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The B&R Technology Magazine



Smart factory

Industry 4.0 @ B&R

Interview "Many companies just don't know how to protect their know-how."

openSAFETY Intelligent light grids for safe machinery

Turbo charge for OPC UA Time Sensitive Networking

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B&R Strasse 1, 5142 Eggelsberg, Austria
Tel.: +43 (0) 7748/6586-0
redaktion@automation.info

Managing Director: Hans Wimmer

Editorial staff: Alexandra Fabitsch

Editorial staff: Craig Potter

Authors in this edition: Craig Potter, Alexandra Fabitsch, Stefan Hensel, Heike Henzmann, Olivier Rambaldelli, Franz Joachim Rossmann, Raimund Ruf, Thomas Schmertosch, Nicole Wittmann, Marie Zoffmann

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Take a look around, and it's easy to get the feeling that the world is growing more complex by the day. Yet, you may also notice that the most successful products on the market are the ones that manage to encapsulate this complexity within a simpler, more friendly package. Most of us probably have a perfect example of this in our pocket right now: our smartphones. Our phones also highlight the transcendent influence of the Internet – the universal pacemaker of technological progress.

This influence has been intensifying over recent years, with Industry 4.0 and the Internet of Things drawing attention to the core challenges facing industrial automation. What better time to harness this momentum into a tangible competitive advantage that we can pass on to our customers?

That's why, at this year's SPS IPC Drives in Nuremberg, the motto flying high at B&R's booth will be "web meets automation". Come by and learn about the new ways B&R is introducing web technology to the world of automation and machine operation. Seamless integration of web technology into Automation Studio opens the door to an intuitive, flexible and modular engineering environment with the virtually limitless possibilities and openness of the web. You don't have to be an expert web developer, nor do you have to make any compromises in software security.

Beyond this door lie answers to the market's demands for innovative new approaches to human-machine interaction for modern, networked machine operation. B&R will be unveiling this and other innovations in Hall 7, Booth 206/110. Come by and find out what it could mean for you.

We look forward to seeing you there!

Happy reading!

Dr. Hans Egermeier
Business Manager Automation Software

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Smart factory

Industry 4.0 @ B&R

What today is paraded under the banner of Industry 4.0 has been common practice at B&R's own production facilities for nearly a decade. The smart factory in the Upper Austrian town of Eggelsberg has been fully networked since 2006 and is being upgraded all the time.

Each component is subjected to functional testing. The results can be viewed years later, along with all other relevant production parameters, simply by entering its serial number.

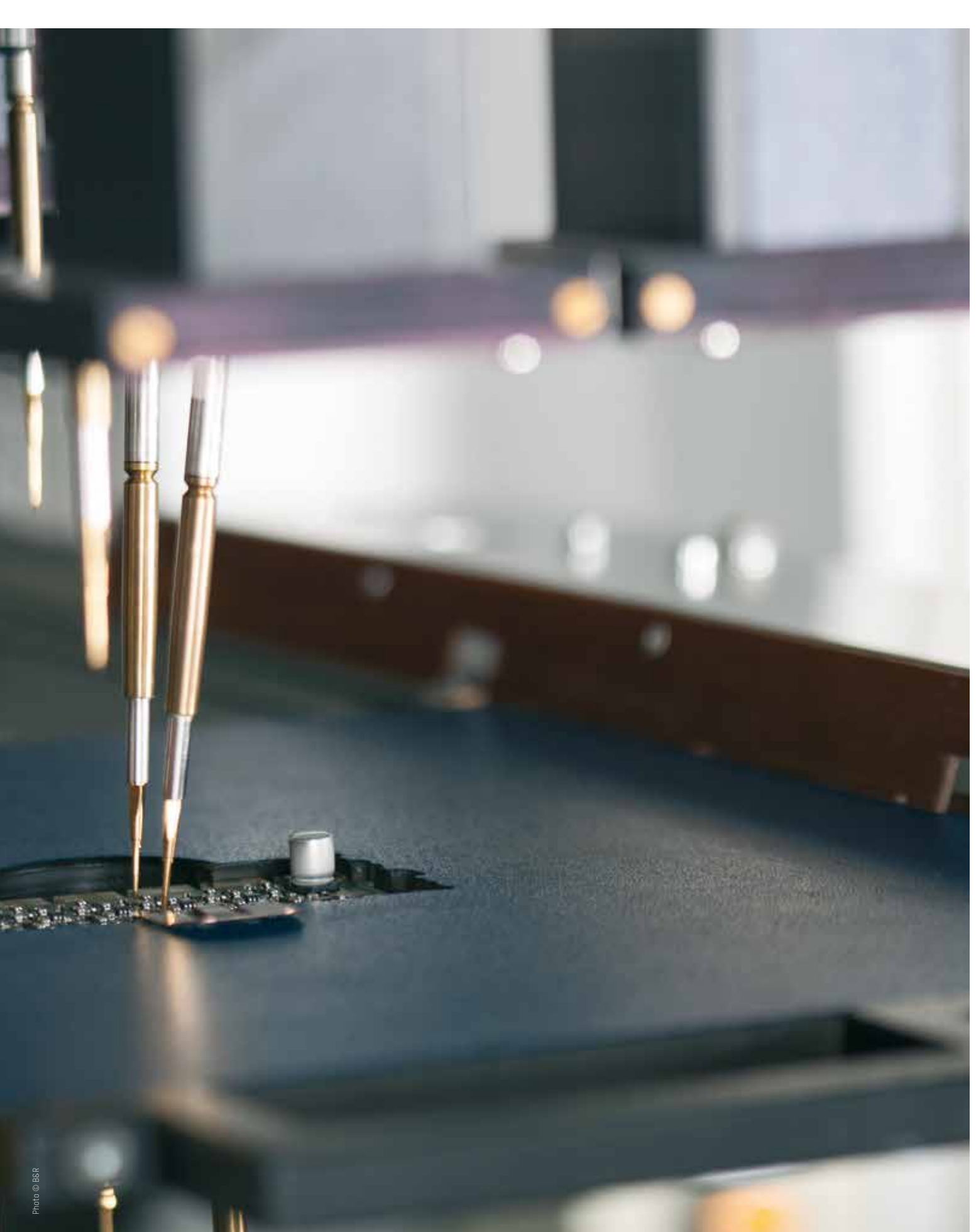


Photo © BSR



For its latest project, B&R optimized production of its industrial PCs. Using an online configuration tool, B&R customers assemble their PCs to their exact specifications. After verifying the feasibility of the configuration, the ERP system automatically generates a bill of materials with a unique serial number.

250 billion possibilities

"Mathematically speaking, the customer has more than 250 billion different hardware configurations to choose from," says Gerald Haas, head of global industrial management at B&R. That's without considering all of the software options. Most order quantities are in the two to three-digit range. "The way we're set up, order quantity is irrelevant," says Haas. "We can produce a one-off item with the same efficiency as a batch of 1000."

The ERP system plans an optimized order processing schedule and ensures that the logistics run smoothly. Parts that come from the warehouse are delivered just in time. This is where one of the advantages of B&R's smart factory comes into play. The plant in Eggelsberg is completely networked – both horizontally and vertically.

A single, homogeneous network

"What's special about our solution is that we don't have a collection of subnetworks that are interconnected with varying degrees of efficiency," says Haas. "What we have is a single, homogeneous network that incorporates every machine and every building automation component as well as the ERP system." That's what gives the ERP system the ability to control the automated storage



and retrieval vehicles in the high bay warehouse. The ERP system sorts the items in the high bay warehouse according to current and forecasted production volumes and triggers reorders when inventory is running low.

By the time a PC order arrives at a worker's assembly station, all the necessary components are within reach. The worker is guided through the assembly of each PC by on-screen instructions and light signals. Workstations are setup ergonomically and the tables are easily adjusted to workers of different heights.

Each and every PC is tested repeatedly during and after assembly. They are checked for correct assembly and the CPU and RAM are subjected to functional and stress testing. Only when all tests



Peter Gucher (General Manager, left) and Gerald Haas (Head of Global Industrial Management) are proud of BSR's smart factory.



A B&R industrial PC isn't shipped until it has passed exhaustive functional and stress testing.

have been completed successfully does the ERP system release the PC for shipping. "After all, every product that our customers receive should work flawlessly," explains B&R's general manager, Peter Gucher.

Seamless traceability

"Functional testing is nothing we've invented," grants Gucher, "but what is fairly unique is the complete traceability we have for every single product." Every step in production, every test and every significant component can be retraced at any time. This traceability extends throughout the entire lifecycle of the product. Even years down the road, based on nothing more than the PC's serial number, you will be able to look up the results of every functional test ever performed on it and clearly identify every component it contains. "This gives our customers an added layer of certainty," explains Gucher. On its website, B&R provides a ser-

vice portal where its customers can look up technical data and order-related information by simply entering their product's serial number. This includes version information, delivery date, warranty status and much more. "We're able to save our customers a lot of time and effort this way," adds Gucher.

Real-time dynamics

Communication throughout the networked factory works in every direction. "Our X20 modules are a good example of this," says Haas. Currently, there are 200 module types being produced on various lines. When a module reaches the fully automated station for assembly, testing and labeling, a real-time SAP query determines which tests are required. A fraction of a second later, the machine is busy putting the answer it received into action. This is only possible because every product can be uniquely identified by its serial number.



BSR's production halls are fully networked. The ERP system has direct control of the storage and retrieval vehicles in the high bay warehouse and automatically optimizes production logistics.

If an R&D engineer makes a note in SAP that a module has received a certain certification, and a module of that type happens to arrive at the labeling station only seconds later, the correct certificate mark will be laser printed on the housing. "That's smart factory technology at its finest," says Haas. Of course, fully networked intelligent production generates its fair share of data. On large systems, the collected data can quickly reach gigabyte or even terabyte levels. "Automated data processing and analysis is essential to reaching an informed decision," says Gucher. That's why B&R collects and evaluates all of its production data using its own APROL process control system.

OOE parameters at any time

In APROL, parameters such as overall equipment effectiveness (OEE) can be viewed at any time and even compared between production lines, shifts or workdays. "With APROL we always have an

eye on our energy consumption as well," adds Haas, "so we can make immediate corrections when something is wrong."

B&R sets the bar high when it comes to maintenance, too. Using condition monitoring tools from its own portfolio, B&R is able to determine the ideal timing for maintenance work. This eliminates the waste of replacing parts too early, as well as the risk of waiting too long and damaging a machine. If a key parameter moves out of its defined tolerance, an employee receives automatic email notification and can intervene before the aging component fails and causes an unplanned stoppage.

Industry 4.0 as usual

"For B&R, networked smart factory production has been a reality since 2006," says Haas. "What for us is business as usual, has since been given a name: Industry 4.0." ←

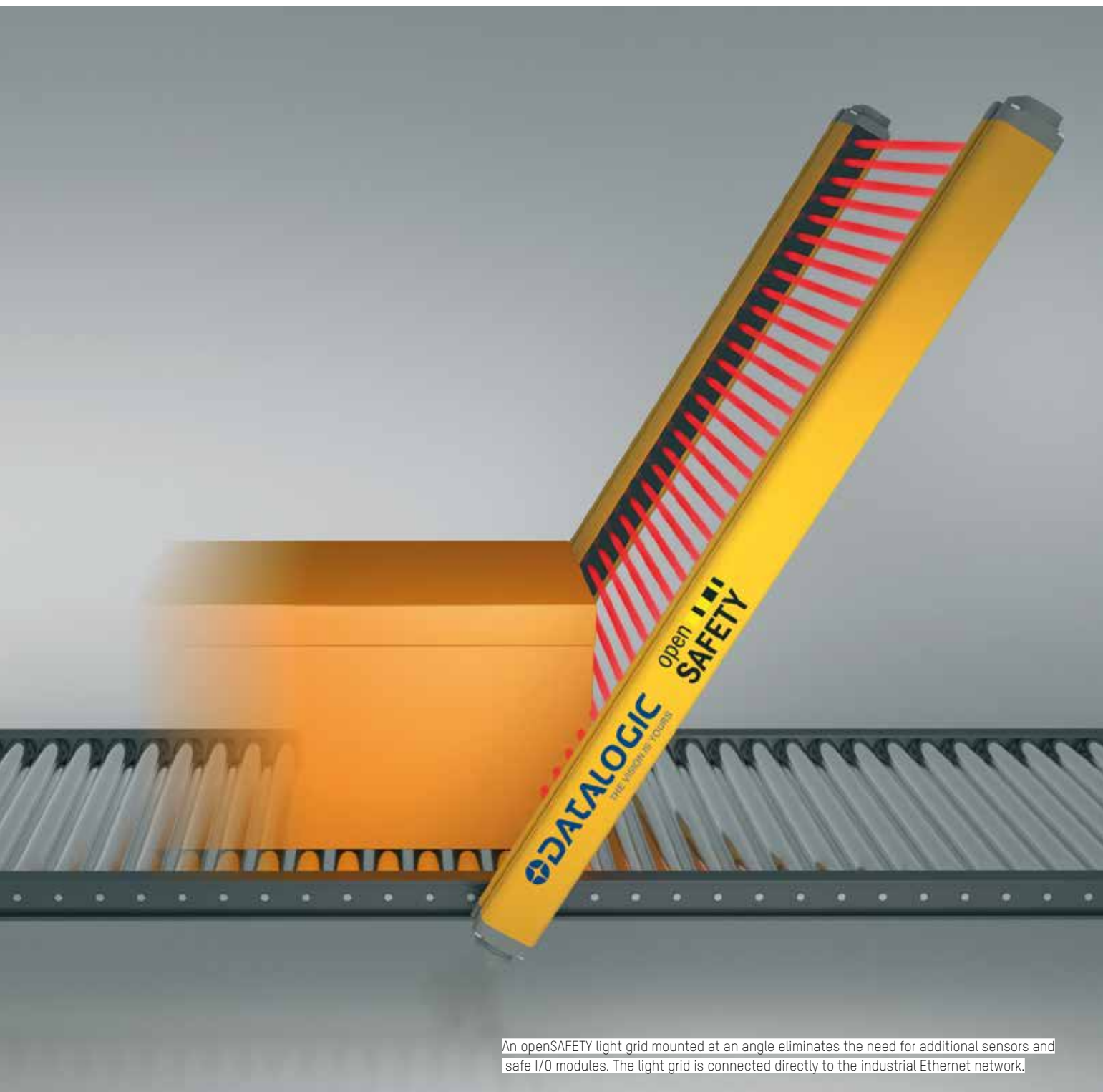
openSAFETY

Intelligent light grids for safe machinery

In production environments where humans work in close proximity to machines, conventional sensors provide insufficient active protection against injury for operators. By integrating openSAFETY-based light grids into its automation landscape, B&R is opening up completely new approaches to safety for today's manufacturing facilities.



Photo: B&R



An openSAFETY light grid mounted at an angle eliminates the need for additional sensors and safe I/O modules. The light grid is connected directly to the industrial Ethernet network.



Light grids have been used for many years now to protect operators of machinery and equipment. "Unfortunately, conventional light grids are very inflexible," explains Miodrag Veselic, technology manager of openSAFETY at B&R. They are known to hinder the implementation of modern design concepts where human operators and machinery actually work together hand in hand. It is for this reason that the EPSG developed an openSAFETY profile for intelligent light grids. "B&R is the first manufacturer to work on completely integrating this type of profile into its automation landscape," explains Veselic. The automation specialist is accompanied on this journey by the Italy-based company Datalogic, who is busy developing a light grid based on the new profile.

No hardwiring necessary

The intelligent light grid is connected directly to the real-time POWERLINK network. The overlying openSAFETY protocol replaces the

hardwiring that used to be necessary for the light grid. "Since no safe I/O channels are necessary, an application with openSAFETY light grids is less expensive than a hardwired solution," explains Veselic.

Intelligent single-beam evaluation

Light grids with single-beam evaluation, as they are defined in the new EPSG profile, provide an easier way. "When this type of light grid is mounted at an angle, we are able to obtain all the data we need for intelligent muting," says Veselic. Based on which light beam is interrupted first, it is possible to determine the direction traveled by the product – without any additional hardware. openSAFETY provides the SafeLOGIC controller with detailed information about which beam was interrupted and when. In addition to the product's direction of movement, it is also possible to determine its height – and, using the transport speed, its length as well. Using this information, the safety controller is

able to confirm that the product moving through the light grid is exactly the one that was expected. If a person were to sit on a product in order to bypass the photoelectric sensor, for example, then the machine would enter its safe state. "Solutions using conventional light grids require a lot of technical effort in order to detect that type of tampering," explains Veselic.

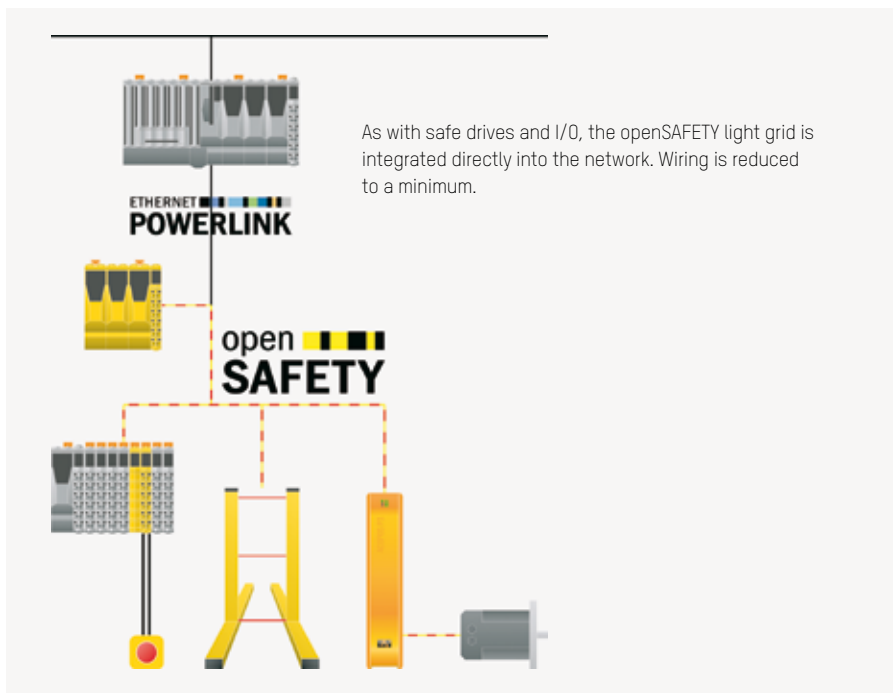
Programmed in the engineering software

With a B&R solution using openSAFETY light grids, safety functions such as muting and blanking are easily programmed in Automation Studio. Once an openSAFETY light grid has been installed and the node number set on the device, the rest of the configuration is handled in Automation Studio. Conventional light grids require tedious DIP switch configuration on the device or even the use of dedicated software. This becomes even more problematic once everything is installed, because the DIP switches are difficult to reach and represent a potential source of errors.

Fast commissioning

"openSAFETY light grids considerably reduce the amount of work needed for commissioning – especially for equipment produced in series," explains Veselic. This is because, once written, the safety application can be reused on every machine. The light grid simply has to be connected to the network. The safety controller automatically detects whether it is dealing with the correct light grid model and transfers the configuration to the device. Errors that might otherwise result from manual configuration or on-site wiring are prevented.

"The troubleshooting possibilities of the intelligent light grid are a huge step forward as well," adds Veselic. Error messages that used to require painstakingly reading and interpreting LED blink patterns can now be viewed in plain text. This allows for more detailed diagnostics and considerably shorter downtime. ←





Miodrag Veselic
Technology Manager, openSAFETY, B&R

"The possibilities opened up by the openSAFETY light grid greatly simplify the cooperation between humans and machines."



Conventional light grids also require additional hardwired sensors in order to implement functions such as muting.



Textiles

A new twist on industrial knitting

It all started with the idea of accelerating the textile manufacturing process by producing yarn directly at the knitting machine. The result is the revolutionary Corizon, which allows operators to develop and fine-tune yarn and material characteristics directly on the machine. It creates entirely new fabrics and garments that offer maximum wear comfort.



The processes of yarn production and industrial knitting themselves are nothing new. The first industrial spinning and knitting facilities appeared in the late 18th century. By 1871, Charles Terrot's company had already delivered its 500th circular knitting machine. Used to produce knitted underwear, these machines set new standards in quality and efficiency.

150 years later, Terrot is once again poised to revolutionize the field of textile production with its latest development, presented at the 2015 ITMA exhibition. By now, the original idea of shortening the textile manufacturing process has been surpassed by even more impressive benefits. "The new technology grants the stitcher much more freedom and puts him a lot closer to his customers' needs," explains Terrot managing partner Thomas Mutschler. With the Corizon yarn, he can directly control the properties of the finished fabric so it comes out exactly the way it is needed."

Reinventing the process

The textile manufacturing process begins with spinning – one of the oldest crafts ever performed by humans – where a mass of fibers of finite length are formed into a continuous yarn. The process begins with the fibers being cleaned, blended and carded, after which they are drawn out and twisted. Finally, the yarn is wound on a bobbin and passed on for further processing. At the knitting machine, yarn is unwound from numerous bobbins and fed into the machine in parallel. Subsequent steps perform mechanical and chemical processing, and then the finished material is ready for the tailor. "Our initial idea was to bring yarn production closer to the knitting machine," explains Michael Lau, who has been doing R&D for Terrot since completing his degree in textile machine manufacturing. "It's not often you get the opportunity to completely reinvent one of the world's oldest technologies. But with Corizon, that's exactly what we did."



Terrot's Single-Jersey S296-2 circular knitting machine relies on automation technology from B&R.



The Corizon yarn: with the easily recognizable surface structure that gives it its excellent feel.

The Corizon yarn consists of a core filament wrapped with a bundle of cotton or synthetic fiber known as a roving – an intermediate product of the spinning process. Although it looks like a thick yarn, roving has not yet been fully drawn out, so it is easily torn and must be unwound very gently from the bobbin. In a multi-stage continuous process, the fiber is twisted around the core filament at a defined tension. "It wouldn't be possible to wind the yarn on a bobbin in this form," explains Mutschler. "So, already during the knitting process, Corizon lends a unique feel to the final product."

Precise synchronization is key

A central requirement for the Corizon process is the precise synchronization of approximately 100 individual bobbins as they are fed from the spinning to the knitting process. Each individual spinning system must produce the exact same quantity throughout the continuous process. This is ensured using multiple mechanically decoupled servo drives, whose gear ratios can be defined freely on the HMI. The servo technology must regulate the speeds with absolute precision, because any deviation would cause defects in the final product. "We had suspected for some time that a moiré pattern that was affecting product quality was related to the technology we were using," reveals Lau. It wasn't until during development of the new process and machine that it became clear that insufficient control technology was to blame.



Thomas Mutschler
Managing Partner, Terrot

"We're going to revolutionize textile production with Corizon. This technology relies on precise synchronization of all the yarn feeds. POWERLINK communication and BSR drive technology give us the performance we need."

Textile machinery is frequently operated in locations that are subject to power outages. In the event of an uncontrolled stop, many strands of yarn could break and cause material defects. In the worst case, this could mean 4 to 5 hours of costly downtime until all the strands have been replaced and the machine is back up and running. The drive technology must therefore be designed to shut down and start up safely no matter what.



The ACOPOSmulti drive system allows Terrot to fine-tune yarn parameters with very high precision.



Michael Lau checks the quality of the roving in the open drafting system.


Sophistication comes standard

"The team from B&R's Leipzig office identified the cause of the problem and presented a solution right there at our first meeting," recalls Lau. "It was like something out of a fairy tale. We didn't really believe it until we received their testing equipment – only 3 weeks later – and saw the quality with our own eyes." The automation solution features B&R's ACOPOS drive system and the Ethernet POWERLINK protocol, both of which support microsecond synchronization as a standard feature. Both the hardware and software are standard products, including the electro-mechanical buffer axis, on which a 3-kilogram flywheel is moved by a servo motor at over 6,000 revolutions per minute. In the event of a power failure, the rotational energy stored there generates sufficient electrical energy to bring the machine to a controlled stop. Yarn breakage due to power failure is a thing of the past.

This drive design allows the yarn parameters to be fine-tuned with great precision during operation. These include the feed quantity of the yarn, the fineness of the Corizon yarn and the tension of the core filament. These parameters are set on the operator panel and can be modified without interrupting production or making any mechanical adjustments. This allows knitting machine operators to experiment with the finished product in real time or produce exclusive designs in small batches. ←




Operators set the basic parameters on the HMI, for which Terrot uses a B&R Automation Panel with a Panel PC 2100.



Pharmaceuticals

The perfect match

Photo © InnoScan



After terminating a long-term cooperation with a machine builder, InnoScan took the opportunity to rethink both the mechanical and electrical design of its high-speed vision-based inspection machines – a pursuit that called for both expertise and creativity. In addition to the cutting-edge automation components needed to handle the pharmaceutical industry's demanding requirements for speed and versatility, B&R offered the development support and flexible partnership InnoScan was looking for.



To maintain its competitiveness, InnoScan decided to terminate a long-term cooperation with a local machine builder back in 2003. In the wake of the termination, InnoScan redesigned parts of its machines and started looking for automation components suitable for upgrading the old control system. With demand for improved speed, complexity and flexibility growing by the day, InnoScan was looking for an automation provider able to meet these challenges long into the future. In 2006, the company turned to B&R. The goal was to test whether the selected components were compatible with the high speeds of the inspection machines as well as the communication protocols already in use. After proving its expertise in these matters, B&R has played an important part in the redesign and continued development of the entire InnoScan control system.

Critical speed requirements

InnoScan is active in one of the most demanding pharmaceutical segments. Through intelligent software, advanced mechanics and specialized know-how, InnoScan meets the highest standards with regard to speed and complexity. An InnoScan inspection machine typically inspects 10 to 25 different attributes on filled vials – at speeds approaching 650 vials per minute. The machine vision algorithms must therefore be processed in milliseconds, leaving no time



for communication delays of any kind. True real-time processing is crucial for an InnoScan inspection system.

From mega-volumes to smaller batches

"We see ourselves as the perfect match for demanding customers who require the highest degree of complexity in combination with extreme speeds," says director Gert Nielsen, who has been with InnoScan since 1988. "The success of our inspection machines depends heavily on reliable system components that interact efficiently at high speeds." Changes in the market, such as drastically shrinking batch sizes, have had a significant impact on InnoScan and the design of its solutions. "The development has gone from mega-volumes to much smaller batch sizes," observes Nielsen, "while at the same time inspection machines are expected to handle an increasing range of different products. So, while speed and complexity are still important drivers, our solutions need to be extremely flexible as well."

Complementary expertise

An inspection machine has a multitude of moving and spinning parts, which need to be very tightly synchronized to deliver the mind-boggling speeds at which vials and are inspected. Motion control is therefore a crucial element of the control system. Servo drives offer the necessary precision and the ability to changeover quickly and easily between batches. In fields like motion and servo control, InnoScan recognized that it had reached the limits of its expertise. "The fact that we can draw on B&R's programming know-how in situations where either our experience or resources are limited is of tremendous importance to us," praises Nielsen. "It allows us to focus on our specialty – machine vision – while drawing on B&R's expertise for specific automation challenges. As a partner, B&R possesses the know-how and flexibility to perfectly complement our own R&D."



Helge Jacobsen
R&D manager, InnoScan

"Our customers demand high speed combined with the inspection quality of the human eye. That's why we need an automation partner who understands our needs and who can supply us state-of-the-art automation products and automation experts to assist us in our R&D."

A flexible partner

Today, B&R components are used widely in every inspection machine from InnoScan. The cooperation involves motion, I/O, safety, HMI, PCs, sensors and a very close partnership in software development. InnoScan still makes use of B&R experts from time to time; however, today they usually come from the local B&R Denmark office, which has grown significantly since the partnership began back in 2006. "Before the redesign, we examined the possibility of proceeding with our previous automation provider," recalls Nielsen. "However, we could not come into terms with their take-it-or-leave-it approach. B&R turned out to be a much more flexible solution provider, with the combination of the high speed real time bus Ethernet POWERLINK and openness to the communication options we needed for our own developed hardware. The most important for us was the willingness to find solutions to our specific challenges." ←



High precision at high speeds: An InnoScan inspection machine typically inspects 10 to 25 different attributes on filled vials – at speeds approaching 650 vials per minute.



B&R components are used widely in every inspection machine from InnoScan. The cooperation involves motion, I/O, safety, HMI, PCs, sensors and a very close partnership in software development.

"Many companies
simply don't know
how to protect
their know-how"



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Year after year, manufacturing and processing companies suffer damages in the billions due to their products being produced illegally, both at home and abroad. Manufacturers and owners of production machinery and equipment need to take measures to protect their products and their intellectual property. Oliver Winzenried, from the German Engineering Association VDMA, explains what this type of security might look like in practice.



What are the potential risks of intellectual property theft for manufacturers of machinery and equipment?

Each year, VDMA members experience estimated damages of around €7.9 billion – or about 4% of their total revenue. These are the results of the most recent product piracy survey held by the VDMA every two years. Nine out of ten companies with over 1,000 employees are affected. More than 50% of them report having had entire machines or products reverse engineered.

Are these companies aware of the potential threat?

Certainly. Others quickly become aware once they see an imitation first-hand or face warranty claims for counterfeit products. Only upon closer inspection does it become clear that they are dealing with an illegal copy rather than their own product.



"Manufacturers and operators of industrial equipment need to safeguard their know-how and their products," says Oliver Winzenried, chairman of the VDMA consortium on product and know-how protection.

Are there any sectors that are affected more than others?

There are indeed. The most heavily affected are wood processing, textile and agricultural machinery.

Where do the counterfeits typically come from?

The main source of counterfeit machinery and products continues to be China. Although the number has gone down slightly from our previous survey, at 72% it is still very high. Many are surprised to learn that second place for pirating goes to Germany.

How do these counterfeiters generally operate?

The most common approach – again at 72% – is reverse engineering. They take apart the machine or product and analyze it. Then they copy the mechanical components and

decompile the software. The final step is to figure out the processes performed by the machine. These can then be implemented on the counterfeit machine without any significant development expenses or years of field experience. In a way it's not strictly counterfeiting, because they actually understand and apply the processes themselves. However, it does constitute infringement of any patents that exist on the equipment.

Why don't we see more protective measures in place?

Many companies simply don't know what technical options are available, or which measures are appropriate for their machinery or products.

What about techniques that have proven themselves in IT applications?

Protective measures used in an office environment have limited application in industrial machinery. You can't ask a processing plant, for example, to reboot or run a virus scan that locks up the system for minutes at a time. The requirements are simply very different.

What options are available for OEMs?

Manufacturers of integrated systems can't be expected to develop and implement security measures for each individual component themselves. That must be the responsibility of the component supplier. Still, the machine manufacturer faces a considerable challenge in ensuring that these functions are integrated into the overall system and used properly.

What are the security needs of plant owners?
If you own a clothing brand with production

sites in Asia, you want to be sure that those sites are only producing the specified quantities and are only delivering them to you. You want to prevent those sites from producing excess items and selling them on the gray market for their own profit. With appropriate measures in place, this kind of unauthorized production will not go unnoticed. These measures have applications in every industry, but are still in their infancy. With the onset of Industry 4.0 and big data in production, cybersecurity is becoming increasingly critical.

Are there any standards that can provide manufacturers a frame of reference?

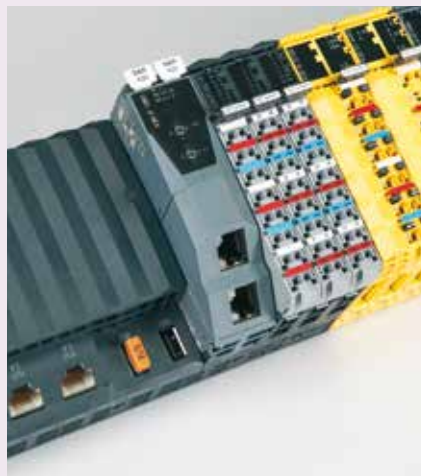
National and global standards, like those established for safety equipment, do not yet exist for cybersecurity. Emerging standards such as IEC 62443 and ISA-99 attempt to define Security Assurance Levels (SALs). These account for the protection of products and intellectual property as well as protection against manipulation and modification.

What criteria should a manufacturer consider when selecting a supplier?

Manufacturers and operators should ensure that they will be able to protect their know-how. If you select suppliers who use open communication standards, you can be assured that interoperability won't be a problem. This is fundamental if you're integrating components from various suppliers into an overall system. And if these open standards also support cybersecurity, this is clearly a huge advantage for the user.

Some examples include OPC UA and IEC 62541, which enable safe communication between components. Intelligent protection opens up new business models for machinery and equipment manufacturers by allowing functions implemented in their software to simply be enabled or disabled for a given machine configuration. ←

Safeguard your know-how with Technology Guarding



Technology Guarding provides reliable protection for B&R customers' products and know-how. The required USB dongle is installed by B&R during assembly.

B&R's license management system has the answer. Each customer's licenses are managed on a central license server and implemented on the machine using a USB dongle.

USB dongle included in hardware assembly

Technology Guarding is programmed in Automation Studio and applied to the hardware using a USB dongle. B&R installs the Technology Guarding dongle during hardware assembly, allowing the customer to have components delivered directly to their panel maker. And of course it's no problem if the hardware ever needs to be swapped out in the field. Simply insert the USB dongle in the new component and it immediately resumes its function.

Secure monitoring of operating hours

Technology Guarding helps machinery and equipment builders protect not only their own interests, but those of their customers as well. It is possible, for example, to monitor a machine's hours of operation in a way that cannot be tampered with. This prevents unauthorized products from making their way to the market illegally.

With B&R's Technology Guarding, manufacturers of machinery and equipment can reliably safeguard their process data and know-how. They can manage licenses easily and monitor hours of operation reliably.

Technology Guarding offers a way for B&R customers to manage the growing portfolio of options they offer for their machines. On the one hand, equipment owners generally don't want to pay for functions that they won't be using. On the other, the manufacturer of the equipment doesn't want to hand out valuable functionality for free.

The result is that options have to be managed on a customer-by-customer basis.

Technology Guarding provides the perfect technical basis for a leasing business model, allowing manufacturers to ensure that operating hours are counted and documented accurately and free from tampering.

The advantages

- Safeguard product know-how and process data
- Secure monitoring of operating hours
- Manage machine options efficiently

The future of renewable energy is here

Seamtec develops innovative, sustainable solutions to help its customers automate and optimize their hydroelectric power plants and biomass heating systems. The power plant and energy sector demands control technology with absolute stability, high availability and failsafe protection. At B&R, Seamtec found a partner with shared values who provides not only reliable control solutions, but also fast and effective support.

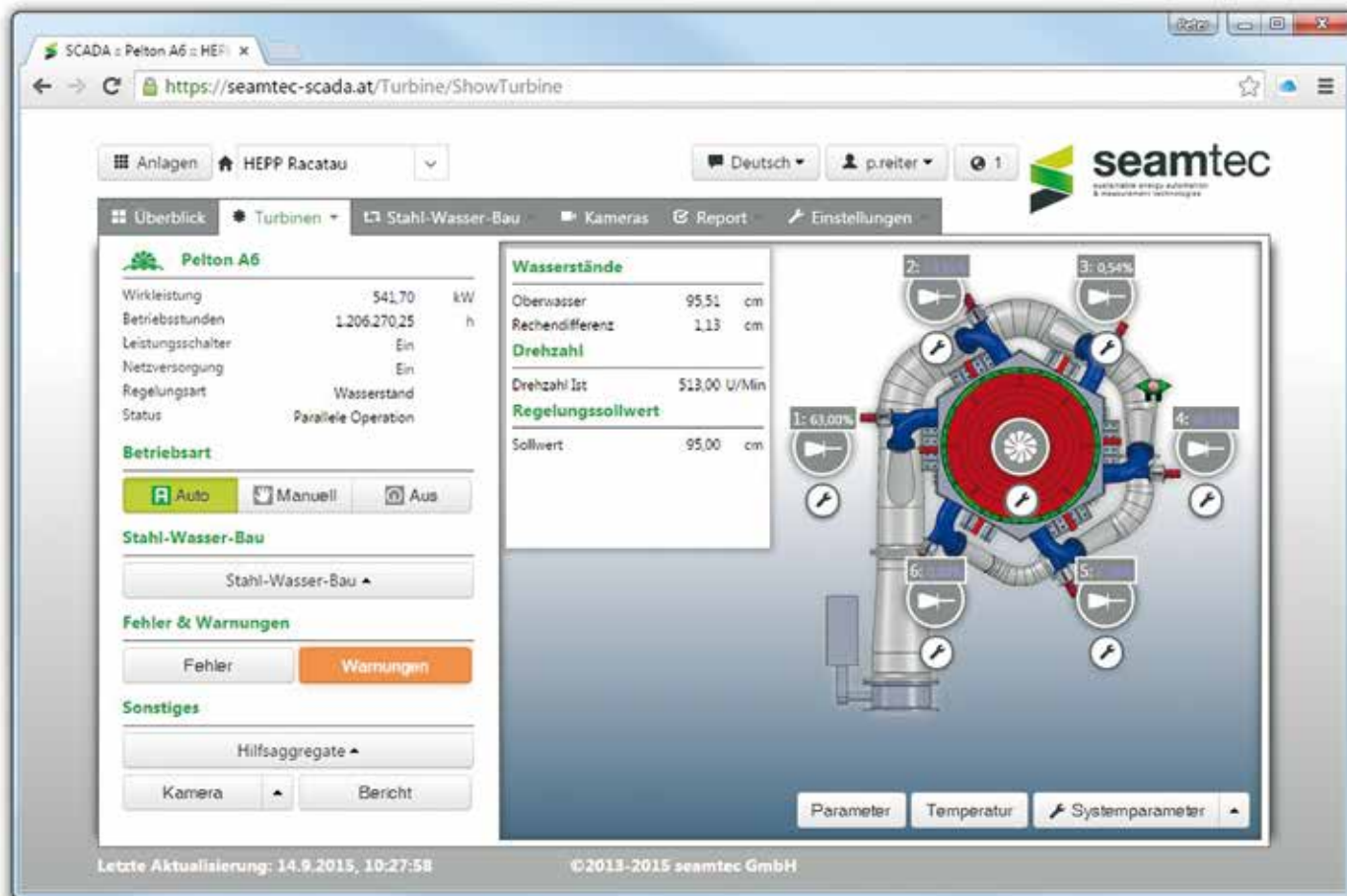


As a specialist in the field of renewable energy, Seamtec develops innovative control techniques to maximize the effectiveness of hydroelectric power plants and biomass heating systems. The company's portfolio spans the entire range of automation, control and electrical components from the level of individual sensors up to feed-in management and grid control. Seamtec also collaborates with partners, such as hydroelectric specialist WWS Wasserkraft, who use Seamtec systems in power plants ranging from 10 kilowatts to 20 megawatts. This broad perspective allows them to develop holistic solutions for their customers.

Changing tides in the energy industry

Seamtec was founded by CEO Peter Reiter in 2009 and currently has 6 employees. The visionary startup has seen substantial growth over the past few years and draws 70% of its revenue from international sales. "It will be very interesting to see how things develop over the next few years," says Reiter. "Particularly in Europe, the energy industry is at a crucial tipping point, and with our innovative products we are well prepared to face the challenges ahead."

With strong roots in the German-speaking region, Reiter also has big plans for developing markets in Eastern Europe, Asia and South America. Energy consumption is rising



Web-based HMI screen showing a power plant with 6-jet Pelton turbine

quickly in these regions, and the potential for hydroelectric power is even greater than in Western Europe. To broaden its stance in the industry, Seamtec is also branching out with new solutions for biomass heating systems and industrial automation. With its specially developed cloud automation solutions, the company demonstrates how well it has its finger on the pulse of Industry 4.0.

Reliable partner past and future

B&R first appeared on Reiter's radar through the real-time POWERLINK protocol, around which he originally designed his control and automation solutions. With POWERLINK and embedded Linux solutions as the starting point, the next question was how best to combine this with the control hardware. Since POWERLINK is not only open, but also established worldwide as an IEC standard, Seamtec had access to thoroughly tested and certified hardware modules. A modular control system is particularly important for hydroelectric plants, because the individual subsystems – turbine controllers with I/O, remote components such as level sensors and control for hydromechanical equipment

like sluice gates and trash rack cleaners – can operate autonomously, while also being interconnected via bus interfaces. This allows communication between them to be coordinated centrally. "Together with our SEAMTEC Cloud Automation product, we also offer a modern web-based HMI solution that combines the advantages of POWERLINK and advanced cloud technologies in a single system – all based on B&R," says Reiter.

An automation partner at your side

For Reiter, partnering with B&R was clearly the right strategy. "Our decision of which control components to use was tied to three criteria," he explains. "The solution would have to ensure high-availability, be extremely reliable and include local support." This third criteria was particularly important to Reiter and his team, because when a customer's system is down – or even when there is a question regarding a new development – they need a qualified contact close by to provide the necessary answers. "We need a partner for whom we're more than an anonymous number, who won't need us to retell the same story every time we call, and who

won't make our customers wait weeks for a solution. That's why B&R was the clear choice," says Reiter.

From the field to the cloud

As a young and dynamic company, Seamtec relies heavily on research and development to keep it a step ahead of the competition. One such development is the company's two-level software design. At the field level, the control application developed in Automation studio is implemented on X20 controllers with corresponding I/O and POWERLINK modules.

The modular and object-oriented implementation in Automation Studio helped drastically increase the reliability of the software and streamline the process of configuring the system. To connect the various subsystems to the central operator station, Seamtec developed a state-of-the-art cloud automation system that runs on B&R industrial PCs. This system networks the individual subsystems via the PVI protocol and offers a web-based HMI solution as well as database archiving of system data.

Seamtec Cloud Automation



Seamtec Cloud Automation System

The main advantage of the SEAMTEC Cloud Automation System is that multiple plants can automatically archive and exchange data with the Seamtec Cloud via secure VPN connections. The customer logs into the secure cloud system once, and from there can not only monitor but also control plants all around the world in real time. This solution also has advantages for the plant manufacturer, offering central access to all plants to resolve problems, compare data or offer dynamic maintenance services for after sales support. All data is safeguarded with the latest encryption technology to ensure maximum security.

Highly efficient thanks to B&R support

"Another important consideration for us in the selection of a partner was the demand for high-availability that we're constantly faced with," notes Reiter. Particularly in projects implemented over great distances, it's important that solutions are available quickly when problems arise. Outages need to be avoided wherever possible and dealt with quickly when they do occur. "The 24/7 support that B&R offers is essential to our business," explains Reiter. Active plant monitoring algorithms help detect faults and warn the customer of potential problems before an outage occurs. Seamtec is only able to

POWERLINK is an open technology and defined worldwide as an IEC standard. A modular control system is particularly important for hydroelectric plants, because the individual subsystems can operate autonomously, while also interconnected via a bus interface so that communication between them can be coordinated centrally.

offer this service thanks to the perfect cooperation and optimal coordination of products with B&R. This makes it possible to guarantee highly available products – even to customers on the other side of the world.

Seamtec sets sights on developing markets. The scope and level of service that Seamtec offers is just one of the ways that its nearly 50 systems installed around the world stand apart from the competition. The constant growth of the renewable energy market raises new challenges all the time. To address the challenge of revitalizing aging plants – a frequent requirement in developing markets – Seamtec developed a special low-cost solution. This solution offers an easy yet high-quality way to upgrade plants with improved availability, secure and easy remote maintenance and optimized overall efficiency. The Cloud Automation System sets new standards in automation, which is why Seamtec is working to adapt it for other industries, such as biomass systems and industrial automation. This is what it looks like when Industry 4.0 is put into practice – with B&R as a reliable expert partner. ←



Peter Reiter
CEO, Seamtec

"We chose B&R based on the reliability and high availability of their automation solution as well as the quality of their local support."

HMI

Armed for any application



In the field of factory automation, operator panels are increasingly being mounted on swing arms. The advantages are clear: They are much more flexible than their cabinet-mounted counterparts with regard to placement and positioning and allow operators to keep an eye on the production process at all times. B&R's latest generation of swing arm HMI – the Automation Panel 5000 – sets new standards in versatility and modularity.



While their predecessors were generally connected to a remote industrial PC, today's decentralized control architectures increasingly demand panels with onboard intelligence – in the form of integrated PC components. Offering a solution for either scenario, the Automation Panel 5000 can be set up as a remote terminal or an integrated Panel PC. This involves equipping it with either a PC unit or a receiver for B&R's high-performance digital display technology, Smart Display Link (SDL/SDL3). Either way, the operator panel itself is identical.

A wide selection of Automation Panels are available for swing arm mounting. One way to go is the traditional 4:3 format with an analog resistive touch screen – which ensures compatibility with many existing applications. These are available in sizes up to 19" and in the widely used XGA and SXGA resolutions.

Swipe, zoom, scroll

Alternatively, you have multi-touch systems, which are quickly gaining popularity in industrial environments. They offer intuitive swiping, zooming and scrolling gestures as well as two-hand gestures to prevent the inadvertent triggering of critical operations. The edge-to-edge glass surface is as nice to use as it is easy to clean. Multi-touch widescreen panels are available in sizes ranging from 15.6" to 24" with either HD Ready or Full HD resolution.



Powerful system on a chip

Today's complex control and HMI applications are computationally intensive. With its latest generation of Atom processors, Intel has created a compact yet powerful system-on-chip (SoC) platform that lends itself ideally to use in space-saving Panel PCs. These processors are scalable – single core, dual core or quad core – and achieve performance values comparable to Celeron processors based on the Core i-series. Graphics performance has also taken a big step forward. For the first time in this segment, the Atom processors support Direct X11, used in many modern SCADA systems. At the same time, the systems are exceptionally efficient. The E3815 single core processor has a thermal design power (TDP) of only 5 watts – even the quad core tops out at 10 watts – allowing the Panel PCs to be entirely fanless. The PC units take up no more space than the compact SDL/DVI receiver does.

From control to HMI

Panel PCs are suited to a wide range of applications. The multi-core architecture of the latest generation of Intel Atom processors makes it possible to combine multiple functions in a single

system. One core can handle control tasks, while the others simultaneously run a Windows-based SCADA system.

B&R's swing-arm-mounted Panel PCs offer flexible interfaces to ensure that they are equipped to handle whatever is required of them. Two Gigabit Ethernet interfaces come as standard, while a modular interface module can be installed to add POWERLINK, CAN and more. Data is stored on a CFast card that provides up to 128 gigabytes of space. Two USB ports – one of them USB 3.0 – offer a quick way to connect additional peripheral devices. B&R's Panel PCs can run a variety of operating systems, including various Windows versions up to Windows 10, as well as embedded variants with additional advantages such as configurable write filters. It is also possible to use Linux or B&R's real-time Automation Runtime.

Maximum convenience

Touch screens open up a new world of possibilities for user interaction. Nevertheless, users continue to prefer mechanical elements for certain operations. That's why B&R offers its Automation



To adapt optimally to the needs of each machine, B&R has made its optional operating element modules very easy to customize.



Users can easily switch between pendant and pedestal mounting on site.

Panel 5000 with optional push buttons, selector switches and key switches. An E-stop button can also be installed on the swing arm device, where it is always within the operator's reach.

Used to manage access rights in many facilities, RFID keys can just as easily control access to operator terminals. Selected variants of the Automation Panel 5000 can be equipped with RFID readers to allow intelligent user-group authorization. The easily abused practice of jotting down passwords on scraps of paper can finally be put to rest.

Easy customization

The arrangement and design of the keys on the operator terminal vary from machine to machine. To adapt optimally to the needs of each machine, B&R has made its operating element modules very easy to customize. Since the basic hardware is always the same, the process is extremely simple. The list of possible adaptations is long, including virtually any arrangement of standard keys, illuminated ring keys and push buttons in various colors. Custom HMI devices are generally delivered fully assembled. A custom operating

element module is also available for installation by the user. The removable cover on the back of the panel makes cabling quick and painless. Inside, two separate cable channels guide the cables into the swing arm. This allows the operating elements to be adapted perfectly to the application, even on one-off custom devices.

Flexible mounting

B&R Automation Panels can easily be adapted for pendant or pedestal mounting. The mounting direction is up to the user and can be changed on site. The panels are designed to allow easy access to all operating elements and cables.

This is done by removing the entire back cover, which – like panel itself – offers IP65 protection. Side grips can be installed so that the user can easily move the panel into the optimal position. The optional swivel-tilt flange allows the panel to be adjusted to an ergonomic viewing angle so that workers of various heights can use it comfortably and without fatigue. As an alternative to the swing arm system, the Automation Panel 5000 can also be installed on a VESA monitor mount. ←

Industrial Ethernet now on Raspberry Pi2

Kalycito implements POWERLINK on newest single-board computer



ETHERNET 
POWERLINK



POWERLINK is the first industrial Ethernet protocol to work on the new Raspberry Pi2. Kalycito has implemented openPOWERLINK master and slave with Linux on the 2nd generation of the single-board computer. Raspberry Pi2 was introduced in the spring of 2015 and offers a new dimension of performance on this well-known platform. Kalycito has come up with a demo that showcases how POWERLINK on Raspberry Pi2 can be an interesting platform for networked industrial and home automation projects to be applied using devices like PLCs and distributed I/O. It should be noted that the demo was created using the

unmodified official open source release package. The quick start guide and pre-built demo binaries can be used to get started before proceeding to modify the C programs for transmitting and receiving data via the I/O pins.

This demo shows how easy it is for anyone to set up and run openPOWERLINK on the Raspberry Pi2 to build their own distributed automation platform and control the signals of motors, sensors, actuators and relays. More information regarding this demo can be found at <http://www.ethernet-powerlink.org/en/raspberrypi2/>. ←

No machine is out of reach

B&R presents a simple and secure solution for remote maintenance.



The SiteManager component of B&R's remote maintenance solution can be connected via LAN, WLAN or mobile network.



The new remote maintenance solution from B&R provides easy access to machinery and equipment anywhere in the world. The solution follows the latest IT and cybersecurity guidelines and offers substantial savings with reduced investment costs. Service technicians can access machines from anywhere in the world. In addition, a certified and encrypted VPN connection is established between the SiteManager on the machine and a gateway, which is usually located at the machine manufacturer's service center. There, all access rights for up to 10,000 machines are stored. It is extremely easy

to set up a comprehensive machine pool management system.

Integrated firewall

The SiteManager has integrated digital inputs and outputs. These could be used to connect a key switch, for example, that must be actuated to permit access for maintenance. An integrated firewall provides protection against unauthorized third-party access. In order to avoid security conflicts with plant firewalls, communication to the Internet is handled using firewall-compatible encrypted web protocols. No additional ports must be opened.

Connection via LAN, WLAN or mobile network

All the diagnostics and maintenance functions of the B&R system can be used via a secure VPN connection. The SiteManager is easy to configure in B&R's Automation Studio engineering software, making it perfectly suited for both series-produced or retrofit machines. In cases where a LAN or WLAN connection is not possible or not desired, the VPN connection can be established via a GPRS and UMTS mobile network. This ensures optimal service even for facilities in remote locations without the expense of dispatching a field technician. ←

Research

Spaceworthy

In the clean room: the open thermal vacuum chamber with the structural model of the CHEOPS satellite.

Photo © Hoyer/Jacob



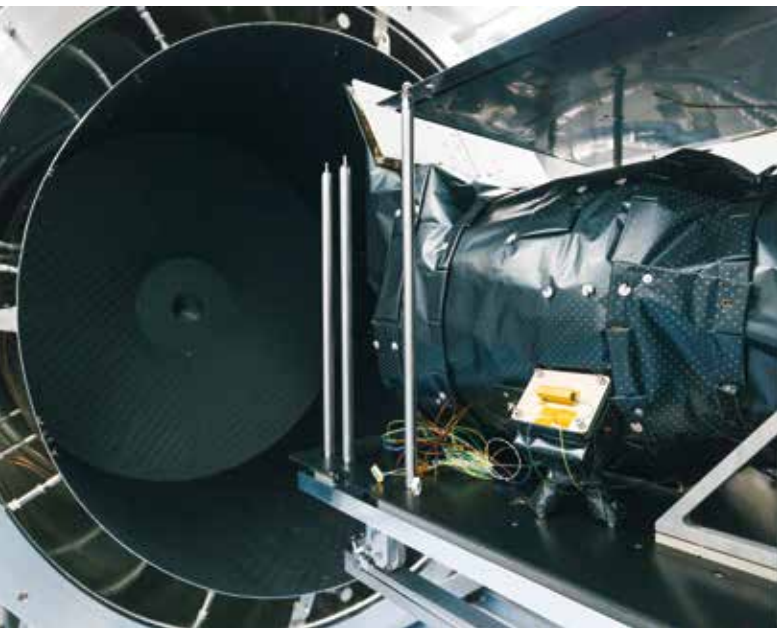
The Great Pyramid of Giza, built in honor of the pharaoh Cheops, is the oldest of the world's seven ancient wonders. In Bern, Switzerland, however, the name Cheops is now associated with a much more modern marvel. The CHEOPS project – short for CHaracterising ExOPlanet Satellite – is being led by the Center for Space and Habitability at the University of Bern in partnership with the European Space Agency. In a few years, this satellite-born photometric observatory will provide valuable assistance in the search for planets capable of supporting life. The system's spaceworthiness is assessed through automated testing performed using advanced B&R technology.

The solar eclipse viewed in Switzerland in March of 2015 is still fresh in people's minds. A solar eclipse occurs whenever the moon passes between Earth and the sun. During a total eclipse, the moon covers approximately 70% of the sun's surface. The same thing happens when any planet passes in front of its star as viewed from Earth. In this case, however, far less than 1% of the star's surface is covered, causing only a tiny dip in the intensity of its light. The CHEOPS telescope is designed to measure this deviation and use it to calculate the diameter of the passing planet.

Before any new satellite is launched, it must be thoroughly tested under space-like conditions. In close cooperation with B&R, the Center for Space and Habitability (CSH) in Bern has constructed a fully automated thermal vacuum testing chamber for this purpose.

The CHEOPS project

At CSH, a team of 20 employees is hard at work developing, constructing and testing CHEOPS under the guidance of Prof. Willy Benz and lead project manager Dr. Christopher Broeg. The CHEOPS



Movable chamber section, with a good view of the interior and the shroud (black) full of thermal fluid.



Studying the technical drawings on the screen in the clean room.

project is the first satellite project where the responsibility lies solely in Swiss hands. A number of different universities and space agencies are involved in various capacities. The German Society for Aeronautics and Astronautics (DGLR) and the Space Research Institute (IWF) in Graz, Austria, are responsible for the electrical subsystems, for example. The telescope's objective is to investigate known planets that circle distant stars far beyond our own solar system. Known as exoplanets, they are identified in advance by ground-based observations using a technique called Doppler spectroscopy. The additional size data generated by CHEOPS will allow researchers to deduce the planets' density and likely composition of gas, rock and ice. The hope is that this will identify which planets are most likely to support life. With future telescopes, it may one day be possible to search the top candidates more closely for specific signs of life. The CHEOPS satellite is slated to launch in 2017.

The thermal vacuum chamber

Before the satellite is sent into orbit, it needs to prove that it is fit for the task. After all, it will be subjected to some fairly extreme conditions. The telescope and the satellite that carries it will have to withstand a vacuum of 10^{-7} millibars and temperatures ranging from -80°C to $+165^{\circ}\text{C}$. To simulate these conditions, the University of Bern developed a thermal vacuum chamber. Measuring 2 by 4 meters, the chamber can hold the entire satellite platform and telescope. The various components of the vacuum chamber – roughing pumps, turbo pumps, thermal shrouds, Huber thermostats, a solar simulator and liquid nitrogen radiators – must frequently be

reconfigured with new settings throughout the course of testing. It is also incredibly important to protect the equipment being tested. Alone the structural model of the satellite currently being tested is worth more than half a million dollars.

The requirements

The thermal vacuum chamber is situated in a clean room to protect the sensitive optical elements. Since it is impossible to enter the clean room without contaminating the highly purified air, the testing chamber needs to be automated as much as possible to minimize the need for human interference.

When it came to selecting automation components, the focus was on reliability, safety, cleanliness and flexibility. It would also be necessary to connect to a higher-level Supervisory Control and Data Acquisition (SCADA) system as well as leave open interfaces for future expansion. In the interest of establishing a successful partnership it was also important that the supplier provide excellent support and have an interest in the scientific subject matter. After evaluation of various suppliers, the choice fell in favor of B&R.

The test lab

When the thermal vacuum chamber is switched on, its first task is to generate a vacuum. It does this by opening all the corresponding valves and activating the roughing pump, which creates an initial vacuum of 10^{-2} millibars. Subsequently, two turbo pumps further refine the vacuum. Once a sufficient vacuum has been established, the necessary temperatures are generated using the thermal



The automation solution is divided into 6 subsystems, which allows optimal placement of the components and reduces the number of cables required.



To determine whether the satellites are prepared for deployment in space, they are tested in a manual thermal vacuum chamber. This chamber is operated using a controller and other modules from B&R's X20 system.

shrouds and solar simulator. Around 150 temperature sensors provide information about the temperature distribution inside the chamber and on the surface of the test object. If the object grows too hot, the temperature must be reduced to prevent damage to the satellite and its electronic components. Now the chamber is ready to examine the strain on the test object caused by the extreme temperature variations. Since they are made of glass, the mirrors of the telescope don't expand in the same way as the mechanical supports. This could result in serious damage. It is therefore very important to measure how the area around the mirrors is affected by space conditions in order to determine how to compensate appropriately.

The temperature is also monitored on the outer casing of the thermal vacuum chamber. The casing is equipped with a heating system that can be activated to prevent condensation.

The architecture of the B&R automation solution

B&R's automation solution is comprised of the X20 system with an X20CP3586 CPU as well as an X20SL8100 SafeLOGIC controller with cable redundancy, a combination of standard and safety I/O modules for temperature and valve monitoring and an interface for the turbo pumps. Using the OPC UA protocol makes it possible to connect with the higher-level SCADA system.

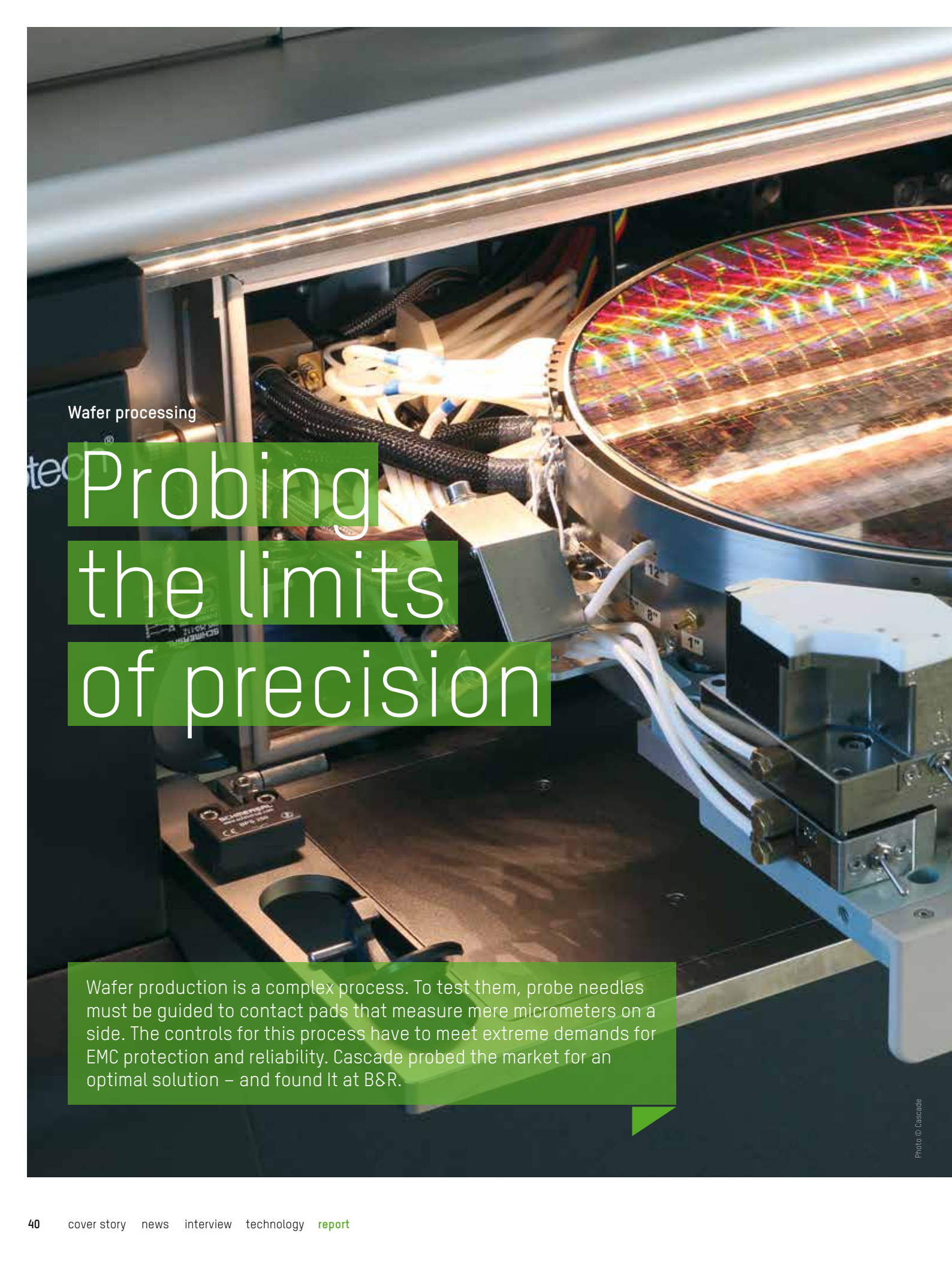
Dividing the solution into 6 subsystems allowed a portion of the automation components to be placed in a machine room next door to the clean room and reduced the number of cables required. Con-

siderably reducing the number of components in the clean room also contributes to the level of air purity. In addition to the controller, the control cabinet inside the clean room also houses serial and Ethernet interfaces, as well as the unit for evaluating pressure measurements received via a serial interface. The controller itself operates fanless and doesn't generate any dust. The components have also proven to be so clean, that it wasn't even necessary to include a filter in the control cabinet. The system is operated using a B&R terminal in the clean room. This is where the temperatures are set and the results are evaluated. Recently, B&R's Unit Test solution was added to check the automation system at the beginning of each series. Programming is done in C or C++, the predominantly used languages at the institute.

Future lab equipment

"The modularity, flexibility and real-time capability offered by B&R's automation solutions are why they are valued so highly in the academic arena," says Severin Oeschger, who is responsible for automation systems in the thermal vacuum chamber at the University of Bern. "B&R's reliable service, active R&D cooperation and keen interest in science and research were also decisive factors in our decision to team up with them on this and other projects."

With the goal of standardizing architectures and consolidating suppliers to minimize overhead, the Center for Space and Habitability and the Space Research & Planetary Sciences Division at the University of Bern will be equipping new lab equipment and future expansions with B&R components whenever possible. ←



Wafer processing

Probing the limits of precision

Wafer production is a complex process. To test them, probe needles must be guided to contact pads that measure mere micrometers on a side. The controls for this process have to meet extreme demands for EMC protection and reliability. Cascade probed the market for an optimal solution – and found it at B&R.



Wafer chuck with wafer in loading position



Cascade Microtech CM300 Dual Prober



What do a multi-function oven, a digital clock, a toaster and a GPS navigation device have in common? Simple: they all rely on microchips built from silicon wafers. In today's consumer market, it's almost a challenge to find a product without one. The huge bandwidth of applications presents a substantial challenge for developers of semiconductor components. They face constant pressure to integrate a growing range of functions on permanently shrinking chip sizes, while at the same time reducing production costs. Already, the smartwatch on your wrist is both cheaper and more powerful than the office PC you used just 10 years ago.

Thin slices of semiconductor material – known as wafers – contain more than 1,000 chips with billions of transistors and other components and currently measure up to 300 millimeters in diameter. This complexity makes developing and validating new designs and production methods a very important process. Nevertheless, the amount of time allotted for development is shrinking rapidly.

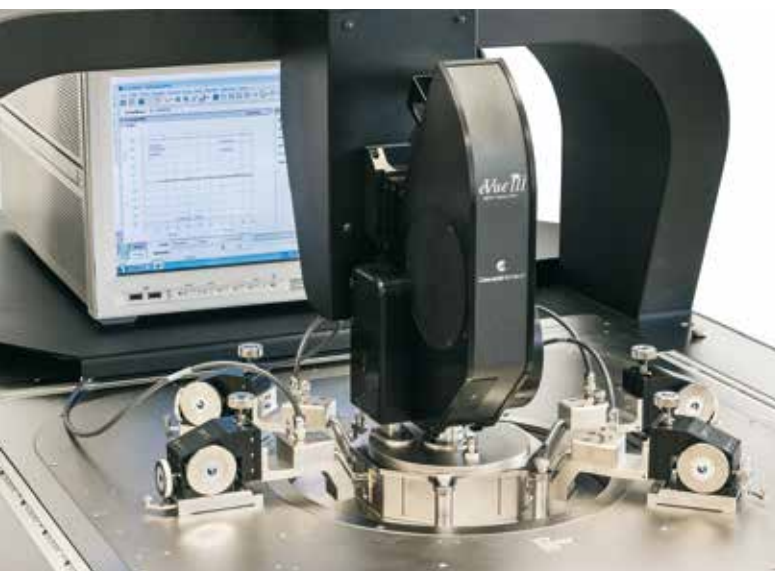
Thorough testing ensures quality

To validate the functionality of newly developed components and ensure consistent quality once they reach serial production, wafers are subjected to extensive testing in probe stations immediately after they are produced. Each wafer is fed into a measurement chamber, fastened into position with micrometer precision using a chuck and brought to a specific temperature. Then probe needles are guided to specially designated contact points on the chip. External measurement and testing instrumentation, which itself can fill entire control cabinets, dictate the positions based on the test program and then initiate the measurements. Testing is performed

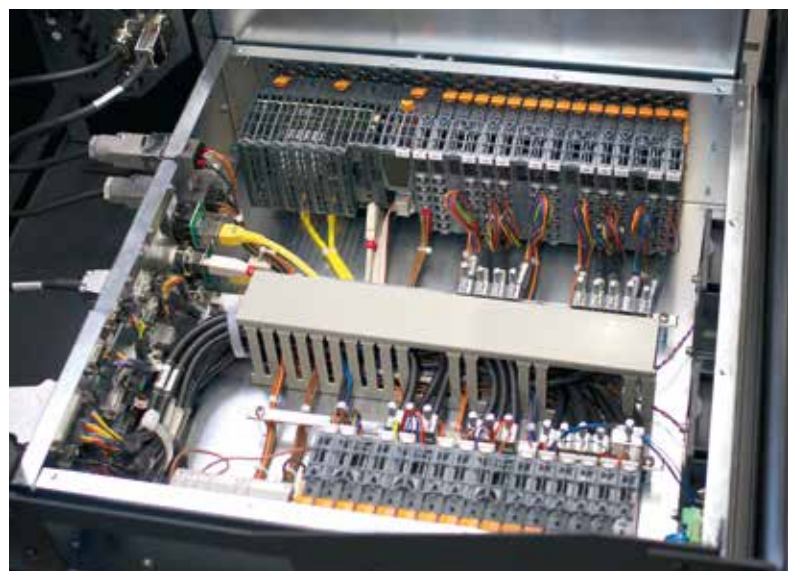
at temperatures ranging from -55°C to 300°C . Depending on the application, the currents measured can range from several femtoamps (a number with 15 zeros after the decimal point or 6,250 electrons per second) up to 400 amps. It's not uncommon to have measurement frequencies in the gigahertz range – on chips used in car radar systems for example – or to measure charge/discharge capacitance values as low as several femtofarads. A prominent feature of the requirements specifications is therefore the exclusion of all sources of electromagnetic interference.

High-tech measurement chamber prevents interference during testing

Cascade Microtech GmbH, a subsidiary of Cascade Microtech Inc. with headquarters in Beaverton, Oregon, is familiar with these requirements. As a worldwide leading manufacturer of wafer probing solutions, the company first introduced its patented probing station in 1992 and has been improving it ever since. With over 50 years of experience developing precision positioning technology, mastery of the processes involved is an integral part of day-to-day operations. "Under the given conditions, there are several factors to be considered in order to guide the probe needles to the contact pads, which measure just 30 micrometers on a side," explains Dr. Jörg Kiesewetter. Kiesewetter is the R&D manager for probe systems at Cascade Microtech's Dresden office. Here, 140 employees develop and build these systems for more than 800 customers around the world, including semiconductor producers such as IBM, Intel and Infineon, as well as many organizations like the Interuniversity Microelectronics Center (IMEC), Europe's largest research center for nano- and microelectronics.



DC test setup for low-leakage measurements



Arranged in tight quarters and protected against electromagnetic emissions: the machine controller with BSR components



Dr. Jörg Kiesewetter
R&D Manager, Cascade Microtech

"The complete modularity we have gained has helped us reduce development times considerably," reports Kiesewetter. "Outstanding support from BSR's expert engineers in Leipzig saved us valuable time."

Precision positioning

When it comes to achieving the necessary precision, the experts at Cascade Microtech have a number of mechanical and electrical solutions up their sleeves – as evidenced by their impressive 190 patents. For example, several of the 25 axes for the positioning stage, digital camera and other auxiliary equipment require cooling. "It's not possible to measure the quality of electrical contact to the chip directly," Kiesewetter points out, "so it's important that this process is intrinsically reliable." A single positioning error of only a few micrometers could render an entire wafer or a probe card with over 10,000 contacts unusable. This would lead into hundreds of thousands of euros in damages, not to mention tarnishing the company's reputation. Yet the requirements continue to intensify rapidly. "The contact pads occupy valuable surface area, so they are being made smaller all the time. Soon they will be 20 micrometers on a side – less than a quarter of the cross-section of a human hair." On top of that are the numerous special requests posed by device users. To keep

pace with the mounting requirements, Cascade Microtech began evaluation of a new controller design concept three years ago.

Modularity accelerates development

In addition to long-term product availability, EMC protection and access to a global sales and support network, the modularity of the control system was a key criterion. It would also be necessary to continue development of existing C++ program code. BSR offered the most compelling solution, and Cascade Microtech already has plans to implement it in additional devices. The designers were free to decide whether to use DC or stepper motors for the various motion control tasks. Using BSR's Generic Motion Control software solution for axis control allowed Cascade Microtech to keep hardware and software separate and accommodate different types of motors without requiring any code changes. "The complete modularity we have gained has helped us reduce development times considerably," reports Kiesewetter. "Outstanding support from BSR's expert engineers in Leipzig saved us valuable time." ←

TSN –

A turbo charge for OPC UA?

Integration of all communication from the ERP level to the field level is an essential requirement for today's most advanced production systems. To penetrate the barriers between IT and automation, equipment owners are increasingly turning to the open OPC UA standard. When it comes to complex processes with real-time requirements, however, OPC UA has its limitations. That could soon change, thanks to Time Sensitive Networking.

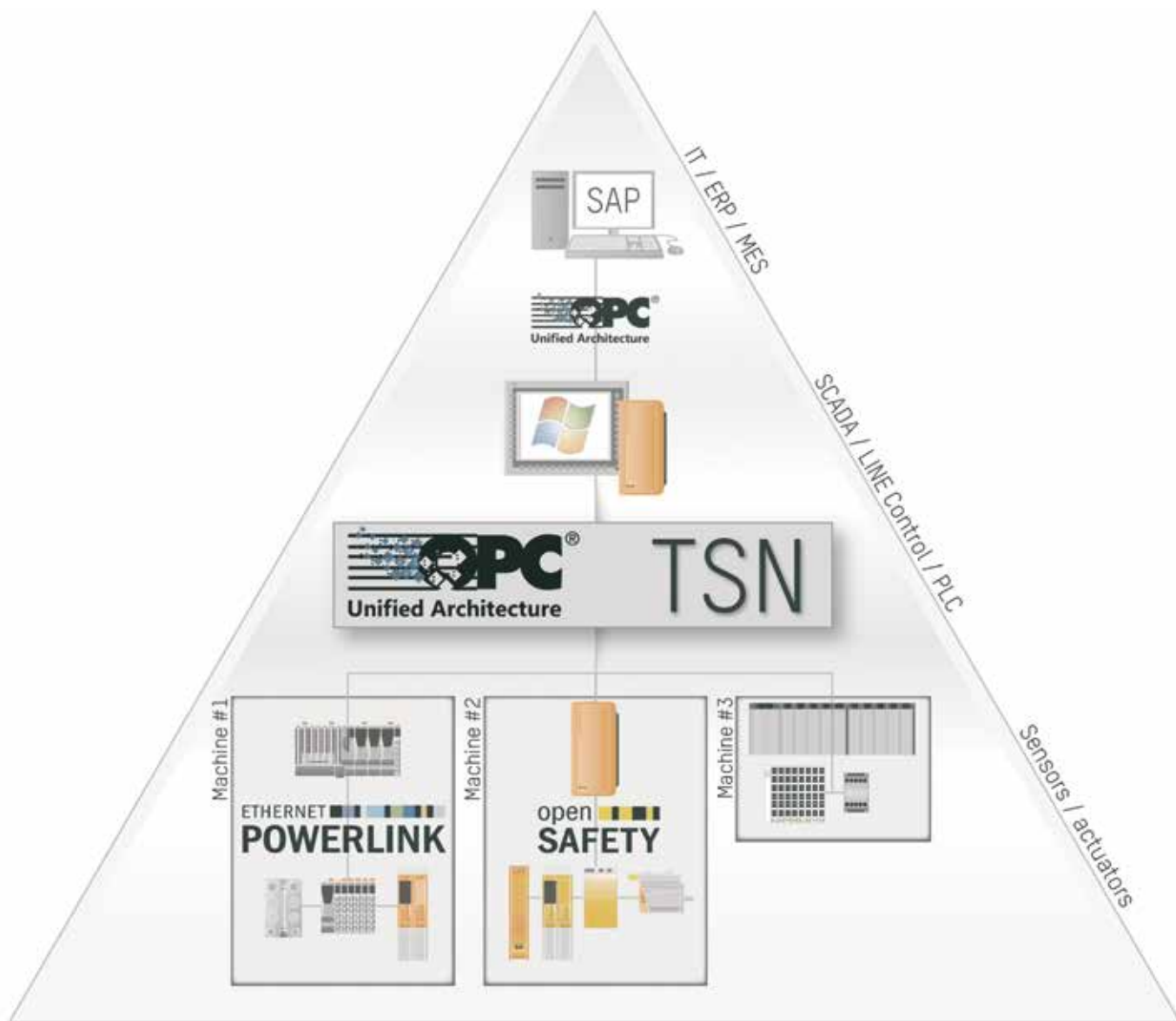


The complexity of industrial automation tasks is continually increasing, leading to the development of more and more distributed control concepts. These approaches allow for individual, flexible and modularly structured automation technology as intelligent peripheral devices connected via industrial Ethernet become increasingly prevalent.

It is becoming more common, for example, for individual subsystems and modules to be equipped with their own controllers and grouped together to make up a complete machine.

Communication is key

"Effective communication between the individual components is a decisive factor in the productivity of these types of solutions," explains Stefan Schönegger, marketing manager at B&R. "For manufacturers of machinery and equipment, it's very important that their ability to implement a given process is



With OPC UA TSN, traditional factory-level fieldbus systems are no longer needed.

not limited by proprietary solutions." From the field level to the ERP system, the open OPC UA standard is an ideal communication protocol.

OPC UA has now been implemented by all the major control system manufacturers. This standard ensures that machines with controllers from different manufacturers can be easily coordinated within a system. The protocol itself is also platform-independent, and the communication stack can be ported to any operating system or embedded hardware. "OPC UA is the only protocol that so effectively combines all of these benefits," says Schönegger. This is comparable to the advantages that POWERLINK offers at the machine level.

Real-time for maximum productivity

As long as the machines in a factory continue to operate as relatively self-contained units – sending and receiving isolated diagnostic data and commands – OPC UA will continue to be an excellent choice for M2M communication.

"The factory of the future will look quite different, though," says Schönegger. "Machines, robots and conveyor belts will need to talk to one another in real-time in order to maximize productivity."

"It would surely be technically feasible to add real-time capability to OPC UA itself, but doing so would involve considerable effort and would still have disadvantages," Schönegger

adds. That's why a large group of automation and robotics manufacturers joined forces to move in a different direction. Their goal: to have OPC UA make use of TSN – an extension of the IEEE 802.1 Ethernet standard currently being developed.

Automotive industry driving TSN development

Time-Sensitive Networking (TSN) is a set of extensions currently in development that will later to be included in the IEEE 802.1 standard. The goal is to provide real-time data transmission over Ethernet. "A huge advantage of the TSN standard is that the automotive industry is behind it. That means that the required semiconductor components will be available very quickly and rela-

tively inexpensively," explains Schönegger. The amount of data being transmitted in automobiles has skyrocketed in the past several years. "Conventional bus systems don't have nearly the bandwidth to handle it," says Schönegger. The first step for the automotive industry was adoption of the 802.1 AVB (Audio Video Bridging) standard, which enables synchronized, prioritized streaming of audio and video files. This allows images from rear view cameras mounted on the back bumper to be transferred via Ethernet.

To pursue the goal of reaching new industries and broadening the spectrum of applications, the AVB working group became the TSN initiative. The automotive industry would also like to handle all control tasks and applications that require functional safety over Ethernet. For this to be possible, they will need cycle times in the real-time range and deterministic network behavior. "These are the exact same requirements we face in the automation of production lines," says Schönegger. That's why we and other automation suppliers have decided to give OPC UA real-time capability with TSN.

IT meets automation

"With OPC UA TSN, we're building a bridge between the IP-based world of IT and protocols for hard real-time demands such as POWERLINK," says Schönegger. OPC UA TSN is the perfect solution for all applications in factory automation above the machine level with soft real-time requirements. This includes things like line synchronization, links to SCADA systems, solutions for simple control tasks, and operation of conveyor belts. These are all tasks that require performance in the range of 2 to 10 milliseconds and jitter in the range of hundreds of microseconds.

Limited selection of topologies

"Even with TSN, cycle times under 2 milliseconds will not be technically feasible," says Schönegger. The realm of hard real-time for servo drives and high-speed sensor connections will continue to be reserved for industrial Ethernet protocols like POWERLINK. TSN also has a significant disadvantage be-

Stefan Schönegger
Marketing Manager, B&R

"The combination of OPC UA TSN and POWERLINK will cover the full range of communication in industrial production."

low the level of line communication. It has been optimized for the star topologies typically found in IT solutions. There are limitations to the use of line (daisy-chain) topologies such as those generally found in machinery. With OPC UA extending its reach to the level of line automation in the coming years, there will be some dramatic changes to the structure of machinery and equipment. "Traditional factory-level fieldbus systems will no longer be needed," says

Schönegger. The combination of OPC UA TSN and POWERLINK will cover the full range of communication in industrial production. OPC UA and POWERLINK are purely software-based protocols with stacks that are freely available and can be ported to any platform. "The combination of OPC UA and POWERLINK provides the maximum amount of freedom when engineering machines and systems," says Schönegger. What name is printed on the controller is irrelevant. ←



OPC UA TSN is ideal for line synchronization.

A photograph of a complex industrial facility, likely a cold storage or food processing plant. The scene is filled with a dense network of silver-colored metal pipes, some of which are insulated with white material. In the foreground, there are several large, vertical red cylindrical tanks. To the right, there are large, horizontal stainless steel tanks, one of which has a label that reads "Isolcell". Various blue and green electrical motors and pumps are integrated into the piping system. The overall environment is industrial and brightly lit.

Cooling, heating, power and solar

Integrated control melts energy costs

By coupling its power, heating and cooling systems, the wholesale fruit market in Mittelbaden, Germany, managed to reduce the energy costs associated with operating its cold storage facilities by 50%. At the heart of the network is a central controller based on a B&R Power Panel, which ensures that the individual systems interact with optimal efficiency.

The energy control center of the wholesale fruit market in Mittelbaden, Germany. With active support from B&R, aeteba developed a modular and scalable control solution that couples all of their energy supply systems.



Photo: aareba GmbH



Over the course of a year, the local-grown apples on your supermarket shelves actually leave a larger ecological footprint than their imported cousins. This has been confirmed by studies comparing the carbon dioxide emissions associated with growing, transporting and storing fresh produce. Surprisingly, the environmental cost of energy-intensive cold storage significantly outweighs that of transporting freshly harvested fruits from large plantations half-way around the globe.

Yet the scales may soon tip in favor of your friendly local orchard. By creating intelligent links between their various supply systems and incorporating renewable energy, producers of pharmaceuticals, foods and beverages as well as plastics processors, hotels and, of course, cold storage facilities can minimize the impact of their energy-intensive enterprises on both the environment and their bottom line.

High energy consumption

Case in point: the wholesale fruit market in Mittelbaden. At its headquarters in Oberkirch, between the Rhine and the Black Forest in

one of Germany's largest fruit-growing regions, the 3,100-member producer group operates more than 50 cold storage facilities home to a total of 550 cold rooms, 45 freezer rooms and 12,100 controlled atmosphere rooms for 11,000 metric tons of pome fruits.

Until late 2014, the 4,987 megawatt hours of refrigeration these facilities require each year were generated using conventional chillers. This alone accounted for an estimated 65% of the market's total power consumption of 2,557 megawatt hours, with the rest going to operation of the cleaning, sorting and packaging lines. To provide the necessary electricity – at a total cost of €409,100 per year – the utility company consumed a calculated 6,649 megawatt hours of primary energy. This doesn't even account for the €58,000 of gas – another 1,284 megawatt hours of primary energy – needed to heat the buildings.

Custom-tailored intelligent energy supply

"In the past, the heating and cooling systems operated completely independently of one another," explains Elmar Sporer, the R&D manager at aeteba who was responsible for planning and implementing the new energy generation and distribution solution for the wholesale warehouse. "While this kept the design relatively simple, it didn't make efficient use of the available energy."

A solution that is both ecologically and economically optimized must account for every process involved in generation and distribution of heating, cooling and power. Most importantly, it must be custom-de-

signed in a way that allows for intelligent interaction between these systems. "Since the circumstances vary from location to location," explains Sporer, "the supervisory controller responsible for networking the energy systems needs to be easily adaptable. Off-the-shelf controllers we found only covered a portion of our needs or were simply too rigid, so we chose to develop our own solution based on standard B&R components."

Scalable and adaptable control

For aeteba, the decisive arguments in favor of B&R technology were the scalability and modularity that make it particularly cost-effective. At the heart of the new control solution is a Power Panel that serves double duty as both HMI and control platform. For the wholesale market in Mittelbaden, aeteba selected a fanless Power Panel 520 with an Intel Atom processor and a 15" touch screen display. If necessary, the HMI and



At the heart of the new energy supply system designed and implemented by aeteba is a combined heat and power unit with electrical and thermal capacities of 200 and 256 kilowatts, respectively. Power and waste heat are used primarily to generate energy for refrigeration.



Elmar Sporer
R&D Manager, aeteba GmbH

"The advantages of B&R's solution are its scalability, modularity and ease of use. On top of giving us remote maintenance possibilities that grant us access down to the field level, B&R's technology allowed us to create a control solution that quickly and easily adapts to each location's customized energy supply system to guarantee high availability."

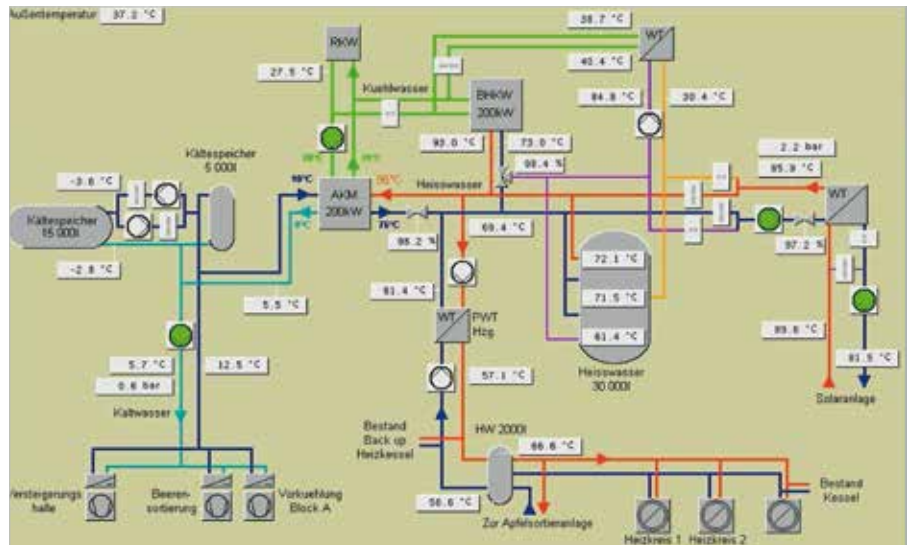
control applications created in Automation Studio can easily be ported to a Power Panel variant with a more powerful processor or larger display or to an industrial PC with a remote operator panel. In cases where production data acquisition is desired, the APROL process control system can also be integrated. To communicate with the various system components, aeteba uses modules from B&R's X20 and X67 systems. The latter offers IP67-rated I/O modules that allow designers to control remote subsystems or integrate them directly, via X2X for example.

80% of electricity produced in-house

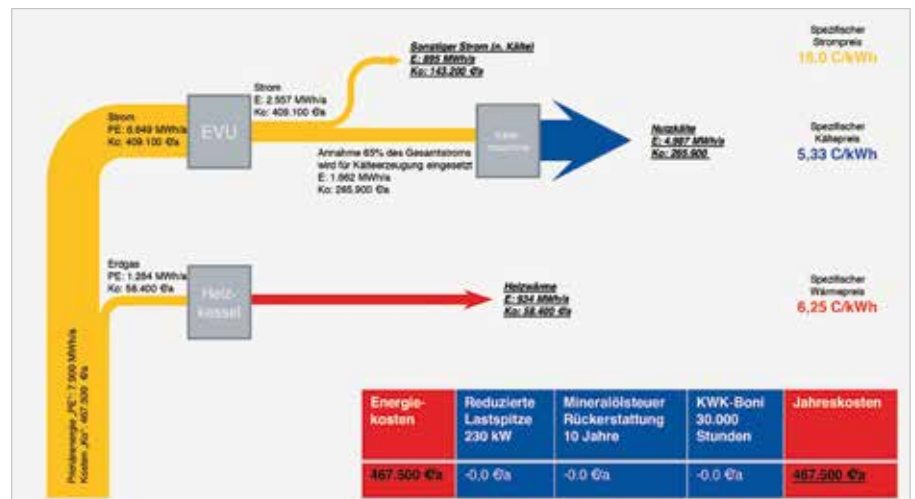
The wholesale fruit market in Oberkirch has been using this solution to control the new energy supply system implemented by aeteba, which is built around a combined heat and power unit with electrical and thermal capacities of 200 and 256 kilowatts, respectively. For economic reasons, the system was designed to cover 80% of the facility's total electricity requirements. Electricity generated in-house is used almost exclusively to operate the chiller (1,389 megawatt hours or €162,700 per year), leaving only 881 megawatt hours to be purchased from the utility provider. Additional cooling energy (820 megawatt hours) is provided by an absorption refrigerator that utilizes waste heat from the combined heat and power unit. Supplemental power for the heating and cooling systems is provided by 409 square meters of solar panels (219 megawatt hours) and a small gas boiler (219 megawatt hours).

Energy costs cut in half

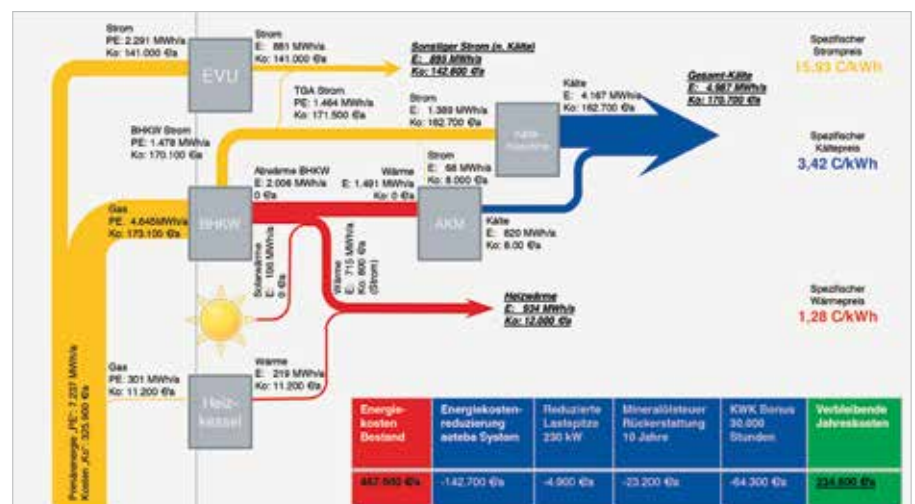
The combination of custom-tailored energy supply systems and the control solution from B&R made it possible establish optimal interaction between the systems and cut the wholesale fruit warehouse's energy costs in half – from €467,000 to only €234,000 – in spite of incorporating a previously unrefrigerated auction hall into the climate control system. This explains Sporer's optimistic outlook on the future: "Combined cooling, heat and power has proven to reduce energy costs and improve the carbon footprint of nearly all energy-intensive enterprises with continuous consumption over 100 kilowatts of electricity who also need thermal energy for refrigeration and/or heating. The investment costs pay for themselves in a few years, and it benefits both the climate and society." ←



The HMI for the energy control center at the wholesale fruit market in Mittelbaden, designed in Automation Studio. To ease aeteba's transition into the new technology, B&R handled the task of developing the control and HMI applications.



Prior to implementing the new energy supply solution, the systems were isolated and inefficient.



Networking energy sources and incorporating renewable energy enabled drastic reductions in utility costs.

B&R expands Business Development

Thomas Rienessl named Head of Business Development, Industries



"Our experts help our customers solve the unique challenges of their industries," Thomas Rienessl, Head of Business Development, Industries.



B&R has named Thomas Rienessl as Head of Business Development, Industries, along with adding a number of new personnel to the Business Development department. "We've put ourselves in an excellent position to provide our customers even more specialized support to achieve optimal solutions for automating their machines and plants," says general manager Peter Gucher.

"Nearly every industry has unique requirements that demand specialized technologies," explains Rienessl. Some examples include the registration mark detection technology required in packaging and printing and the servo pump control technology required in injection molding processes for the plastics industry. Manufacturers of industrial and consumer goods have their own challenges, such as maximizing system availability. To meet these challenges, they need cutting-edge automation solutions for transparent production processes that utilize resources as efficiently as possible. They also need convenient and intuitive tools

for predictive maintenance. B&R's industry experts thoroughly understand these challenges and are there to help customers meet all of their industry-specific requirements.

Close to the customer

Each new machine or plant is expected to be more flexible and more efficient than the one that came before it. "This presents our customers with a never-ending cycle of new challenges," says Rienessl. "By identifying the automation technology best suited for implementing our customers' ideas, B&R's industry experts are there to help them create innovative solutions that not only maintain but expand their competitive edge."

In 2015, B&R will be presenting its pioneering solutions and technologies at more than 20 industry trade fairs around the world. For a schedule of events and more detailed information about industry-specific applications, visit <http://www.br-automation.com/en/industries/> ←

Photo: B&R

Smart factories and bright prospects

Automation specialist B&R anticipates double-digit growth



"B&R's solutions for factory automation accelerate the practical implementation of Industry 4.0 requirements," says Peter Gucher, General Manager at B&R.



B&R continues its long track record of growth. For the current year, the automation specialist once again anticipates a double-digit increase in revenue. This was announced by general manager Peter Gucher

at B&R's press conference in Salzburg. In addition to solid growth in all existing markets, the company's entry into the field of factory automation delivered a significant boost in turnover. Based on the year so far,

Gucher expects an increase of between 11 and 14%, explaining that general economic uncertainties – in China and elsewhere – render it difficult to make the forecast as precise as he has in previous years.

B&R's own smart factory

The relatively new market of factory automation accounts for an increasing share of the company's revenue. "We've been running our own fully networked smart factory for years now, and we're expanding on our solutions all the time. Our customers certainly benefit from this as well," says Gucher.

Mass customization – Batch size 1

With its PCs and HMI panels alone, B&R offers its customers more than 2 billion theoretically possible combinations to choose from in its online configuration tool. Based on the selected configuration, B&R's ERP automatically organizes the production of each item – down to a batch size of one. "In 2014 we produced 175,000 PCs and panels this way, and we expect that number to be even higher in 2015, particularly for products with multi-touch displays," says Gucher.

Highlights – SPS IPC Drives

B&R will be presenting the next dimension of its mapp software platform at the SPS IPC Drives. With mapp View, B&R now offers direct access to the wide world of web technology right from the engineering software. 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.

Other innovations include service-friendly HMI for the automotive industry and a new class of extremely compact and high-performance controllers. With the Automation Panel 5000, B&R will also be presenting a new generation of swing-arm-mounted operator panels. ←

In-motion scales

Weight without the wait

Typically located at the end of a packaging line, checkweighing systems are used to weigh packaged items and automatically reject any that fall outside the defined tolerance. Checkweighers are a key element in establishing trust between producers and consumers. They also provide manufacturers valuable information to help fine-tune production efficiency and make the most of their raw materials. Thanks to a lightweight, smooth-running automation solution from B&R and perfect POWERLINK synchronization, the new in-motion checkweigher from Precia Molen is able to process products weighing fractions of a gram at a rate of over 120 packages per minute.



All three conveyor belts of the CKW710 are driven by compact ACOPoSmicro servo drives and brushless motors from B&R.



Weight measurements are extremely vibration-sensitive. Thorough testing validated that the ACOPOSmicro servo drives easily met the requirements for minimum vibration.



Precia Molen's CKW710 in-motion checkweigher – automated by B&R – meets the demands of today's food industry for high-speed line-integrated weighing.



Yvan Ruillère
Project Manager, Precia Molen

"The B&R team has always been by our side whenever we needed technical support, even on-site. This helped move the project along quickly and reduced our time-to-market significantly."



In-line weighing for food production

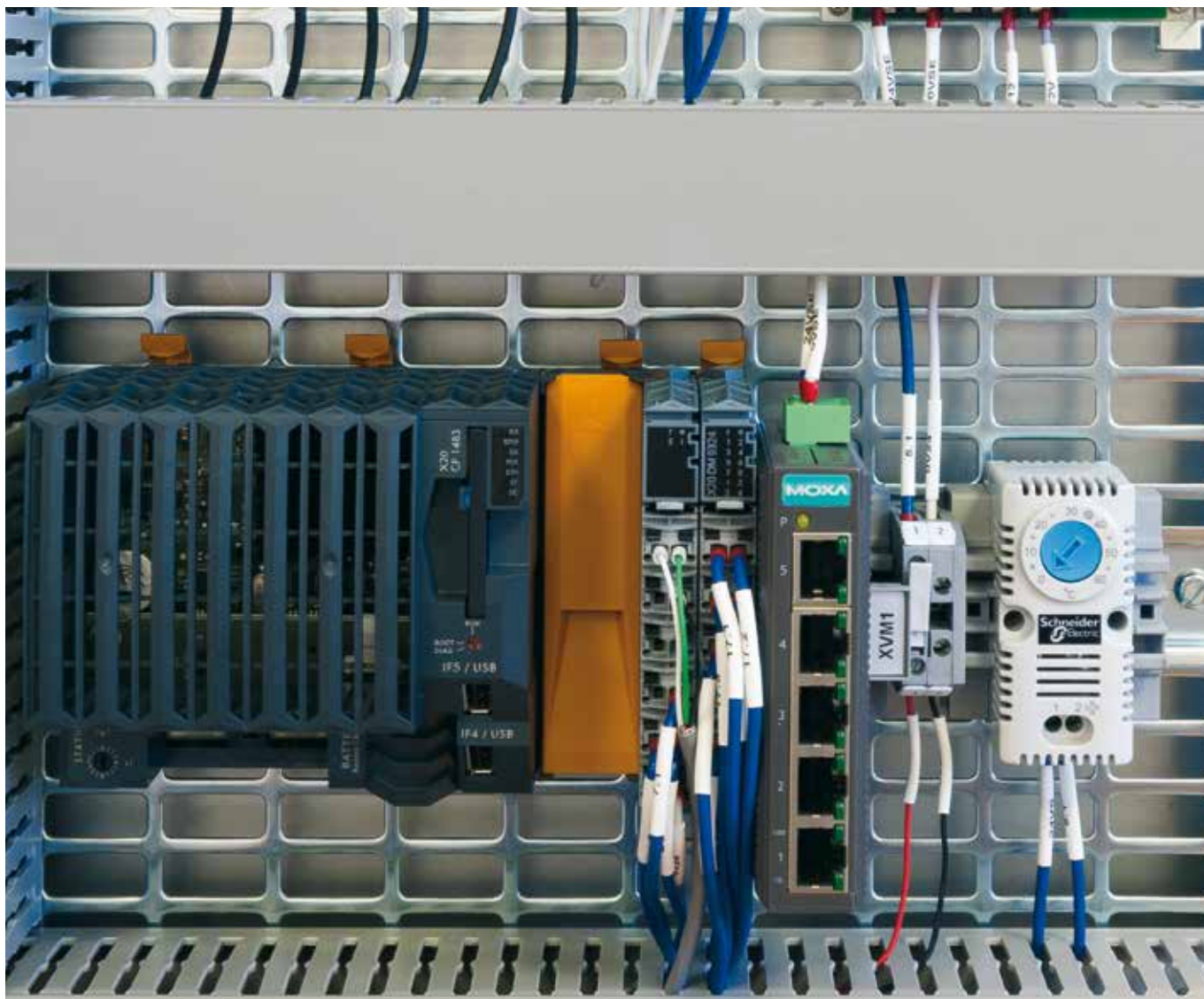
Precia Molen has been France's leading manufacturer of weighing instruments for more than 50 years and is widely recognized as an expert in the field. Originally known as Precia, the company acquired Molen in 1993 and has enjoyed continuous international growth ever since. Besides ensuring compliance with weight measurement regulations, their newest CKW710 in-motion checkweighers – automated by B&R – also meet the demands of today's food industry for high-speed line-integrated weighing.

The CKW710 is comprised of three conveyor belts. First comes an infeed belt, which accelerates or decelerates the incoming packaged item to the speed required for weighing. This is followed by a weighing belt mounted on a weight transducer and a rejection belt

to remove out-of-tolerance packs from the line. An additional feed for electromagnetic inspection is also available to detect any metallic particles and ensure product integrity.

Motion control for high-speed weighing

All four belts are driven by brushless motors and compact ACOPOSmicro servo drives from B&R. Because weight measurements are very sensitive to vibration, the Precia Molen R&D team needed the drive system to be lightweight and to generate minimal mechanical noise when moving the belts. Thorough testing validated that the ACOPOSmicro servo drives were well suited for such constraints. The servo drives are controlled by a compact X20 controller via a POWERLINK network. The Ethernet-based POWERLINK network ensures optimal synchronization between



The full connectivity offered by the X20 controller made it easy to couple Precia Molen's checkweighing software to the B&R axis control solution.

the machine's detection sensors and the ACOP0Smicro servo drives. Based on this automation solution, Precia Molen's dynamic in-motion checkweigher handles 100% of production flow – processing items weighing fractions of a gram at over 120 packages per minute.

Highly connective controller

The sophisticated checkweighing software Precia Molen developed for the CKW710 allows it to evaluate weight, control rejection systems and manage statistics through a modern graphical interface. Data exchange with customers' IT systems are based on Ethernet. The full connectivity offered by the X20 controller made it easy to couple this evaluation system with the B&R axis control solution. Communication was easy to program thanks to the many

libraries offered by B&R's Automation Studio software tool. Using the X20 CPU and I/O modules, the CKW710 can send a signal to upstream machines like fillers or sealers if to trigger adjustments to control parameters. Efficient training to reduce time-to-market Engineers from Precia Molen and B&R worked together very closely to make the checkweigher project a success.

Thanks to the training services provided by B&R France, the Precia Molen project team was brought up to speed on B&R motion control technology very quickly. "The B&R team has always been by our side whenever we needed technical support, even on-site. This helped move the project along quickly and reduced our time-to-market significantly," reports Yvan Ruillère who led the CKW710 project ←

Real solutions in action



Learn more about mapp technology

With mapp technology, B&R is revolutionizing the development of user software in the field of automation. These modular software blocks simplify the development of new programs and reduce the development time for new machines and systems by an average of 67%.

<https://www.youtube.com/watch?v=2reJ0lqcbgo>



Welcome to mapp technology

The result, after many man-years of development, is mapp technology. Short for modular application, mapp represents B&R's strategic investment in its own future viability. It bridges the gap between traditional, sequential software design and intuitive interfaces overlaying advanced software concepts. mapp embeds powerful software functionality inside readily configured software objects, called mapp links, which are based on the IEC 61131-3 standard.

<https://www.youtube.com/watch?v=1hkGrVmJuQE>



mapp Industry

mapp Industry components provide a fast, easy way to implement the ISA TR88.00.02 standard (also known as OMAC PackML) for defining machine states, modes and tag naming conventions.

<https://www.youtube.com/watch?v=LhCX8ATxrUs>



General

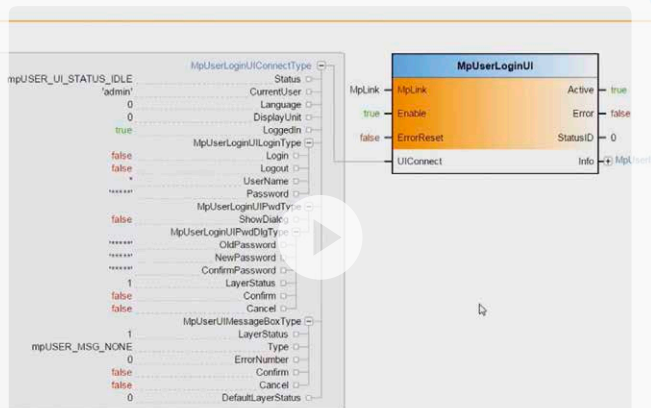
Name	MpDelta type E
Transform Type	Delta Type E
Use Shortest Way	<input checked="" type="checkbox"/>



mapp Mechatronics

It's not hard to find a controls supplier that offers function blocks for motion control. Still, executing a typical synchronized multi-axis application can require a dozen or more function blocks. mapp technology reduces that to one component for single-axis movements and another for multi-axis control. More than 50 different functions are covered by a single mapp component. The machine designer simply enters the parameters and the software figures it out. This is a sea change in motion programming, but it's still only the tip of the iceberg when it comes to mapp technology. The majority of the work involved in providing basic functionalities - which is normally duplicated over and over with each new machine - is handled effortlessly by mapp.

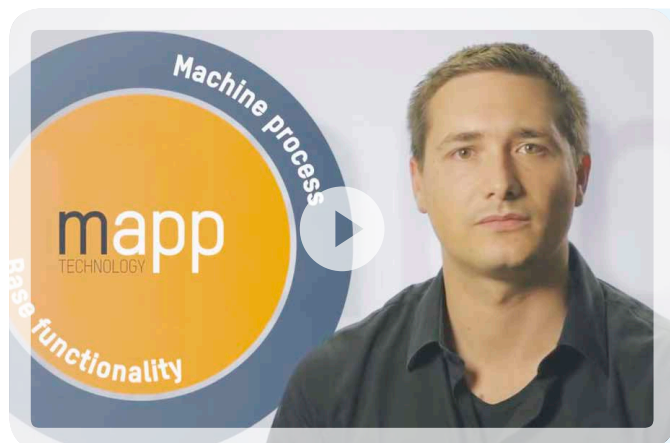
<https://www.youtube.com/watch?v=Mdj9HJARvCI>



mapp Infrastructure

Controls engineers face many tedious, repetitive programming tasks that are essential to machine operation but do not add value or help to differentiate the machine. Recipe handling, user management and audit trails are time hogs in the development of every new machine. B&R's mapp components provide diagnostic information via a web browser - allowing you to access and diagnose machine control down to the function block level without dedicated software, special training or access to the source code.

<https://www.youtube.com/watch?v=l5Le6h1qZWk>



A revolution in automaton software with mapp technology

Statement: Christoph Trappl, International Applications Manager, B&R - technical features of mapp technology

More information about mapp technology:
<http://www.br-automation.com/en/products/innovations-2015/mapp-technology/>



Chemicals & Pharmaceuticals

Stepwise migration

CHT R. BEITLICH's decentralized control system with isolated PDA had seen better days. Rather than helping to optimize production, it was tying up valuable resources. Changes to the system were tedious; replacement parts were getting harder and harder to come by. The company began surveying the market for an appropriate replacement. In the end, there was only one system that met all of their requirements.



"It was becoming increasingly apparent that our antiquated systems would soon no longer be able to keep up with the intensifying demands," says Günther Schätzle, head of production engineering at CHT R. BEITLICH. The requirements for product quality, quality assurance, process reliability and safety regulations had all changed dramatically over the years.

"What is more, our old technology was preventing us from filling new orders," adds Schätzle. It took three days, for example, just to install a new valve and get it up and running. On top of that, equipment was failing more and more frequently, and replacement parts were no longer readily available.

The control, HMI and data acquisition systems, which had become outdated, inflexible and prone to failure would need to be replaced with state-of-the-art new technology. "Fully automating everything was certainly not our primary goal," adds Schätzle, "as that would have been too complex for our multifunctional stations."

83 systems at 2 locations

CHT produces specialty chemicals in the areas of textiles, textile care, construction chemicals and performance chemicals. The company's customer-oriented product development continues to expand an already broad spectrum of products. The majority of the CHT's revenue comes from very complex products, which are produced primarily at the production and logistics centers in Dusslingen and Oyten, Germany.

These sites are home to hundreds of systems including higher-level supply systems and a variety of mixing vessels and chemical reactors. Many of the production stations are multifunctional and can produce up to 100 different products.

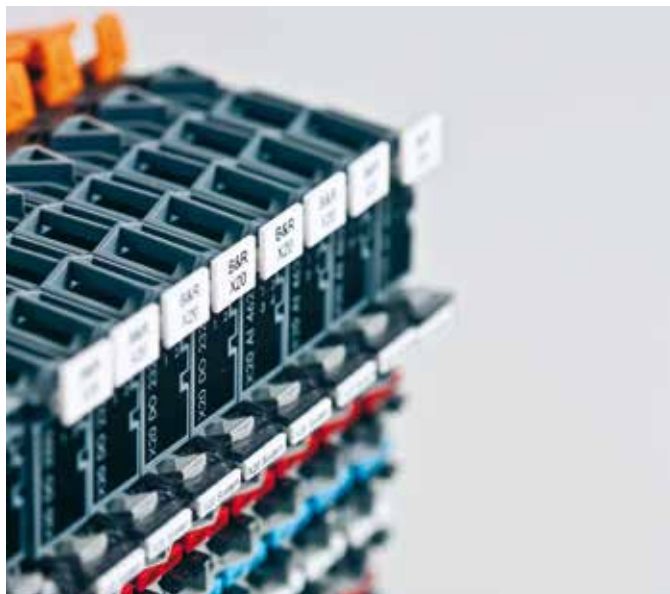
APROL process control system stands out

CHT formed a team of experts to perform an in-depth evaluation of three different process control systems, as well as control and HMI solutions from two bidders, based on an exhaustive matrix of specific criteria. In the end, B&R came out on top.

"One of the decisive factors was that B&R's process control system – in contrast to other systems – provides optimum support for stepwise migration. APROL allowed us to move our production stations successively to the new process control system while keeping the old systems running in parallel."

Process control migration at 2 locations

Migration at the Dusslingen site began in the spring of 2011. From the beginning, there was an emphasis on creating standardized



A total of 23,000 digital and analog X20 I/Os are installed at CHT's facilities in Dusslingen and Oyten.



CHT uses APROL's TrendViewer to analyze process data from its production lines. Visualization of this data helps identify relationships and correctly deduce cause and effect.

procedures that could be repeated at other locations. "It was very important to us that we arrive at standardized control procedures that are consistent at all of our locations, and that they're able to use the same code and the same hardware," says Schätzle. This preparation made the migration of the Oyten site, which began in early 2013, much faster and more cost-effective to implement.

Today, changes to the CHT libraries are applied simultaneously at both sites, which simplifies the validation process considerably. Via remote networks, programmers can access the controllers at the two locations from anywhere. While the Dusslingen site already has all the main systems integrated in the process control solution, Oyten is still working on migration of special-purpose systems, with the ultimate goal of controlling the entire plant with APROL.

B&R hardware perfectly scaled to the system structure

B&R's finely graduated selection of control and HMI products has allowed CHT to match the performance of each system's PLC to its requirements, as well as equip each system with a unique lineup of I/O modules and its own HMI unit. It was this flexibility that led the chemical producer to rely on B&R for control and HMI in addition to the process control system. "The advantage is that we can mirror the actual system structure directly in the control and HMI technology, which helps us implement the stepwise migration perfectly from a hardware perspective," explains Schätzle. He continues, "Another argument in favor of a single source solution is the lack of problems with interfaces and communication."

APROL provides flexibility through openness

For CHT, the selected integrator would need to be willing and able to accommodate specific requirements and react flexibly to addi-

tional changes throughout the course of the project. The contract went to Erler GmbH. The migration process went smoothly, as managing director Alois Erler confirms: "APROL is very open compared to other process control systems, which allows us to react very flexibly to customer requirements even when a project is already underway. We were also very pleased with how easy it was to link up to the existing legacy system. That went astoundingly well."

23,000 X20 I/Os installed

The first migration was completed in late 2011 on an immensely complex pilot station with around 360 digital and 20 analog I/O channels, and since then a new production station has been migrated nearly every week. To date, 72 systems at the Dusslingen plant and 11 production lines in Oyten had been migrated to APROL and the old process control system retired. 54 HMI panels from B&R's Power Panel series and 91 X20 controllers were installed. The



Günther Schätzle
Head of Production Engineering, CHT

"APROL provides optimal support for stepwise migration. We have migrated our production plant step by step to the B&R process control system while the legacy systems continue to run in parallel."



As early as the test phase, CHT technicians were able view data from the B&R process control system remotely via tablets.



Manager Günther Schätzle and members of his engineering team work on project planning. Change management was a core element of the stepwise migration plan.

two plants combined have around 23,000 digital and analog X20 I/Os. Various operator terminals connected via VNC were installed for shift supervisors and to provide links to office applications. Each system includes two runtime servers, one engineering server and a VNC server secured by a disaster recovery system. The redundant Linux-based production network communicates with Windows devices on the corporate network via a clearly defined interface.

Double redundancy guarantees availability

"We have even incorporated double redundancy," adds Schätzle. Every component in a station can be reached via two bus systems: an operator bus and a process bus. Each bus can take over for the other if it becomes necessary. In addition, each station is equipped with two ports that can back each other up. This ensures the high availability that the stations demand.

Before the migration was even complete, it was clear that CHT had found more than simply a replacement for the old system. "The APROL system is significantly more flexible, and we can now have a new valve up and running in a matter of hours rather than days. Any changes to the software can also be reversed with a single click if an error is detected."

Analyzing process sequences is also a much simpler task these days. "With TrendViewer and AuditTrail, we found that we were able to analyze processes that we didn't have access to before," explains Schätzle. "APROL lets us analyze interactions between processes in real time in order to implement process optimizations on the spot. Failed batches can be tracked and analyzed later on based on the logged process data." One way that CHT uses this additional information is to analyze and reduce energy consumption.

Future projects with APROL

Since July of 2015, CHT now has ISO 50001 certification for all of its locations in Germany. The next step for the energy management system is to implement energy data acquisition with APROL. This project began in September 2015. Since the alarm systems in Dusslingen and Oyten also needed to be replaced, CHT decided to use APROL for those as well.

"We're now benefiting from the synergy of B&R's energy monitoring and condition monitoring solutions by expanding the networks at the two locations and connecting all signals with APROL," says Schätzle. This project, which will also be implemented first in Dusslingen and subsequently in Oyten, will ultimately add 4,000 I/Os to the process control system. Upon completion, CHT hopes that centralized evaluation of this newly won data will help tap potential energy savings and improve plant safety and system availability.

Fast and flexible reactions

CHT is already busy thinking up other ways they can utilize the flood of data they have tapped into. In 2017 they will begin development of a custom manufacturing execution system (MES) to utilize the data with an interface to the ERP system.

"We've been very happy with the progress of the migration so far. The stepwise approach, the parallel operation of the APROL and legacy systems – all that hardly affected our production, and we had no data loss whatsoever," says Schätzle, pleased. "This system allows us to react flexibly and quickly to the latest developments and implement changes cost-effectively. These positive results have motivated us to further expand the existing system and implement comprehensive planning and evaluation tasks with APROL. ←

Audit trails made easy

New mapp component for implementing applications in compliance with 21 CFR Part 11



For applications subject to the FDA's Title 21 CFR Part 11 requirements, the *mapp Audit* component means both accelerated development and reduced investment risk.



B&R has added an audit trail component to its mapp technology portfolio. For applications subject to the FDA's Title 21 CFR Part 11 requirements, this means both accelerated development and reduced investment risk. The ability to retrace actions performed on a machine can also be of great service to its manufacturer in the event of warranty claims. Companies in the food and pharmaceutical industries need the ability to log operations performed by users seamlessly and without risk of tampering. The new *mapp Audit* component is quick and easy way to im-

plement and customize the necessary audit trail.

Automatic data exchange

There is no need to write a program for the audit trail function; all that is needed is to configure the machine-specific parameters. *mapp Audit* automatically retrieves the information it needs about the operator from the *mapp User* component using the client-server principle. Audit trail data is stored in memory with a checksum mechanism for tamper resistance. The data can be output in an encrypted file or

viewed on the HMI using the integrated *mapp Audit* visualization.

Warranty claim justified?

mapp Audit offers benefits for other industries as well. It enables manufacturers of all types of machinery and equipment to review operator activity in order to determine whether a system has been used appropriately. It is equally possible to determine whether equipment has been used outside the specified operating times – an indication that employees are engaging in unauthorized production for their own profit. ←

Photo: B&R



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