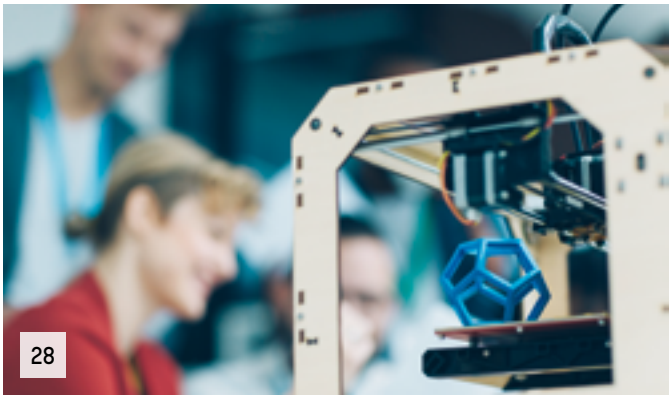

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"One system is all you need"

Automation technology for mobile commercial equipment is currently in a state of transition. Faced with unrelenting demands for higher productivity, the agricultural and construction industries are turning to increasingly automated and networked machinery. We sat down with Stefan Taxer, B&R's product manager for mobile automation, to find out what makes modern concepts such as smart farming so difficult to implement using conventional automation technology.

Stefan, you've said that conventional approaches to mobile automation are outdated. Why is that?
Over the past few years, we've seen a dramatic increase in the number of automation components found in mobile machinery. Nearly every vehicle now features multiple ECUs, displays, sensors and other electronics – all of which need to be coordinated. Maintaining such a complex system is costly and time-consuming, and it's getting harder and harder to implement new developments.

Why is there such a variety of systems?
The requirements for functionality and performance have risen sharply over the past two decades. Manufacturers began with very basic automation systems and then gradually added new hardware and software. When these systems ran up against the limitations of the CAN networks on which they were built, manufacturers simply added parallel networks to implement the desired functions.

What disadvantages can that have?
Inevitably, you're using hardware and software from different vendors. To work with and troubleshoot these components, you need multiple engineering tools. You need a specialist for each system, and when it comes time for support, you first have to figure out who the right contact is. And certainly not the least of your problems is that these systems need to exchange data, so you need to program and maintain all the interfaces. On top of all that, the application software is most often tied to your hardware, which hinders your ability to make hardware changes down the road.

So what's your recommendation for how to deal with the increasing complexity?
You need to be able to develop and maintain an entire mobile automation solution – from the controller down to the sensors – using a single engineering tool. This approach hinges on the use of a consistent, real-time capable backbone bus network with sufficient bandwidth.

Making a switch like that is surely no small undertaking.
If you had to develop such a unified system from the ground up, you would indeed have your work cut out for you. But, you have to remember that these requirements have already been solved for other industries, such machinery and equipment manufacturing. If you can take concepts that have proven themselves in those arenas and apply them to mobile equipment, you're already looking at a whole new generation of mobile automation.

Isn't comparing mobile and industrial automation a bit like apples and oranges?
Yes and no. When it comes to the basic functions, there are virtually no differences. A controller is a controller, regardless of whether it controls a painting robot or an excavator shovel with millimeter precision. The software used for engineering, control, maintenance and diagnostics also needs to meet the same criteria. What's different are the environmental conditions under which the products need to operate.

A printing press controller, for example, isn't cleaned with a pressure washer like the controller on an agricultural or construction vehicle is. Mobile automation needs products that can easily withstand a host of harsh conditions, including ultraviolet light, extreme temperatures, vibrations, shock, saltwater, oil and condensation.

Mobile equipment is exchanging more and more data over the Internet. How can this data be secured?
Transmitting data in the cloud presents a different set of requirements than in an industrial environment. Here, the focus is not on high bandwidth and real-time capability, but rather on security against theft and tampering. With its integrated security features, the vendor-independent OPC UA standard is a perfect match for this challenge. It can also communicate easily over WLAN, mobile networks, the Internet or industrial Ethernet. The OPC UA protocol has rapidly gained significance in the field of industrial automation over the past few years. ←

Photo © B&R, iStock

Mobile automation

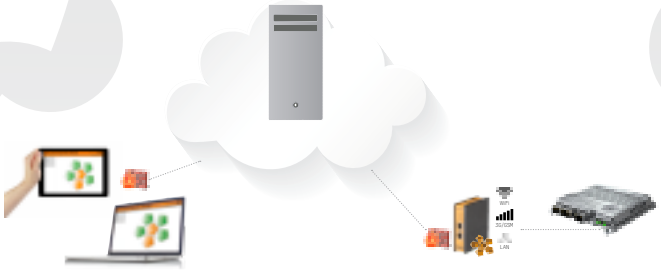
From a single source

For many years, B&R has been committed to developing a uniform and comprehensive automation solution based on 100% scalable hardware. Since the hardware and software are decoupled, components can be replaced at any time without adding to the time and cost of engineering. B&R's Automation Studio provides a universal environment for engineering, simulation, commissioning and diagnostics.

Photo: BSR

Engineering made fast and easy

Automation Studio is the perfect tool for concurrent development. Round-trip engineering and bidirectional data exchange let you start the software while mechanical and electrical planning are still underway – getting new products to market sooner.
mapp technology accelerates software development by 67%. The modular, intelligent components provide thoroughly tested functionality that can be configured graphically. A full-fledged user management or energy monitoring solution is only a few clicks away.



Diagnostics info available any time

B&R automation solutions offer numerous features for diagnostics and service. An integrated tool allows you to view diagnostics information about all B&R hardware on any device with a web browser or via a remote maintenance connection.

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Simulation for faster development

Simulation simplifies and accelerates the development process as well as saving costs. B&R offers integrated simulation within Automation Studio as well as convenient bidirectional interfaces for popular simulation tools like MATLAB/Simulink and MapleSim. Control functions you develop in a simulation tool can be automatically imported into your development project for use in your application.

Modern HMI made easy

Industrial operators want the interfaces they use on the job to be as friendly as their smartphones. mapp View gives automation engineers the tools to create web-based HMI solutions with the ease of drag-and-drop and without requiring knowledge of HTML5, CSS and JavaScript.

Security by design

Concepts like smart farming demand that machines are constantly online. B&R solutions transmit and receive data through secure VPN connections – in accordance with the latest IT standards. When it comes to communication with higher-level systems, B&R relies on the OPC UA protocol and its extensive built-in security features.

open SAFETY

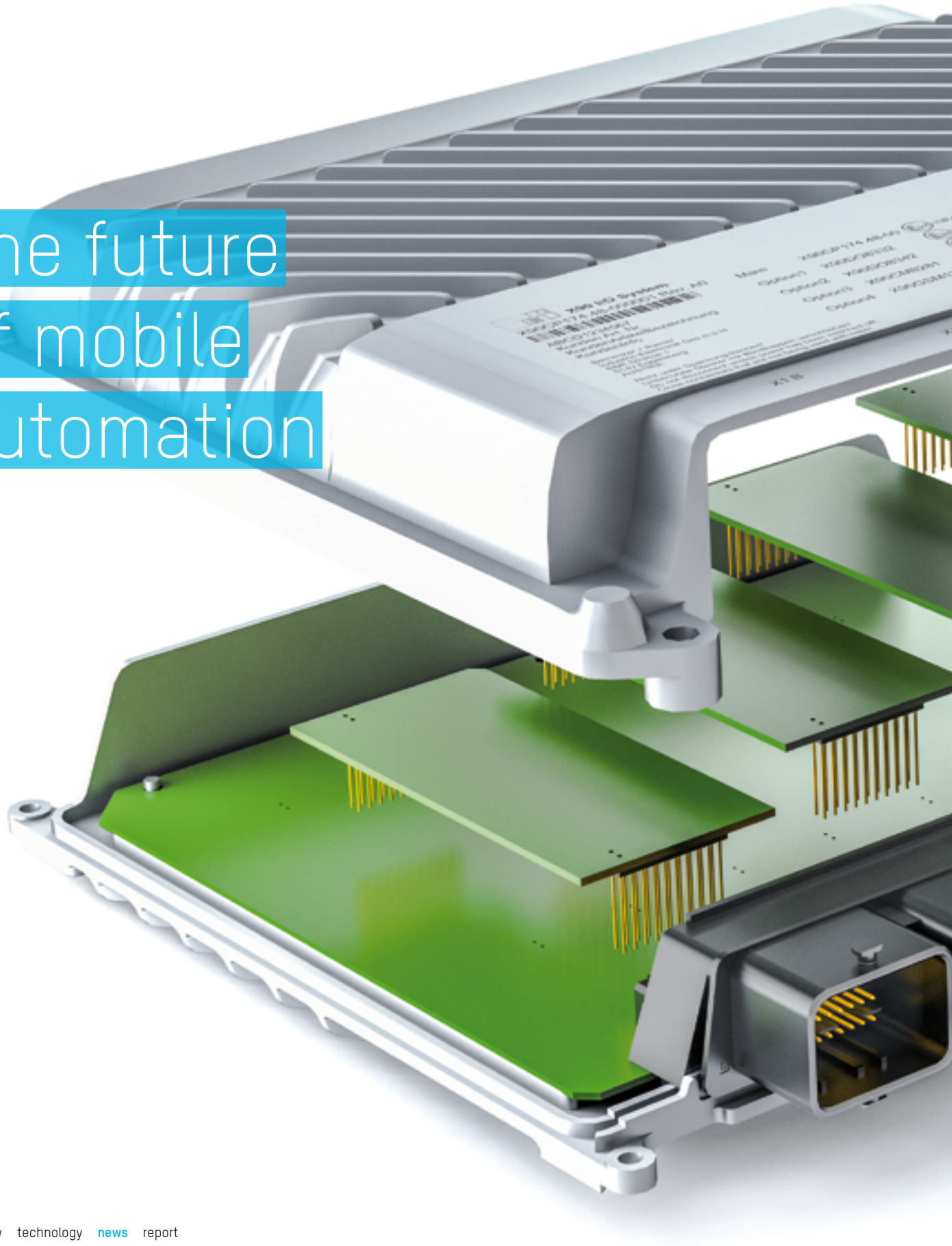
ISO 13849
ISO 25119

Safety included

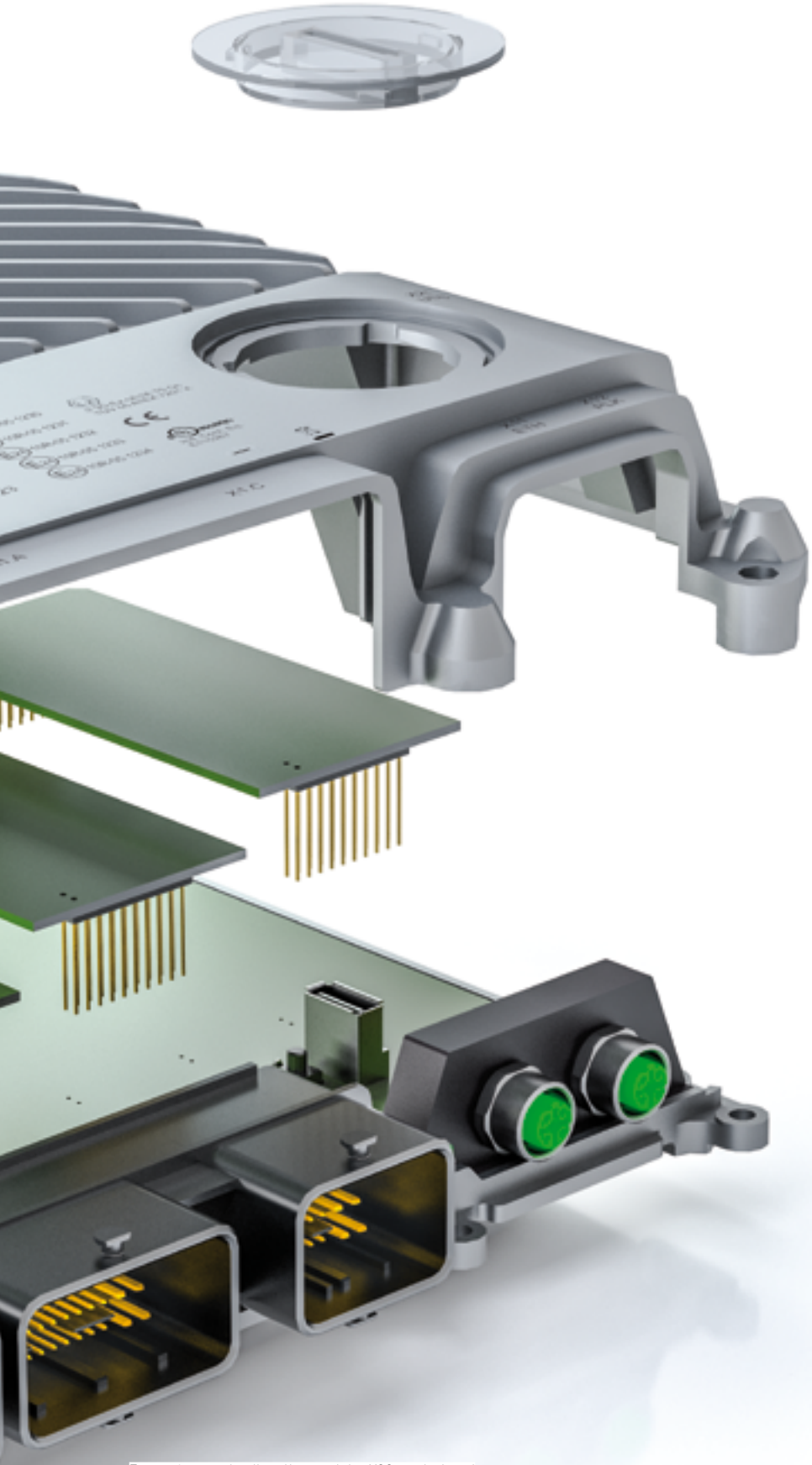
By seamlessly integrating network-based safety technology – up to PL e – into its overall automation system, B&R eliminates the need for hardwiring. B&R offers the same advantages with its safety technology as it does with its standard components: complete scalability, reusable software and a universal tool for engineering, simulation, commissioning and diagnostics.

News

The future of mobile automation



B&R presents: the modular X90 control and I/O system



Expansion cards allow the modular X90 control and I/O system to be perfectly tailored to any application.

Photo: B&R

B&R continues to open up new possibilities in mobile automation with its innovative X90 product line for mastering mobile control and I/O tasks. The comprehensive set of standardized components is perfect for implementing flexible automation concepts.

The heart of the X90 system is a controller with a powerful ARM processor and 48 multifunction I/O channels. Basic features include interfaces for CAN, USB, Ethernet and the real-time POWERLINK bus system.

Maximum flexibility

The extremely robust cast aluminum housing provides space for up to four expansion cards. This makes it possible to add additional I/O channels, interfaces and even a complete safety controller with safe I/O. Expansion cards for WLAN, Bluetooth and GPS interfaces are currently in the planning phase.

Maximum protection

All products in the X90 family are designed for use in harsh industrial environments. They can handle operating temperatures from -40 to 85°C as well as strong vibrations or shocks in addition to being resistant to salt, UV light and oil.

Maximum integration

The X90 system offers all of the advantages offered by B&R automation technology. This includes modular and hardware-independent software development using modular software blocks, which greatly reduce software development times and ensure software reusability. Safety technology and extensive troubleshooting options are also fully integrated in the B&R system and available to X90 users without limitations.

POWERLINK in mobile automation

High speed for mobile equipment

Photo © B&R

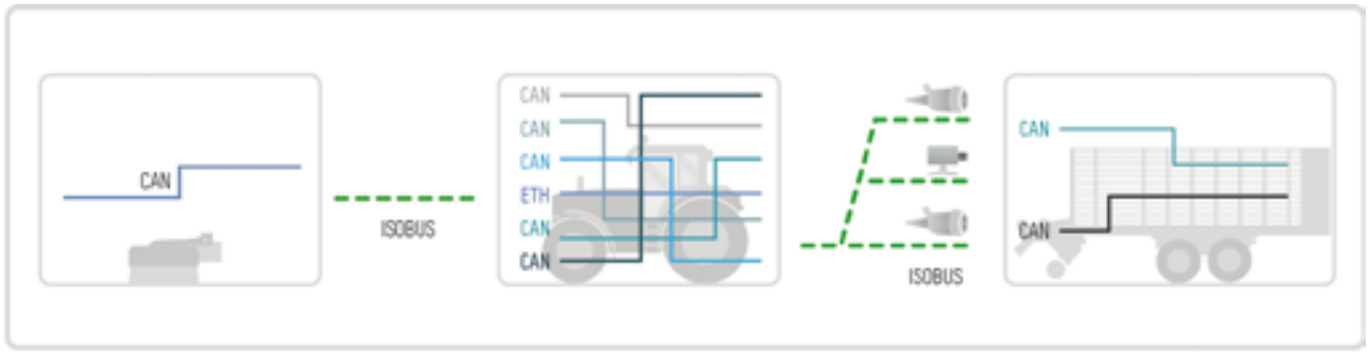
With each generation of mobile equipment more automated than the last, the traditional CAN bus can no longer handle the necessary volumes of data. Having proven themselves for years in a diverse range of manufacturing and processing applications, industrial Ethernet protocols like POWERLINK offer exactly the performance boost that the construction and agriculture industries are looking for.

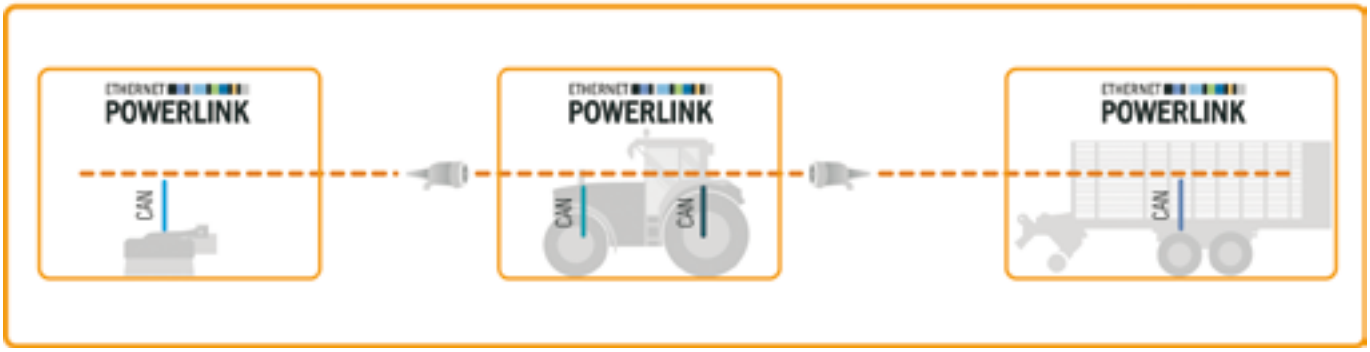
GPS navigation, rear view cameras, safety technology and countless fully-automated processes have all become standard features on today's high-tech mobile equipment and commercial vehicles – from combines and excavators to fire engines and multifunctional municipal vehicles. Having exceeded the maximum bandwidth of the conventional CAN bus, vehicles now rely on as many as ten parallel CAN networks to provide the necessary functionality.

More bandwidth

"With every network you add, you also add time and cost for engineering, maintenance and diagnostics," explains Stefan Taxer, B&R's product manager for mobile automation. And yet, there is still not enough performance or bandwidth for safety-critical applications. "Manufacturers have reached a point where the traditional bus system is standing in the way of progress." Mobile automation is looking for a new backbone bus system to serve as the basis for sustainable innovation.

"Industrial automation faced a similar dilemma around the turn of the millennium," notes Taxer. Since then, a high-performance solution has emerged as the clear winner: industrial Ethernet. It offers a larger bandwidth, is real-time capable and is based on the cost-effective Ethernet standard. "These benefits will make it successful in many areas of mobile automation as well," Taxer is convinced. The common Internet protocol TCP/IP is not an option, because it doesn't support deterministic communication.





With POWERLINK, you can transfer all the data for a mobile machine – or even a combination such as a tractor, mower and trailer – using a single cable.

The choice of a bus system is a long-term commitment, so manufacturers are looking for a solution that is open and future-proof. "That's exactly what POWERLINK is designed for," says Taxer. The protocol stack is published under the BSD license. The source code for master and slave implementations is readily available to anyone, and there are no licensing fees. POWERLINK's user organization, the EPSG, offers any manufacturer the opportunity to join and help shape the future of the protocol.

POWERLINK based on CANopen

Implementing a new bus system can be a costly process, with new hardware to be purchased and a large portion of software to be rewritten. "Despite the huge leap in performance, switching to POWERLINK as the backbone bus is surprisingly easy," explains Taxer. POWERLINK uses the CANopen object dictionary as well as CANopen profiles and communication mechanisms. Cyclic process data is exchanged via process data objects and parameter data via service data objects. POWERLINK and CAN work together perfectly.

Communicate faster – 100 Mbit/s

Like CANopen, POWERLINK also offers direct cross-communication. All CANopen applications and device profiles can be directly implemented in a POWERLINK environment – as far as the application is concerned, there is no difference between the two protocols. The difference in speed, however, is considerable: POWERLINK has a transfer rate of 100 Mbit/s. In cases where even more bandwidth is needed, it's no problem to switch to Gigabit Ethernet.

"Today's mobile equipment can have up to 3,000 meters of network cable in as many as 10 networks," says Taxer. This results not only in high costs for installation and maintenance, but also increases susceptibility to errors.

One cable for everything

With POWERLINK, you can transfer all the data for a mobile machine – or even a combination such as a tractor, mower and trailer – using a single cable. In addition to real-time process data, the network also carries HMI data, safety data and the video signal from the rear view camera. POWERLINK's multimaster capability allows self-driving equipment to switch between controlling itself and being controlled from a tow vehicle – without having to make any configurations or restart the system.

POWERLINK networks offer complete freedom of topology. "Star, tree, bus or ring structures – or combinations thereof – are all possible without requiring any network configurations," explains

Photos © BSR

Taxer. The resulting modularity allows you to add or remove network segments during operation. Particularly when it comes to modular machine design, POWERLINK offers maximum flexibility paired with optimum usability.

More complex automation solutions have conventionally required multiple networks and multiple controllers, each with its own software. Of course, this all has to be coordinated and maintained. With the high data transfer rates and real-time capability of POWERLINK, all you need is one controller for one application. Data from sensors and actuators is sent to the controller in real time, where it is processed and returned as required. Centralized and decentralized control architectures are equally possible.

High machine availability

"Compared to other Ethernet-based fieldbuses, the cost of implementing POWERLINK is very low," says Taxer. There are no license fees or special hardware, and – rather than come at the cost of quality – the savings are actually accompanied by an increase in machine availability. The high bandwidth allows you to do things like implement detailed diagnostics or perform software updates quickly and reliably over the network. Since POWERLINK uses a single-frame protocol, it is virtually immune to EMC disturbances.

Safety included

Since mobile equipment is also subject to the EU machinery directive, it often requires its own safety application. "openSAFETY is perfect for this," says Taxer. The open source safety protocol can be implemented in conjunction with POWERLINK and doesn't require a network of its own. Safety-related data is transmitted over the POWERLINK network independently of other traffic. Pre-certification up to SIL 3 / PL e makes implementing openSAFETY especially fast and uncomplicated. ←

Stefan Taxer
Product Manager - Mobile Automation

"POWERLINK makes it possible to implement modern automation solutions on the basis of CAN technology. The protocol offers plenty of bandwidth for video, remote HMI, real-time processing and safety."

When *retro* means forward

For System TM, replacing an outdated control system for wood processing machines with a 100% B&R solution led to a more efficient interface between onboard components and inspired a systematic hunt for milliseconds that ultimately delivered an overall capacity increase of up to 50%. By replacing custom components with standard B&R technology, System TM has streamlined its spare parts supply and can now offer its customers improved service.

When System TM – a global supplier of machinery for the wood processing industry – needed to replace an outdated control system on its cross-cut series, the original plan was to find a supplier of system components that could solve the retrofit challenge without affecting the overall performance of the machine. What System TM was aiming for was a conversion rather than a development project.

After several unsuccessful trials with other suppliers, B&R was asked to join the project – not only with a complete set of compatible components, but also with its team of experienced system engineers. Shortly after the initial tests in 2011, System TM realized that the task of retrofitting showed signs of numerous small improvements. What started with a 10-millisecond improvement, and thus a capacity increase of one extra plank per minute, eventually added up to a 50% capacity increase of the entire machine.

Timing is everything

The wood processing industry has undergone tremendous changes since the financial crisis. Many small wood processing businesses that typically had 3 or 4 automated cutting machines have been replaced by fewer, much larger sawmills with up to 15 automated cutting machines and a fully automated flow from the infeed through to inspection, cross-cutting, finger jointing, molding, laminating, stacking and more. The intense competition and

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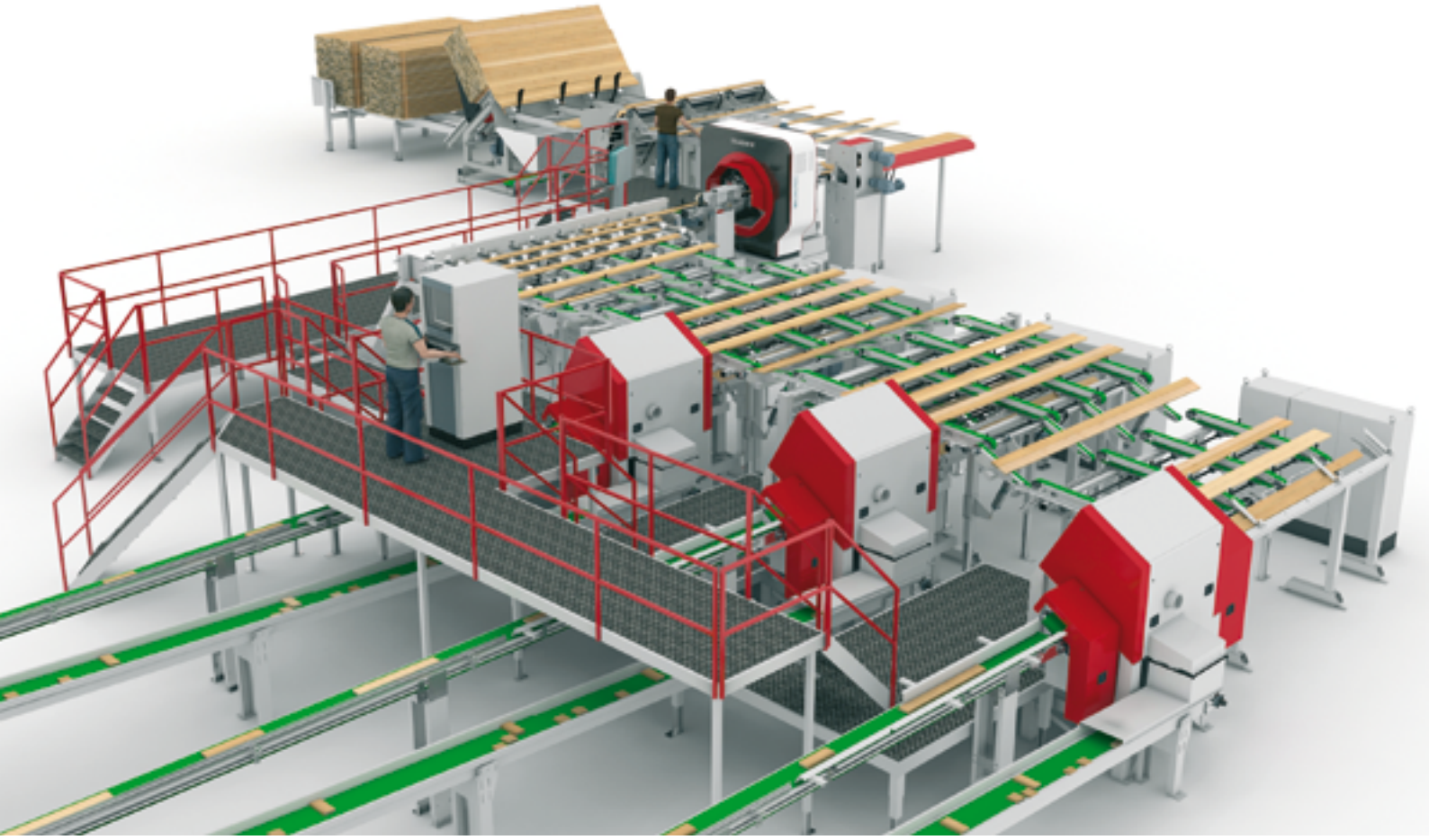


System TM offers wood cutting machines as standalone equipment, or as part of a fully automated flow with infeed, cross-cutting, finger jointing, molding, laminating and stacking.

the absence of human operators on the factory floor create demand not only for further automation, but also for optimized utilization of both human and manufacturing assets. The hunt for continuous improvements – however small they might be – is a central focus of today's modern sawmills.

According to System TM's COO Thomas H. Olesen and his staff, the improvement couldn't have come at a better time, since the market at that point was calling for higher speed and improved capacity. "Although we initially saw the conversion as an inconvenience," says Olesen, "the outcome has brought us a valuable competitive edge due to the unexpected scale of improvements."

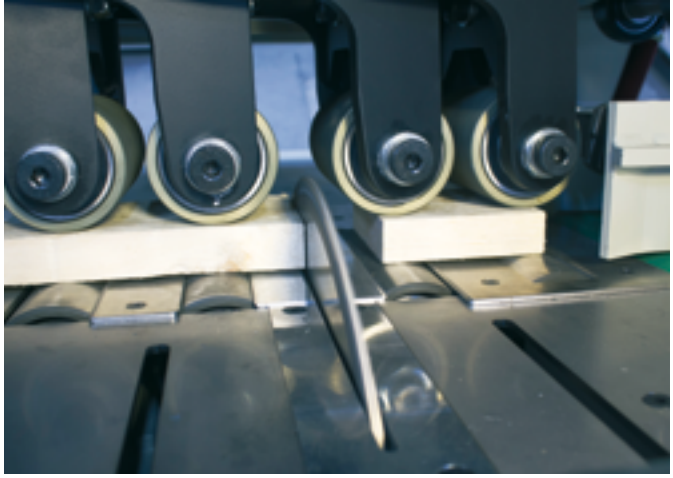
The turning point

Back in 2011, System TM was in a position where it could no longer supply sufficient spare parts or software upgrades, and the conversion was becoming urgently necessary. At first, the company intended to upgrade the control system with components from their existing supplier. When all trials in this direction failed, however, the company began its search for a supplier that could match the rather strict requirements. In B&R, System TM found a solution provider that was also able put a team of programmers and engineers at their disposal. The joined commitment was, according to Olesen, a turning point and one of the main reasons why the cooperation has yielded such great success.

"At the time of the conversion we were involved in a lot of ongoing projects," recalls Olesen, who was heavily involved in the selection of B&R and the subsequent system integration. "It was therefore absolutely crucial that the conversion could take place as quickly and smoothly as possible."

Standard replaces customized

The switch to a fully B&R-equipped control system – complete with an industrial PC, motion controllers, servo drives, PLCs and I/O – opened up the possibility of more efficient internal communication. So, even though the change of interface and communication fell somewhat outside the scope of the planned conversion project, System TM decided to pursue these new opportunities.



With a retrofit of the system based on standard products, System TM's cutting machine is now 50% faster.

Thomas H. Olesen (COO, System TM) and Carsten Clemensen (Managing Director, B&R Denmark) agree that the close cooperation between their engineering teams has been an important factor in their success.

Thomas H. Olesen
COO, System TM

"Since the conversion, we have used B&R's programmers on several occasions as if they were part of our own organization. This has been beneficial in situations where our team was tied up with other work, or in projects where B&R possessed special know-how that helped us speed up development."

The Opti-Kap 5003 was the first machine B&R converted – achieving a total capacity increase of up to 50%.

Previously, all communication between the individual system components was controlled by a customized industrial PC. In the retrofitted solution, the customized PC has been replaced by a standard industrial PC that primarily handles the HMI, accessed through a multi-touch panel. All data processing and internal communication between the different components now takes place via integrated onboard controllers. The distributed architecture allowing internal communication between the individual system components has been the main contributor to the capacity increase.

The fact that the entire retrofit challenge has been solved using standard components is of great importance to System TM. "We implement machines and large turnkey solutions around the globe," says Olesen, "so we need to have easy access to spare parts wherever the customer may be situated. The switch from custom system components to a solution based on standard products not only eases the supply of spare parts, it also puts us in a position to offer improved service."

Sharing knowledge is the key to success

Since the challenging conversion project in 2011, System TM has based all of its control systems on B&R components. System TM still attributes the success of the project to B&R's high-end programming assistance.

"Since the conversion we have used B&R's programmers on several occasions as if they were part of our own organization," explains Olesen. "This has been beneficial in situations where our team was tied up with other work, or in projects where B&R possessed special know-how that helped us speed up development."

System TM A/S

As one of the largest suppliers in the world, System TM specializes in optimizing system solutions for the solid wood industry. System TM takes responsibility for the entire process from infeed to inspection, cross-cutting, finger jointing, molding, laminating, stacking, and all kinds of internal transport. The competencies of its staff range from line design, installation and commissioning to staff training, service and maintenance. ←

Open, safe robotics

New paradigm in radiotherapy

Photo: iStock

Through years of close contact with oncology treatment centers and radiotherapy integrators, LEONI saw a strong demand within the medical industry for a patient positioning solution that combines this broad experience with highly reliable and well proven industrial products and solutions. With motion control and safety technology from B&R, LEONI developed a new paradigm in radiotherapy robotics: LEONI ORION.

LEONI ORION offers dynamic positioning control with six degrees of freedom and sub-millimeter accuracy.

As a worldwide solution provider for reliable industrial robotics as well as healthcare applications, LEONI's extensive product and service portfolio encompasses not only cables and cable systems, but also software development, programming, machine vision systems, automation and training. The latest innovation – a sophisticated patient positioning system for radiotherapy – comes from the company's ORION Center of Competence in Chartres, France.

LEONI ORION was the star of the ASTRO radiation oncology event held in San Antonio, Texas. The robotic positioning system is designed to meet the real-world needs of the medical community – with the primary clinical value being its intuitive operation that provides smart support to medical staff. The robot's tool changing system allows it to grip the treatment table in any location. Its 3D camera system monitors and adjusts the patient's position relative to the radiotherapy beam in real-time. LEONI ORION offers dynamic positioning control with six degrees of freedom and sub-millimeter accuracy. These features, in combination with LEONI's haptic technology – which allows the therapist to manually guide the patient into position – set an unprecedented new standard in radiotherapy treatment.

100% open robot controller

Solutions with integrated robotics allow optimal synchronization between robots and machines. "The openness of the B&R control system was a perfect match for our requirement of 100% openness for our robot controller," says Samuel Pinault, head of robotics innovation at LEONI. "The large selection of safe motion control functions combined with full openness make SafeMOTION and openSAFETY the ideal technology for safe robotics systems."

Samuel Pinault
Robotics Innovation Manager, LEONI

"The performances of POWERLINK and openSAFETY technologies combined with robotics safety functions from B&R enabled us to design the most advanced patent positioning system for radiotherapy on the market."

Working side-by-side with human nursing staff, LEONI ORION relies on B&R's SafeMOTION functions to meet the strict safety regulations for medical collaborative robotics.

The next step for LEONI will be to integrate the safety laser scanner directly into the control network via open SAFETY. In addition to improved performance and reduced cabling costs, this will allow the scanner's safety parameters to be configured automatically by the robot controller – opening up innovative new options for increased productivity.

Safe collaborative robot

LEONI ORION works side-by-side with human nursing staff, who are in immediate contact with the moving robotic arm that extends the treatment table. In such an environment, it is clear why LEONI ORION must fulfill the strict safety regulations required for medical collaborative robotics.

The patient positioning limits of 10 centimeters and 6 degrees per second are ensured by B&R's SafeMOTION software, while the robot's mechanical speed is limited to twice the maximum safe speed to allow for efficient maintenance. The SafeMOTION software functions provide angular limitation of the robot's movements without requiring mechanical clamps.

ETHERNET POWERLINK

open SAFETY

Based on a 6-axis robot, the system achieves positioning accuracy of 0.5 millimeters, setting a new standard in radiotherapy robotics. Combining a safe robotics system and a sophisticated dynamic volume modeling system, the ORION robot requires high volumes of real-time data exchange between all hardware and software components. That's why LEONI chose to base its open and safe robot controller on POWERLINK and openSAFETY technology.

The future of healthcare

The increasingly positive results being achieved through radiotherapy cancer treatment have increased demand for the procedure and hence waiting times for patients. The task of accelerating processing times without compromising accuracy places extreme demands on the patient positioning system. With a fully integrated solution featuring B&R motion control technology and openSAFETY communication, LEONI ORION sets the bar high for a new generation of flexible, intuitive, collaborative robotics for the healthcare industry – unparalleled in speed, precision and safety. ←

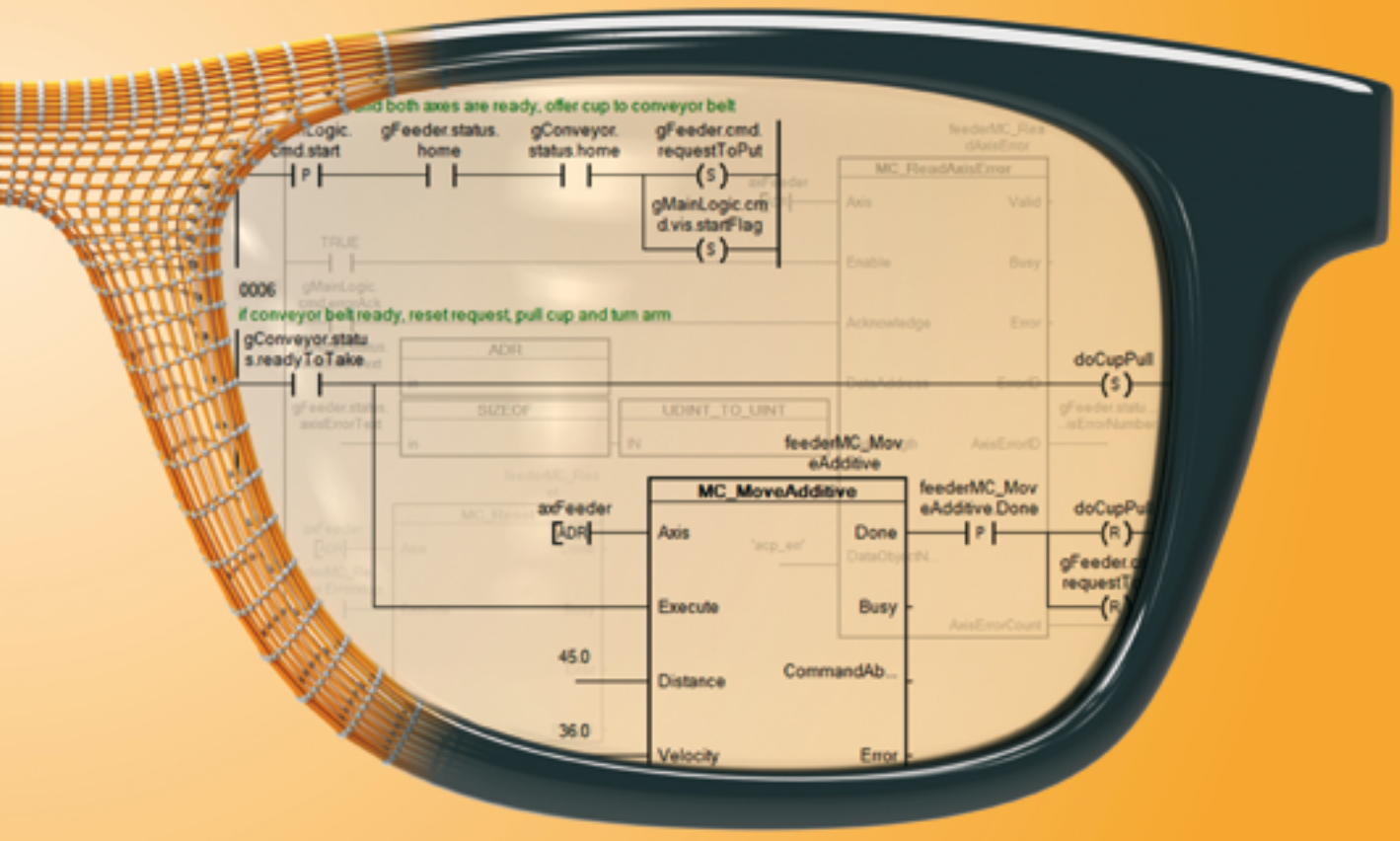
Photos: LEONI

Web meets automation

With mapp View, B&R introduces web technology to the world of automation engineering.

Photo © B&R

The smartphone is the poster child for high-performance electronics with ultimate interface usability. Unsurprisingly, operators of industrial machinery and equipment desire nothing less for the interfaces they use every day. With mapp View, B&R now offers direct access to the wide world of web technology right from the engineering environment. For the first time, automation engineers have all the tools they need to create powerful and intuitive HMI solutions – and they don't have to be an expert web developer to do it.



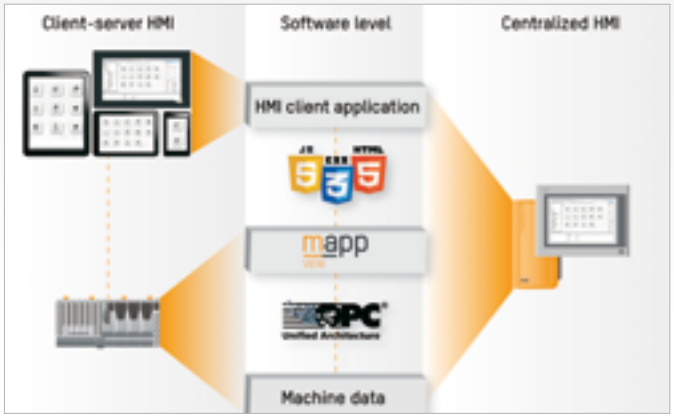
Modern websites and smartphone operating systems are designed by large teams of usability, design and ergonomics specialists. "An OEM doesn't typically have those kinds of resources at their disposal," says B&R's marketing manager, Stefan Schönegger. To bridge the gap, what they need are easy-to-use tools integrated in their familiar programming environment.

The right info at the right time

Operators aren't impressed by fancy graphics and multi-touch navigation alone. "The HMI needs to directly facilitate the primary goals of industrial production: maximum productivity and minimum downtime," explains Schönegger. The key to both of these goals is having the right information at the right time. Important notifications need to reach their intended audience every time, whether that happens on the main operator terminal, a small info screen, a smartphone or tablet. At the same time, the design must be able to prevent human error.

100% web technology

"With mapp View, we solve these challenges by relying 100% on web



With its modular organization, mapp View can just as easily be used as a centralized HMI solution or in a client-server architecture.

The automation engineer builds HMI pages in the familiar Automation Studio environment.

mapp VIEW

standards," says Schönegger. These technologies allow content to be displayed optimally on any output device or even customized for specific users or user groups. "Conventional approaches require considerable resources and expertise to develop pages for all the different output media," explains Schönegger.

Working in a familiar environment

What makes mapp View unique is the way it integrates web technology right into the engineering environment. "While mapp View is built on HTML5, CSS3 and JavaScript, automation programmers never need to deal with these languages," ensures Schönegger. "Instead, they can continue to focus on their own areas of expertise." HMI pages are built in the familiar Automation Studio environment. All GUI functionality is encapsulated in modular control elements called widgets, which are simply dragged and dropped into place and configured.

One of the main advantages of web technology is the way it separates content and layout. Even after the content of the HMI application has been finalized, developers can fine-tune the layout and style to optimize usability after initial field testing. Widgets are available in a number of standard themes, or they can be customized with the user's corporate design. Thanks to the use of web technology, the content can easily be adapted to different output media – whether it's a widescreen operator panel or a small smartphone screen.

Ideal for modular architectures

"It's not just the content and layout that are separate from one another," continues Schönegger. "The machine control and HMI applications are also completely decoupled." The HMI software or individual GUI components can be reused and modified at any time, making mapp View ideal for flexible, modular machine architectures. This also reduces maintenance costs and improves overall quality.

The web is subject to continuous change and progress, yet web technology itself has remained remarkably constant over time. "HTML pages created in 1985 are still displayed correctly in any of today's browsers," says Schönegger. mapp View is built on the globally accepted web standards HTML5, CSS3 and JavaScript.

"Unlike proprietary platforms like Flash or Silverlight, these standards are updated continually and remain usable for decades."

Open with OPC UA

mapp View is fully integrated in B&R's Automation Studio engineering environment. Controllers from other vendors can easily be incorporated in the HMI via OPC UA. "mapp View is the first web-based HMI tool in the world that doesn't require developers to know web programming languages." ←

Photos © B&R

mapp View offers a large selection of preprogrammed HMI widgets in various design themes. The design is independent of the HMI application and can be modified at any time.

With mapp View, any automation engineer has all the tools and knowledge it takes to create powerful, intuitive HMI pages.

Stefan Schönegger, **Marketing Manager, B&R**

B&R introduced mapp technology about a year ago – heralding a revolution in software development. Now you're following that up with mapp View. What do the two have in common?

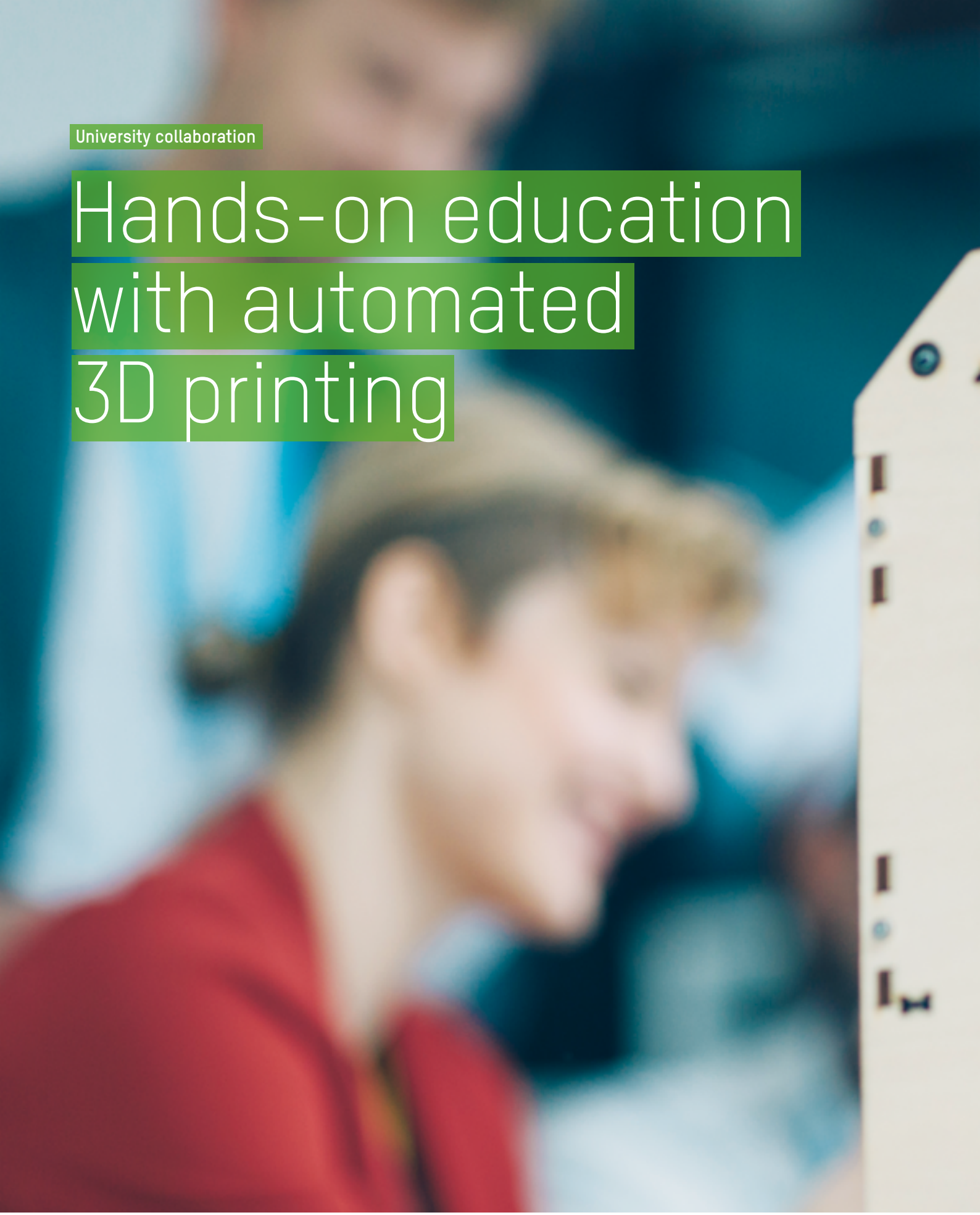
They're based on the same principle. Both mapp and mapp View provide encapsulated functions that all communicate with each other within a single framework. The two technologies complement each other perfectly. Just as mapp technology simplifies and accelerates the development of machine control software, mapp View does the same for HMI software. Each mapp component includes an HMI element that makes it even easier to display and modify the corresponding data.

mapp and mapp View are both software products. What's the reasoning behind B&R's heightened focus on software?

The complex processes required of modern machinery can no longer be handled by mechanical and electrical technology alone. The market's insatiable demand for flexibility is resulting in more and more processes being implemented in the form of software. With mapp and mapp View, we're helping our customers stay at the forefront of these trends in an extremely efficient and cost-effective way.

University collaboration

Hands-on education with automated 3D printing



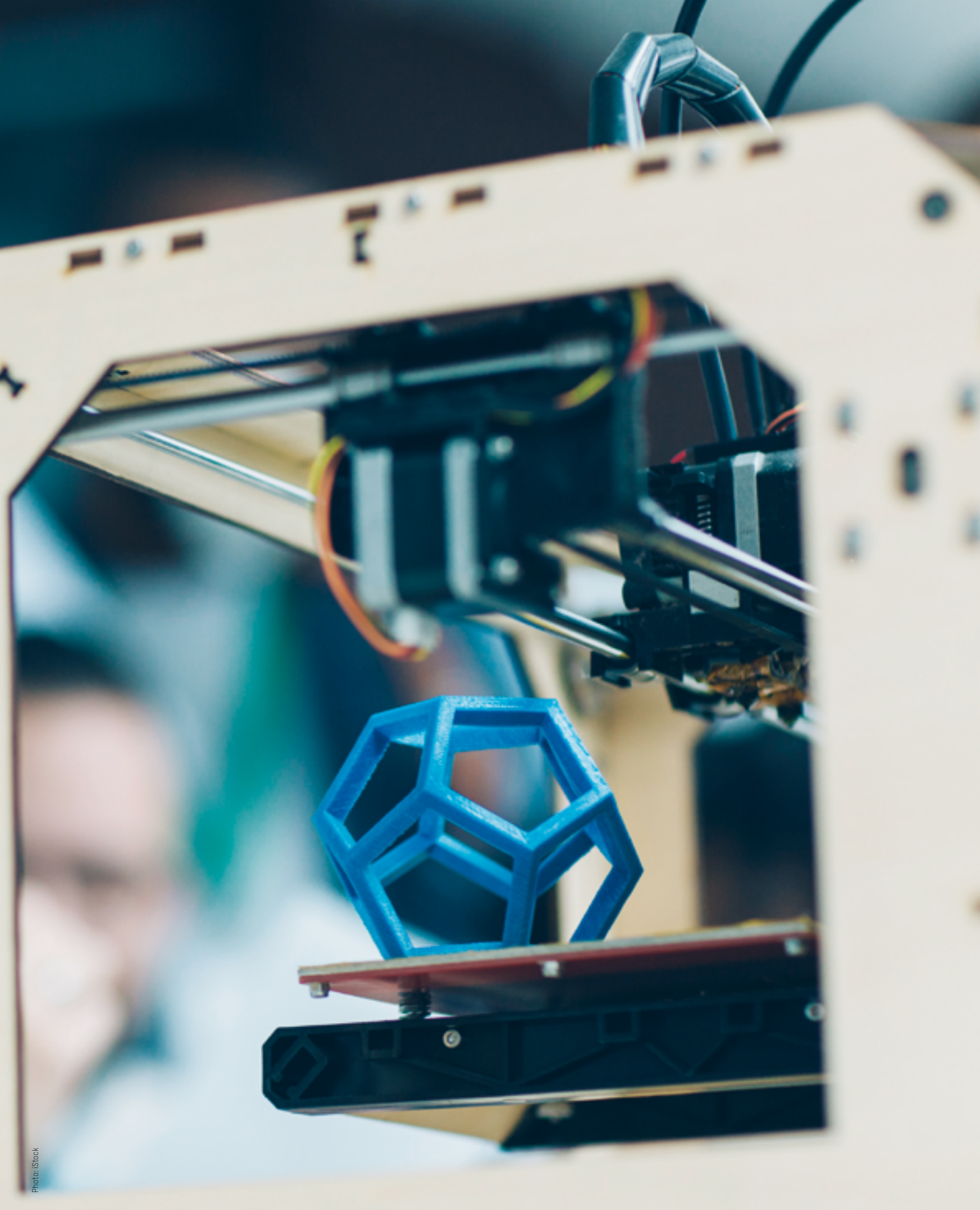


Photo: iStock

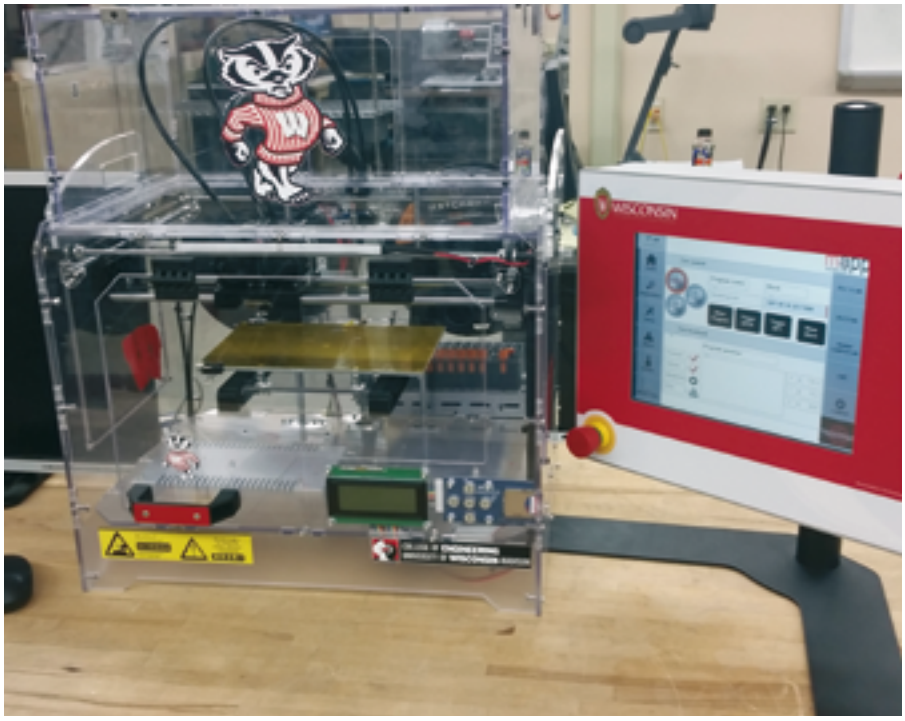
The University of Wisconsin-Madison is a renowned and highly ranked teaching and research institution. Its College of Engineering produces some of the nation's best mechanical engineers. In the fall of 2015, the department took the opportunity to further enhance its core curriculum with more comprehensive real-world applications, equipping its laboratories with state-of-the-art 3D printers and innovative automation technology from B&R.

Mechanical engineers require an incredibly diverse set of knowledge and skills and work with equipment ranging from jet engines to medical instruments. It is therefore no surprise that the University of Wisconsin-Madison's mechanical engineering course Manufacturing Fundamentals is so multifaceted – covering areas of the manufacturing process such as CNC, control theory, motion control, automation and programmable logic, in addition to metrology and engineering economics.

The course has always taught this broad range of concepts. Yet, in the past, each was treated separately in its own laboratory setting, sometimes making it difficult to fully grasp how they relate to one another in a real-world situation. The mechanical engineering departmental team therefore took the opportunity of its increased enrollment to restructure the course in a way that provides students with a more cohesive presentation of the engineering concepts as well as more hands-on training. The newly designed course integrates additive manufacturing into the core undergraduate curriculum. Laboratory activities are now centered around a single physical plant – an experimental setup of a 3D printing platform.

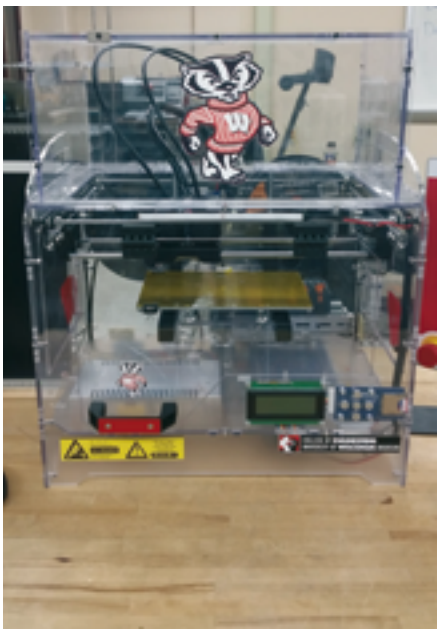
Reduced development time and complexity

The mechanical engineering department equipped each laboratory workbench with its own fused deposition modeling 3D printer running sophisticated industrial automation software. When Erick Oberstar, Associate Faculty & Mechatronics Lab Manager, saw potential to further enhance the program by implementing new automation technology



Using a B&R Power Panel and the flexible X20 I/O system that combine control, visualization and motion control technology into a single system, students can easily implement machine logic, CNC motion control and advanced temperature control functions and leverage a sophisticated touch-screen HMI for machine interaction.

In a close partnership that dates back to 2010, the University of Wisconsin - Madison's Mechatronics Laboratory uses solutions from B&R to help achieve its goal of affording students access to cutting-edge automation equipment and techniques.



The University of Wisconsin - Madison mechatronics laboratory is equipped with 3D printers featuring automation control technology from B&R.

equipment, he decided to contact B&R. In a close partnership that dates back to 2010, the University of Wisconsin-Madison's Mechatronics Laboratory has used solutions from B&R to help achieve its goal of affording students access to cutting-edge automation equipment and techniques. B&R's ability to provide CNC control as well as general purpose machine control within one system made B&R an ideal partner for the laboratory's requirements. "The level of hardware and software support that B&R provided us made development and implementation of the new laboratory format simple and painless," says Oberstar.

By implementing solutions from B&R, the laboratory was able to accomplish more with fewer resources. The university's mechanical engineering team faced what could otherwise have been the daunting feat of switching over all their equipment to a new additive manufacturing setup with all new hardware and a complete software solution from the ground up. Yet, program development was easy thanks to the availability of CNC libraries and B&R's mapp technology (a development solution that drastically reduces the time it takes to create machine software through the use of modular software components). Standard G Code commands were already embedded in mapp components, saving the team development time and allowing them to instead focus on configuring the mapp library to utilize their own set of sensors and actuators. "The software development and deployment effort was very fast-paced," says Oberstar. "We started active development in the end of the fall semester and deployed by the midpoint of the spring semester."

In the mechatronics laboratories, the automation control technology is integrated with the 3D printers to provide students more hands-on interaction with the hardware in a real-world scenario. When they write code in the Automation Studio software environment, they are truly programming and will produce actual printed parts on the same machines they program. To further tie in its commitment to training based on real-world applications, B&R sends an automation expert to the mechatronic laboratory each semester to discuss today's market for industrial automation and present trends in technology, employment and industry as they relate to machine control.

Flexible all-in-one control solution

Using a B&R Power Panel and the flexible X20 I/O system that combine control, visualization and motion control technology into a single system, students can easily implement machine logic, CNC motion control and advanced temperature control functions and leverage a sophisticated touch-screen HMI for machine interaction. This advanced capability to have a single system for all the main control-related functions is ideal for the lab environment – where students are exposed to numerous topics in the span of only a few months.

The students are well pleased with their new lab. The 3D printer system has been such a success that the mechanical engineering department has plans to introduce a new medical lab application featuring B&R automation technology into the 2016 curriculum. "We have made a huge impact on hundreds of students," explains Oberstar, "and we want to continue to nurture our program by adding even more real-world applications and comprehensive introductions to the concepts covered by pairing our mechanical engineering automation projects with B&R's control solutions." ←

Photos: University of Wisconsin

The new mapp RoboX and mapp Teach make it faster and easier than ever to get robotic systems configured and ready for operation.

Complex kinematics, easy operation

New mapp components: Set up and control up to 15 axes

B&R has further expanded its portfolio of modular mapp software components. The new mapp RoboX and mapp Teach make it faster and easier than ever to get robotic systems configured and ready for operation.

mapp RoboX can be used to control any kinematic system with up to 15 axes. Developers enjoy complete design freedom while still benefiting from all the conveniences of mapp technology. The robot is simple to parameterize, with visualization and diagnostics already on board. This saves valuable time, both in development and during operation.

Fast commissioning

For the next step there is mapp Teach, which provides intuitive teach-in functionality to define and manage the robot's movement sequences and get it up and running in no time.

Fast development

mapp technology consists of individually encapsulated blocks that streamline development of new applications. The components provide basic functionality that can be configured graphically – cutting development times by an average of 67% . All mapp components are connected via mapp links. Each mapp component retrieves the data it needs from other components using a client-server model.

Photos: B&R

OPC UA companion specification for POWERLINK

Thomas J. Burke (left), president of the OFC Foundation, and Stefan Schönegger, managing director of the EPSG, announce the development of an OPC UA companion specification for POWERLINK at the SPS IPC Drives trade fair.

B&R customers will now be able to benefit from integrating communication from the sensor layer to the ERP layer without any interfaces whatsoever. This will be made possible by a companion specification that is now being developed by both the OPC Foundation and the Ethernet POWERLINK Standardization Group (EPSG).

Industry 4.0 and the Internet of Things (IoT) require seamless and consistent communication both within the digital factory as well as externally to cloud-based services and other Internet technologies. These requirements are now being met as the EPSG and OPC Foundation work to implement a common definition for open interfaces between their technologies. B&R has been relying on the open-source POWERLINK protocol for years, so all future B&R automation solutions will allow communication without interfaces.

Leading real-time Ethernet system

"POWERLINK is one of the leading real-time bus systems for machine manufacturers," said OPC Foundation president Thomas J. Burke during the OPC Foundation's press conference at the SPS IPC Drives trade show. It is an excellent complement to the functionality provided by OPC UA, he emphasized. "OPC UA is ideal for connecting directly to real-time networks and allows complete, secure and scalable communication between these networks and the world of IT."

Ideal combination

"The combination of OPC UA and POWERLINK is ideal for integrating devices from different manufacturers as well as the various levels of the automation pyramid to create a complete system," said EPSG managing director Stefan Schönegger. "For this reason, the EPSG relies on OPC UA as the communication protocol from the control level all the way up to ERP systems."