

automation

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The B&R Technology Magazine

High Precision Motion Control

Precision makes a great impression

functional printing

Additive manufacturing Will the disruption live up to the hype?

Interview The future of package printing

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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: Martin Dreher, Yvonne Eich, Engelbert Grünbacher, Stefan Hensel, Irene Plats, Stéphane Potier, Franz Joachim Rossmann, Huazhen Song, Adrian Tippetts

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Dear Reader,

As the dust settles on the electronic media revolution, the printing industry is displaying its extraordinary capacity for innovation by emerging stronger than ever. While other industries spend much of their time discussing the implications of Industry 4.0, online print shops speed ahead as the undisputed front-runners in industrial implementation.

Digital printing and its natural counterpart, digital finishing, are setting the stage for individualization and differentiation throughout the entire value-added chain – to a degree that few would have thought possible. At the same time, 3D and functional printing are opening up new prospects and dimensions for a promising future. All of this is made possible by fascinating new machine designs and state-of-the-art automation technology.

Maybe you're looking for innovative solutions on the threshold of process technology and motion control or where the worlds of IT and automation intertwine. Or maybe you're in search of a practical big data solution that fits your everyday production reality. With the absolute latest in automation technology, hard-won engineering expertise and a global support network – B&R is a solid partner who is always "in-register" with your printing needs.

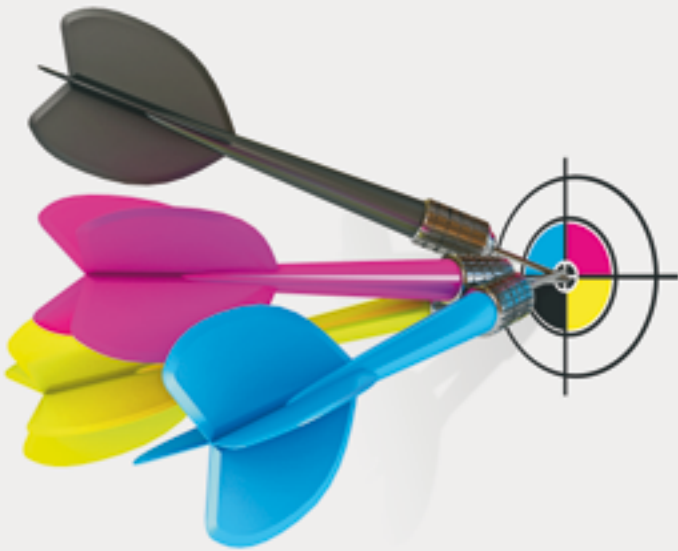
Come visit us at drupa in Düsseldorf from May 31 to June 10 (Hall 13, Booth E37). We look forward to seeing you there!

Happy reading!

Thomas Rjenesl

Head of Business Development, Industries

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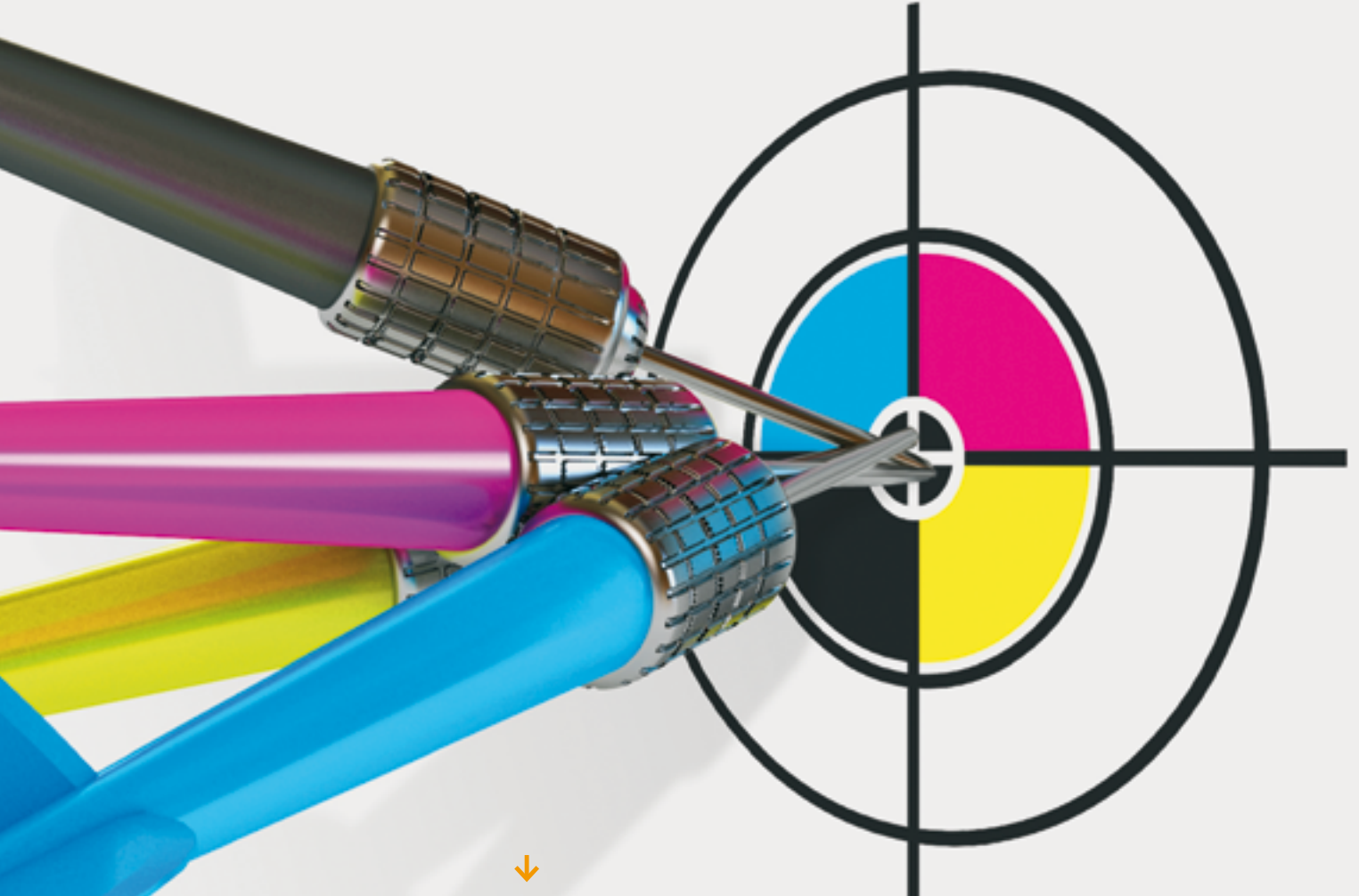
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High Precision Motion Control

Precision makes a great impression

To keep pace with the market's insatiable appetite for productivity, printing presses are being asked to achieve higher and higher speeds. Unfortunately, as you increase speed, you're faced with a disproportionate increase in vibrations. To compensate for these disturbances – and allow even the fastest presses to print with impeccable quality – B&R has developed a set of advanced control functions.



The level of quality that a flexographic printing press is able to achieve depends heavily on how well it can synchronize the web on the impression cylinder with the plate on the printing cylinder. Highly precise positioning at the nip is crucial. "A conventional press is a relatively rigid system, so the motor's encoder signal is sufficient to control the printing process," explains Dr. Engelbert Grünbacher, head of B&R's motion control firmware development team.

In contrast, a growing number of today's presses feature a streamlined mechanical design that utilizes lightweight materials. The resulting elasticity of these systems means that the motor position is not perfectly aligned with the target position at the nip during operation. Disturbances and vibrations also have a stronger impact on image quality. To mitigate these sources of error, B&R's servo drives offer the new High Preci-

sion Motion Control. "This solution encompasses three key technologies: virtual sensing, model-based control and predictive disturbance rejection," explains Grünbacher. Each of these features can be implemented and configured independently of the others. B&R's newest servo drive, the ACOPOS P3, is perfectly suited for High Precision Motion Control. Its fast 50-microsecond sampling time ensures that the advanced control functions are executed effectively.

Active disturbance rejection

Since the printing plate doesn't cover the full circumference of the printing cylinder, the resulting gap produces a fixed-position disturbance torque that results in lag error. Even the print profile itself produces a certain amount of disturbance torque. "Fine-tuning the drive parameters can minimize this lag error, but will not be able to completely prevent the disturbances,"

says Grünbacher. All of BSR's ACOPOS P3 and ACOPOSmulti servo drives offer a function called Repetitive Control – an adaptive, predictive method of rejecting periodic or fixed-position disturbances. After measuring and analyzing the disturbance, the drive then adjusts the motor torque to compensate.

This compensation occurs automatically, minimizing lag error without tedious parameter tuning or mathematical models. The end result is a more stable speed and improved print quality.

Virtual measurement of target position

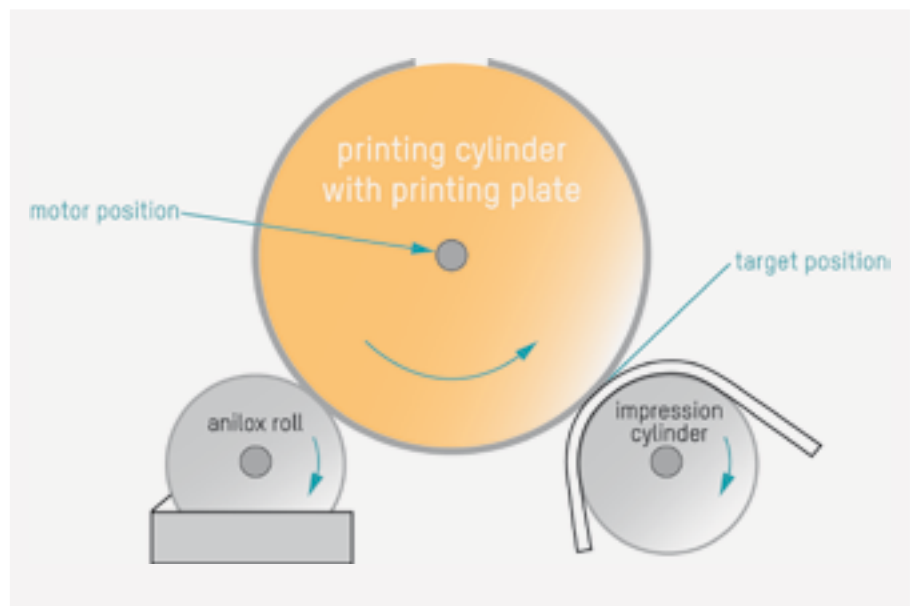
In order to reject periodic disturbances, you need to be able to determine the target position with high resolution. On an elastic mechanical system, that used to require an additional sensor. With virtual sensing, however, there are new possibilities. Virtual sensing involves using easily measurable system variables and a model of the system to calculate the values of other variables that are more difficult to measure. "To approximate the behavior of a direct-driven printing cylinder, we can use a simple two-mass system," explains Grünbacher. "The motor and printing cylinder are joined by a shaft, which for the sake of our calculations we will assume is flexible and massless. A torque proportional to the angle of rotation is generated in the shaft. The speed and position of the motor are easy to measure, and the motor torque is known. If we use these known values to calculate the hard-to-measure speed and position of the load, what we have is a virtual load position sensor."

Highly dynamic drive control

With a virtual sensor, it is possible to determine the target position without actually measuring it and use the results to reject periodic or fixed-position disturbances. This only applies to quasi-stationary



When the process is dynamic and positioning is critical, you need a motion control solution with exceptional speed and precision. With its fast 50-microsecond sampling times, BSR's ACOPOS P3 servo drive is the perfect home for advanced control functions like High Precision Motion Control.



The level of quality that a flexographic printing press is able to achieve depends heavily on how well it can synchronize the web on the impression cylinder with the plate on the printing cylinder.

processes. Often in the printing industry, drive systems are subjected to highly dynamic requirements. "This is where model-based control comes into play," notes Grünbacher.


A highly dynamic control solution for elastic systems is composed of model-based feed-forward and feedback elements. Depending on the area of application, these elements can be used individually or in combination. The model-based control loop is incorporated in the standard cascade control structure.

The model-based feedback controller includes a virtual sensor and a state controller. The state controller accounts for the state of the overall system – consisting of the motor position, motor speed, load position and load speed – making it possible to detect and actively suppress torsional vibrations. This greatly reduces the tendency of elastic systems to vibrate. "The adverse effect of disturbance torque on print quality is minimized," says Grünbacher.

Preventing vibration

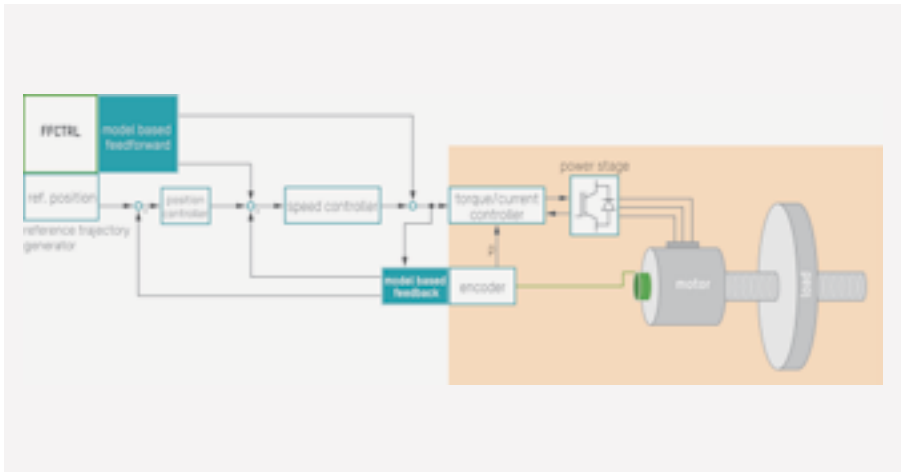
Vibrations can result not only from disturbances on the cylinder surface, but also from rapid changes to the position set-point. Model predictive control can bring substantial improvements here as well. Based on the mathematical model, the motor torque is regulated so that the target position follows the position setpoint without overshooting.

The desired behavior is achieved with excellent dynamic performance. The comprehensive range of High Precision Motion Control functions available on B&R's ACOPOS P3 and ACOPOSmulti servo drives provides all the tools needed to maximize performance, even in elastic mechanical systems. For a printing press, this equates to higher productivity paired with optimum print quality. ←

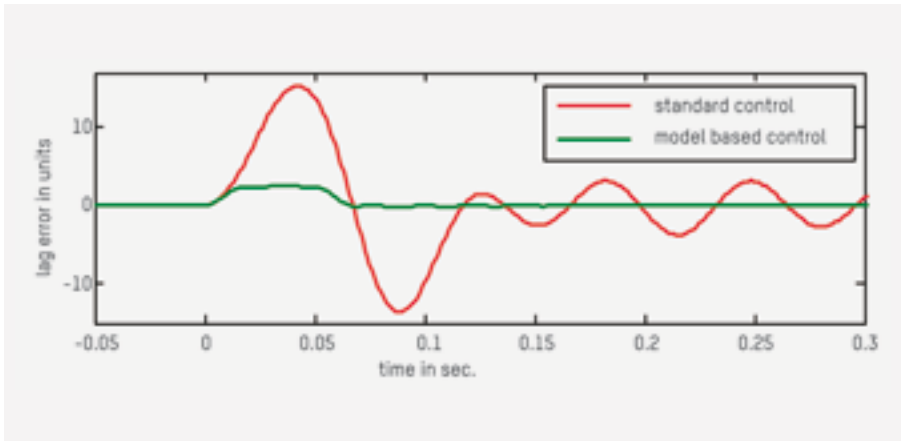


Dr. Engelbert Grünbacher, Team Leader - Motion Control Firmware Development, B&R

"High Precision Motion Control is the key to getting perfect print quality on today's high-speed presses."



The feed-forward and feedback elements of the model-based control loop are incorporated in the standard cascade control structure.



Model predictive control significantly reduces the tendency of elastic systems to vibrate.



Printing trends

The future of package printing

The package printing market – and the flexo segment in particular – is being shaped by trends that pose complex technical challenges. Dr. Martin Dreher of the DFTA technology center describes these trends and predicts the impact they are likely to have on the future of flexography.



Photo: Fotlmann



Dr. Dreher, can you tell us about some of the latest trends in package printing?

If we look at the package printing market – particularly the flexo segment – we see currents moving in a number of directions. For instance, there are trends toward thinner substrates and substrates with a matte finish.

How does a thinner substrate affect the printing process?

While it does lower material costs, a thinner substrate also presents certain challenges that have to be solved by the printing technology. With their ability to get good results on very thin and elastic substrates, central impression (CI) flexographic presses are often a good match for this.

And what challenges are posed by a matte finish?

A matte finish can be both a means of differentiation and a way to convey an image of sustainability. However, these materials are more delicate to process than glossy substrates, because even a minor disturbance could cause an abrasion that produces an unsightly shiny spot. We're able to deal with that fairly well by printing on film with CI flexo presses, because there is relatively low risk of damaging the front of the substrate with guide elements in the press.

Sounds like flexo is ready for the future. What reasons are there for still using gravure?

Something that's popular right now is laminated composite film printed with a

combination of matte finish and design elements to give it a particularly elegant look. To accomplish that, the matte finish has to be precisely aligned with the other printed layers in the composite. Gravure printing has had to deal with this for a long time and is well prepared for it, which is hardly the case with flexo. So, naturally, it would be nice to see more flexo presses being equipped accordingly in the future.

Traditionally, print quality has been the main argument for gravure and digital. Is that still the case?

These days there are very few remaining reasons you would choose gravure over flexo for film printing – and print quality is not one of them. Even with corrugated board, flexo has made such great progress that – if someone does choose offset instead – they're not doing it for reasons of quality.

With regard to digital printing, the thing is that you generally want to minimize packaging customizations so that you tie up less capital and maintain flexibility. Flexo is in a good position here, but does have to compete with digital.

What reasons are there for explicitly choosing flexography?

Flexo is the only printing segment still developing screens, so it also offers the broadest selection with regard to dot shapes, offset angles and methods of dot gain compensation. After a long period where it seemed in-



Dr. Martin Dreher, head of research at the DFTA technology center, talks about new trends in printing technology.

feasible, frequency-modulated screening is also making a comeback – and is once again producing spectacular results.

Screen rulings are growing finer and finer. There are already large-format film printers using screens with 100 lines per inch as standard. However, once you get beyond the threshold that the human eye is able to resolve, a finer screen ruling no longer improves print quality.

Are there differences or limitations to the colors that can be printed?

Like most other package printing techniques except for digital, the common practice is to print in CMYK+X. While the "+X" does help match corporate colors more accurately, it also presents new challenges. These are increasingly being dealt with by using a fixed color set. Some are using – or

at least exploring – seven-color printing, while others have already implemented four-color, or 4C, printing.

The latter has been made possible by advances in the flexo process that allow it to produce vibrant colors that not long ago were unimaginable. Today it's possible to create intensely colorful images with only four process colors.

What does the future hold for flexography?


These are dynamic times for package printing in general – and no less so for flexography. Some of the resulting challenges are easier to overcome than others, but overall, flexo technology is in a very strong position and has the absolute best prospects for the future.

Great, thanks for your time! ←



Digital label printing

The digital difference



The role of digital label printing in today's markets is expanding. Brand owners are demanding not only short runs and fast turnarounds, but a host of value-adding features ranging from variable data and track-and-trace information to security features, varnishing, hot foiling and embossing. Nilpeter worked closely with B&R to develop its PANORAMA label printing and converting solution – based on the Nilpeter DP-3 print engine – which it launched at the 2015 Labelexpo Europe.



Nilpeter's PANORAMA is controlled by a tablet.



The PANORAMA features a simple and highly intuitive user interface, presented on a 42" color touch screen. (Source: Nilpeter)



Modern consumer marketing is driven by a variety of factors, all of which impact the production and timely delivery of labels and packaging. Today's brand strategies focus on brand extension and differentiation – designed to increase market share and physically occupy more shelf space.

This has resulted in a dramatic increase of SKUs and a consequential reduction in label run length per item. When printed conventionally (by offset lithography or flexography) the fall in run length can have a serious impact on a label converter's margins – and ultimately their profitability.

When short-run jobs were the exception, converters would often run them at a loss, subsidizing them from the profits of the long runs. With short runs becoming the norm, the drop in profitability can prove fatal.

The benefits of printing digitally

Digital printing enables cost-effective production of short runs by eliminating the time-consuming and costly processes that make conventional printing unprofitable. Prepress is reduced to the generation of digital files, generally in PDF format. There is no need for films, plates or chemistry; nor is any time needed to set up the press or run waste until proper color and register are achieved.

Only what is needed is printed. Reprints can be produced by simply calling up the file and ensuring the right substrate is in place. This enables just-in-time delivery and significantly reduces – or eliminates – costly warehousing. It also eliminates the large portion of printed products – typically around 50% of everything printed – destined to sit around until they are obsolete. These excess quantities were traditionally made attractive by the "unit cost" model, in which costs appeared to be driven down by printing more than was required.

Ideal partner for inline synchronization

While these efficiencies are great, the Nilpeter PANORAMA takes it a decisive step further. As an inline solution, there is an uninterrupted flow from raw substrate to finished label – complete with all the special features including numbering, flood coating or spot varnishing (using flexo or screen printing), hot foiling, embossing and other enhancements, as well as final die-cutting and matrix removal.

This combination of digital and mechanical (analog) processes calls for a high degree of control and automation, which is where B&R comes in. Nilpeter has worked with B&R for years on flexo and offset litho systems. Familiar with the capabilities of B&R and its products, Nilpeter knew they would make an ideal partner for its PANORAMA project. B&R's experience and expertise helped take the project from kickoff to launch in only nine months.

"One of the strengths B&R brought to this project was its ability to deliver systems with real-time capability," said Søren Ringbo, Nilpeter's manager of digital products and PANORAMA project manager. "This means that adjustments for register, web tension, positioning, and so on are instantaneous – without compromising productivity and quality."



Søren Ringbo
Manager of digital products and
PANORMA project manager, Nilpeter

"Both Nilpeter and B&R have pragmatic approaches to problem solving. B&R also has experience beyond the printing industry that gives it a broader knowledge base to create innovative solutions."

This is no small feat given the variety of optional equipment that can be used in the modular PANORAMA line, which can be set up as a rotary, semi-rotary or flatbed solution. "Both Nilpeter and B&R have pragmatic approaches to problem solving," explains Ringbo. "And, because B&R has experience beyond the printing industry, it is able to draw ideas, concepts and principles from a broader knowledge base to create innovative solutions."

Recognizing digital differentiation

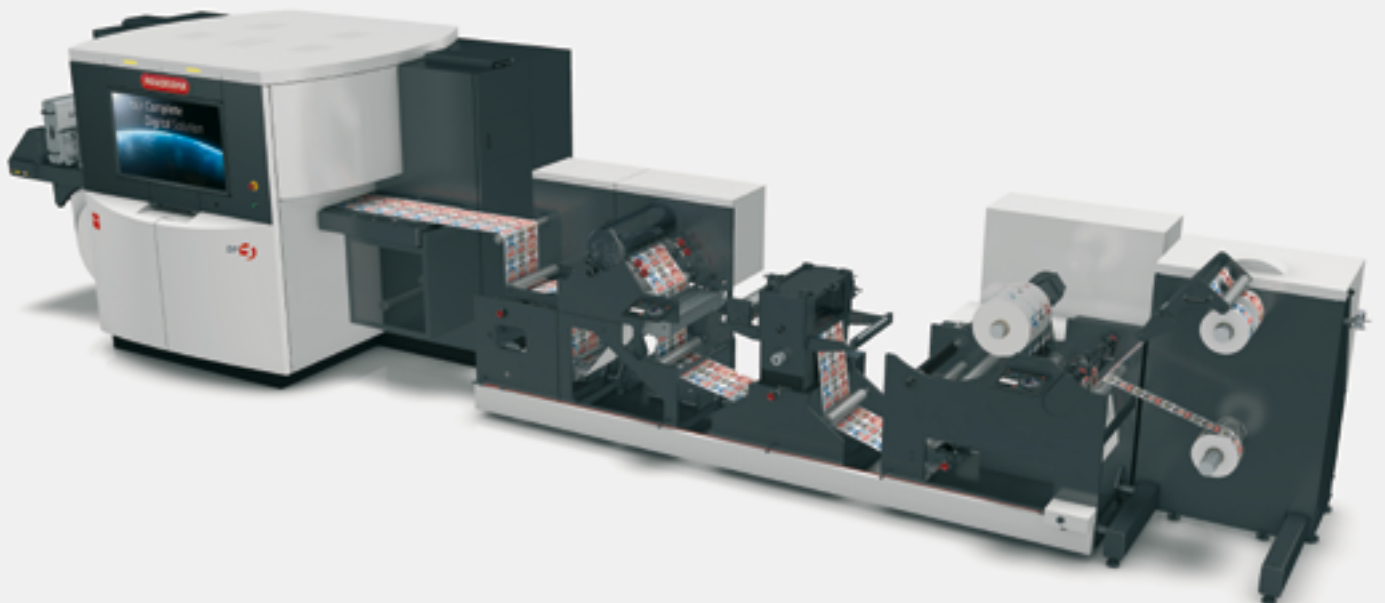
The PANORAMA label printing and converting solution uses single-pass UV ink technology. That means that ink is applied across the web in a single operation, rather than using a scanning process like a desktop printer. While there are fewer moving parts, the application – and curing – of individual colors takes place at different printing stations.

Proper placement of the web, both linearly and laterally, is essential to ensure accurate color registration. This also applies down

the line to the print enhancements and die-cutting. In fact, it grows more important at these later stages as the value of the label increases with each process.

While Nilpeter believes that using UV-curable ink is the best solution for most label applications, it also understands that there is no universal digital printing technology, and converting processes may require a number of different technologies.

The label and package printing markets are extremely complex. "There is no winning technology that covers all applications," says Jakob Landberg, Nilpeter's sales and marketing director. "Nilpeter has always been an advocate of 'combination printing' and has spearheaded technologies that bring together all the different processes for optimum results. With PANORAMA, we can now deliver highly reliable and productive digital printing and finishing applications, using B&R's systems, with results that meet brand-owners' expectations." ←





3D printing

Made to measure

In just a couple of hours, 3D printing systems from voxeljet can create complex molds and models for cast metal components, or even custom movie sets and architectural models. Beyond the high levels of precision and unprecedented design complexity that 3D printers offer, what users really appreciate is the tremendous time savings to be gained with small production runs, prototypes and models. All of this is supported by a versatile, integrated automation and control solution based on high-performance BSR technology, which ensures that even large print jobs can be handled reliably, precisely and true to detail.



"In addition to our primary customers in the automotive and aerospace industries, as well as machine manufacturing, shipbuilding and heavy industry, we are seeing new customers in an expanding range of other industries discover the potential of 3D printing," explains Björn Matthes, responsible for electrical planning at voxeljet. "This is particularly true when it comes to producing prototypes, small production runs and models quickly and without special tools. We have responded to this trend by drastically expanding our range of printing services, while at the same time developing a full spectrum of devices to handle workpieces of virtually any size."

Largest 3D printing system in the world

The printing technique used by voxeljet is quite similar to that used by traditional ink-jet printers. The difference is that the company's specially developed print head uses a liquid binder instead of ink. The binder is applied selectively in the shape of the workpiece to be created on top of a thin coating of particles on the printer's platform. In this way, the VX4000 – which voxeljet claims to be the world's largest 3D printing system – builds shapes of sand layer by layer on a platform measuring up to 4,000 x 2,000 x 1,000 millimeters (LxWxH).

First produced by voxeljet in 2009, the VX4000 prints each layer in just 75 seconds with a resolution of 300 dots per inch and a thickness of 300 micrometers. The spacious platform allows the VX4000 to produce large individual components or several smaller parts simultaneously. By using the CAD data directly, it ensures accuracy down to the smallest detail.

The printer's software places the 3D CAD model in a virtual workspace and then breaks it down into print layers. In order to process



The largest 3D printer in the world has a print chamber measuring 4,000 x 2,000 x 1,000 millimeters (LxWxH). With its high-quality components, it is designed for continuous operation.

the large volumes of data involved, the voxeljet system uses an industry-grade PC featuring an SSD system disk and an additional hard disk with at least 1 terabyte of storage to hold the data.

A seamless product portfolio without rival

"On all the 3D printers we built prior to the VX4000, the PC was also responsible for controlling the entire system via a CAN bus connection," says Matthes. In developing the VX4000, voxeljet introduced an additional level of abstraction in order to further simplify the control architecture and relieve some of the burden from the PC. They also needed to develop a gantry system to drive the two portal systems on which the print head and particle recoater are mounted.

"We've learned from experience that if different suppliers are involved in producing the drive system, problems can arise due to miscommunication and unclear responsibilities," explains Matthes. "That's why we were looking for a partner who could handle the entire automation system, from the gears right through to the control system and HMI." Matthes notes that voxeljet quickly con-

cluded its selection process with a clear favorite. "B&R's seamless portfolio, which includes integrated safety and a universal development and configuration tool, really convinced us that we had found the right partner. The B&R system gives us everything we need as well as plenty of room for future innovations."

The decision was sealed in a meeting with application engineers from B&R, where voxeljet was able to see firsthand just how easy it is to build a gantry system using B&R technology.

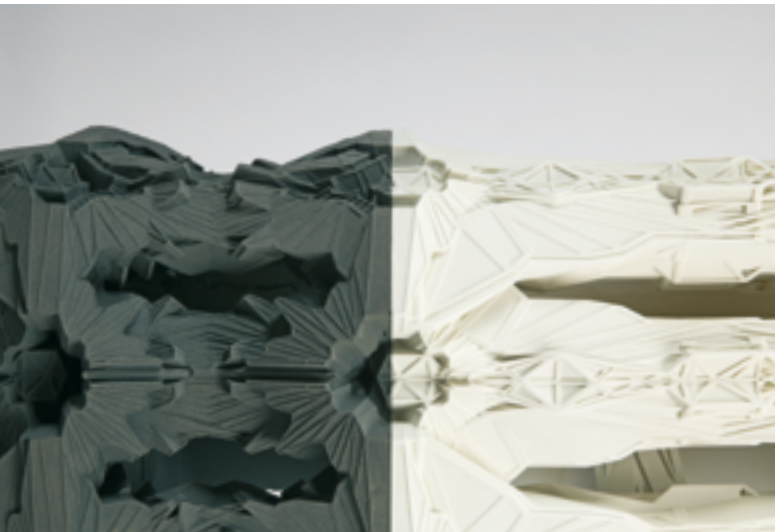
Flexible architecture

In the automation solution for the VX4000, which uses B&R technology for everything except the PC, a PLC from B&R's X20 series functions as the motion controller. Movement commands generated by the PC are transmitted via standard Ethernet to the CPU module, which converts them into corresponding motor movements. In addition to the 4 servo motors controlling the Z axis of the two portals of the gantry system, the VX4000 uses up to another eight servo motors which are partially synchronized (2 x X1 and 2 x X2).

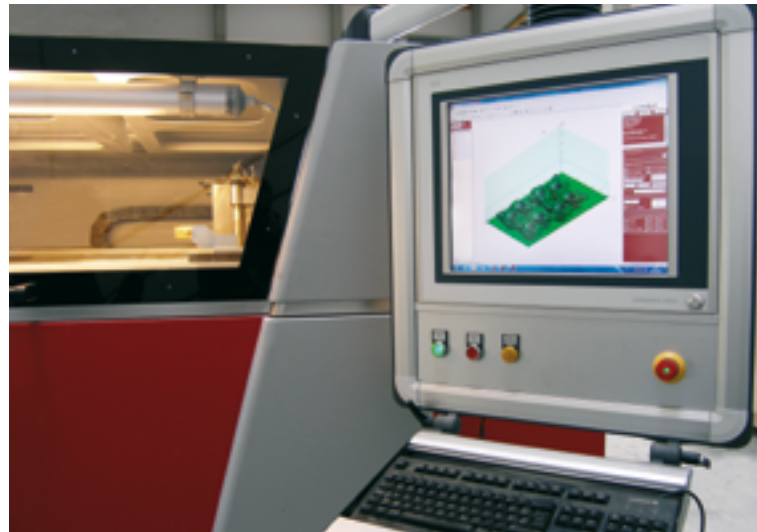


Björn Matthes
Electrical Planner, voxeljet AG

"From the very first training session, it was clear that B&R really thinks ideas through from start to finish to ensure that they are implemented right. The level of support at B&R is outstanding and has helped us many times to answer questions quickly and develop our engineering skills."



Artwork produced using 3D printers from voxeljet. These printers can create items of virtually unlimited complexity (including undercuts) from all types of raw material, including molding sand and plastic.



The operator terminal of the new VX2000 from voxeljet is based on a Power Panel with touch screen from B&R. The HMI application runs on the same PC that prepares the print data for the 3D printer.

voxeljet uses exclusively servo motors in order to keep the architecture flexible, respond quickly to future requirements and optimize inventory. All motors are powered by ACOPOSmulti drives, which communicate with the controller via POWERLINK. These drives are used for more than just motion control. They are also used to coordinate the sequence of lower-level functions that regulate tasks directly related to printing, such as moving the print head (Y) and filling the recoater.

"The prototype VX4000 that was built using this architecture is still working efficiently and reliably at our service center," says Matthes. "Of course, the architecture has continued to evolve since then."

Effortless setup with openSAFETY

The automation solution now incorporates the Safe Torque Off (STO) and Safely Limited Speed (SLS) safety functions. Both functions were implemented by voxeljet developers using ACOPOSmulti inverter modules with integrated SafeMOTION safety technology and Safe I/O modules from the X20 system. "Even with the large dimensions of the printer, which measures 20 meters long and 7 meters wide, service and setup are much easier because personnel can safely move around inside the printer and monitor the processes without having to hold down an enable switch," says Matthes. "The hardware and time needed to integrate the safety functions was minimal thanks to the openSAFETY communication protocol."

The system was designed with the I/O modules split into two strands. While the safety I/O channels are connected directly to the CPU, the non-safety-related I/O channels are isolated via POWERLINK. Originally this separation didn't exist. "By separating the channels we've made it easier to expand the system. Another bonus is being able to disconnect the power supply for the stand-

ard slices without affecting the safety-related areas," continues Matthes. Automation Studio offers a number of clear benefits for voxeljet. It provides a single tool that unifies the entire range of B&R automation components, including control software, HMI and safety functions. The comprehensive diagnostic functions make analyzing software and troubleshooting errors much easier. Of particular value is the clear structuring of the engineering environment and the ability to synchronize hardware configurations thanks to the integrated EPLAN interface. All new automation projects from voxeljet are created using Automation Studio 4.

Virtual master axes simplify reuse

In addition to the integrated safety functions, voxeljet has since also incorporated the concept of virtual axes into the system's architecture. Now all master axes are implemented as virtual axes. For voxeljet this means that, when developing the control software, it doesn't matter which drive will later be connected to a particular axis or how the axes should work together. "This allows us to simulate the drive hardware and test the automation solution even before the system is completed," explains Matthes. "What's more, using virtual axes makes it much easier to reuse the automation architecture for other systems."

Matthes speaks from experience – voxeljet has already reapplied the B&R-based automation solution to its VX2000 with only minimal modification.

"We received excellent support from B&R when introducing this and other technologies," says Matthes. "From the very first training session, it was clear that B&R really thinks ideas through from start to finish to ensure that they are implemented right. The level of support at B&R is outstanding and has helped us many times to answer questions quickly and develop our engineering skills." ←

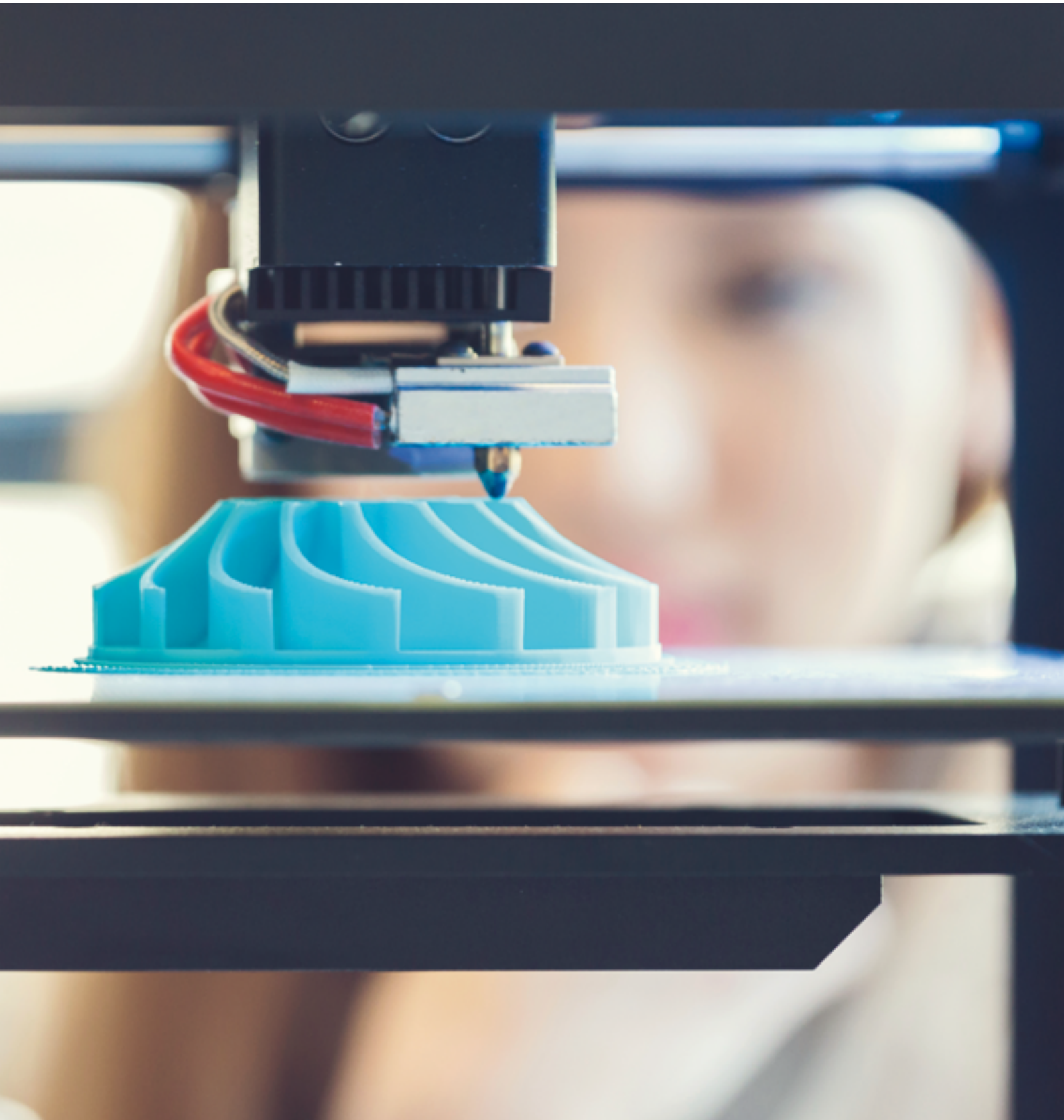
Will the disruption live up to the hype?

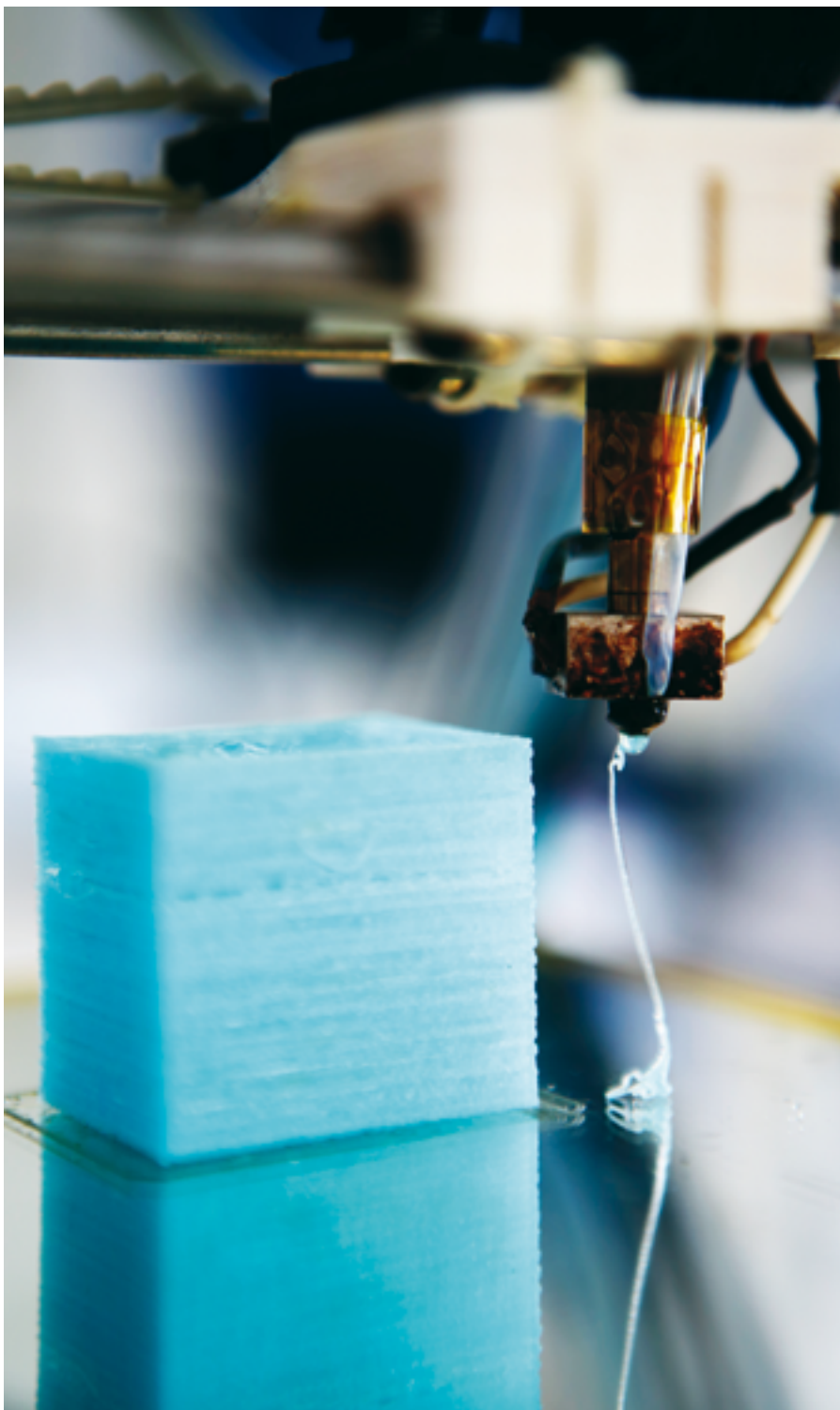


Rainer Gebhardt, Head of the Additive Manufacturing Workgroup, VDMA

Until recently, 3D printing was primarily at home in the maker community, where tech-savvy DIY enthusiasts were among the first to build simple devices able to produce three-dimensional objects by laying down successive layers of material. The potential for this technology to reshape manufacturing on a larger scale has sent shock waves of hype throughout the industry.

automation sat down to discuss this topic with Rainer Gebhardt, who heads the additive manufacturing workgroup at Germany's VDMA engineering association.





Mr. Gebhardt, how did you come to be involved with the topic of additive manufacturing?

Until three years ago, I was with the printing press manufacturer MAN Roland, where I got to know the printing industry from the perspective of OEMs and users and gathered experience and know-how about the technologies used and the market in general. From there I moved to the trade association for print and paper technology at the VDMA, which gave me the chance to get involved in additive manufacturing. And now I've led the additive manufacturing workgroup since it was created in May of 2014.

3D printing and additive manufacturing are hot topics these days. Can you explain these terms briefly for the non-experts among us?

The term additive manufacturing, or AM for short, is basically the opposite of the subtractive methods we're used to, where material is removed through machining processes like turning, milling, grinding and EDM. Instead, material is built up – or printed – layer-by-layer to create a three-dimensional object. This is where the term 3D printing comes from.

What does your additive manufacturing workgroup do?

We observe additive manufacturing along the entire process chain – that is, from the perspective of the equipment builder, the user and the powder supplier. It's important to us that our focus spans all the different methods, including lamination and hybrid techniques for metals and plastics. As a workgroup, we also offer a network for the exchange of know-how throughout the machine manufacturing industry. We also have committees dedicated to current topics such as production quality or process automation.

There is a lot of excitement surrounding 3D printing. What stage in the hype cycle would you say additive manufacturing is in?

The impressive growth rate of over 25% makes it clear that there's some substance



behind all the talk. There are numerous companies offering industrial 3D printing solutions that are already being used commercially for tasks such as prototyping, tooling and mold-making as well as to fabricate replacement parts. Other applications are exploring new geometries that will offer advantages such as weight reduction and improved stiffness. And there are many other applications that haven't yet reached maturity.

There are so many different additive manufacturing techniques. Can you give us a quick overview of which ones are already available?

The best method to use will vary depending on what materials you're working with and what the parts will be used for. The first technology on the scene was stereolithography. Over the years, this has given rise to other techniques for metals and plastics. For metals, you have selective laser melting and electron beam melting. For plastics, there are techniques like thermal 3D printing. It's also possible to use liquid resin, which is then printed using stereolithography and digital light processing. Other popular methods are lamination, polyjet and hybrid systems.

What areas of use are there for parts produced on 3D printers?

OEMs are already using 3D printing to create prototypes without the costly and time-consuming process of first creating the necessary tools. The same applies to replacement parts, which a 3D printer can produce remotely, on demand in small quantities – eliminating the need to maintain a central inventory for years. Another use is to make targeted repairs to very complex components that would otherwise require extensive hardfacing, milling or grinding. Additive manufacturing allows the production of new structures and designs that would be impossible to create with conventional machining. You can make components that are extremely precise, lightweight, stable and integrated, like those used in machine tooling. And these are only a few of the many possibilities.

Where there's light, there are bound to be shadows. What are the challenges people face when implementing 3D printing?

Not everything that is technically feasible makes good economic sense. In addition to the high material costs and the time needed for printing itself, the components also need to be designed in a way that is conducive to 3D printing. The design process must be creative; 3D printing should not be considered a simple substitute for conventional manufacturing. Only then will the technology live up to its full potential.

Additive manufacturing does already have some commercially successful applications. Can you briefly summarize the advantages it offers?

The advantages come when you're producing parts in small quantities or parts that are too complex for conventional methods – or that would otherwise involve high up-front tooling costs. OEMs can use service providers to have parts produced quickly, close-by their customers and without the complications of a lengthy supply chain.

Are there any areas that are definitely not suited to additive manufacturing?

Additive manufacturing won't likely offer the economies of scale you get with conventional manufacturing any time in the near future – so you won't yet see it being used for mass production.

As automation specialists, it's in our nature to focus on how processes and equipment can be optimized. Where do you see the obstacles, technical or otherwise, preventing 3D printing technology from more widespread use?

Additive manufacturing is not yet on par with the long-established conventional methods of production. There is also still some potential for optimizing the automation of the 3D printing process. Aerospace and other industries place particularly high demands on the quality of produced parts. We also have

to think about how to encourage creative new designs, while at the same time protecting them as intellectual property.

What does the future hold for this technology? Are there other challenges besides the technical ones you've mentioned?

Like with the topic of Industry 4.0, there are both technical and sociopolitical aspects. Consider the design and development process. Engineers need to get more creative if they're going to take concepts that are otherwise hard to imagine and implement them in a CAD system for 3D printing. We can expect some breakthroughs when it comes to commercializing new ideas, because a 3D printer lowers the cost barrier for producing prototypes.

Do you think we'll start seeing conventional manufacturing processes supplanted by additive ones?

I think the idea of straight-up substitution is wishful thinking. In reality, it seems like additive manufacturing will be more of a complementary technology. Still, there will surely be areas where individualization and lightweight construction are in high demand, and where the shift from subtractive to additive manufacturing will happen relatively quickly.

When it comes to the industrialization of additive manufacturing, we're still at the very beginning. Which industries will be the first to demonstrate the benefits of additive manufacturing in mass production?

We're seeing the highest growth rates in the aerospace and automotive industries, but tool manufacturers are also very involved. Another active industry is medical technology, where they're working on custom prosthetics, hearing aids and dental prostheses that really highlight the social value, flexibility and benefits of 3D printing.

Very exciting – thanks for your time! ←

Printing gets personal

With Heidelberg's innovative digital printing machine, even small to mid-sized companies are now able to offer custom printing of three-dimensional objects. Whether it's a box of muesli, a soccer ball or a running shoe – the compact Jetmaster Dimension can print on nearly any object quickly, economically and in high quality. For its precise movement sequences and perfectly synchronized components, the Jetmaster relies on B&R technology.

Customers of the MyMuesli shop in Heidelberg, Germany, carry their personal muesli-mix home in a custom package they get to design and print on-site.



Christmas, weddings, birthdays. They could all be so wonderful – if it weren't for the torturous task of finding the perfect gift. No wonder, then, that big-name sporting goods companies, Internet platforms and online retailers have been so successful offering custom-printed items such as greeting cards and t-shirts. Until now, these personalized novelties have been limited to flat or “two-and-a-half-dimensional” objects that can be printed using conventional presses. For three-dimensional objects, personalization has traditionally been cost-prohibitive – except in quantities of

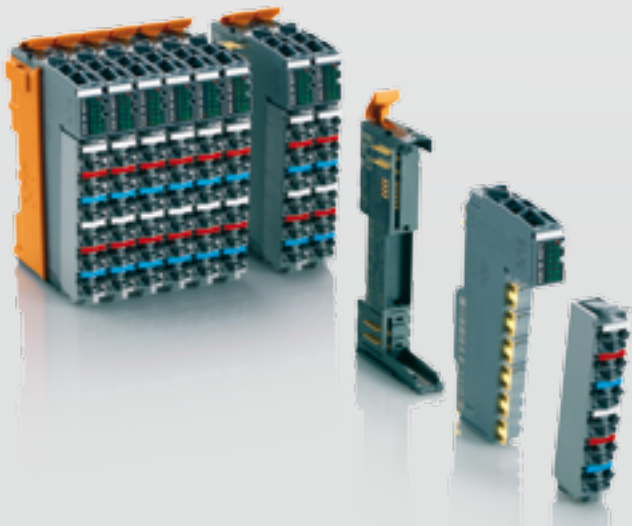
around ten and up (pad printing) or mass-produced items like beverages or cosmetics. Heidelberger Druckmaschinen AG (Heidelberg for short) is now opening up this coveted service for batch sizes as small as one.

Custom-printed 3D objects

“We collaborated closely with B&R and other leading technology partners to create the Jetmaster Dimension,” says Heidelberg’s head of advance development, Dr. Bernard Beier. “For the first



ACOPUS drives draw their software from a central location on the B&R controller without requiring any manual intervention. Increased precision allows for larger quantities, shorter production cycles and better quality.



More than just remote I/O, the X20 system is a complete control solution. Its modular components can be arranged in whatever configuration is needed for the application at hand.



Holger Leonhardt
Team Leader - 4D Technology,
Heidelberg

"B&R's technology is 100% series production friendly and fits perfectly into our production process."

time, this standard machine can print custom text and photorealistic images on virtually any 3D object with minimal adaptation. And, it can do it quickly and in high quality. Now, even smaller enterprises can win new customers by offering personalized products at attractive prices." A number of companies have already taken advantage of the opportunity. MyMuesli recently set up a Jetmaster Dimension 250 at its store in Heidelberg, Germany. On top of creating their own personal muesli-mix, customers can now also choose the images, color and text that go on the package.

Single-pass printing

"If you look closely, you can see that the objects we're printing on – like MyMuesli's paper cups – often deviate from their ideal shapes," reveals Beier. "That's why each object is measured individually prior to printing." After that, an atmospheric plasma coating is applied to prepare the surface. One of the reasons the printer is so fast is that it uses a 6-color single-pass print head. Unlike conventional inkjet printing, this process deposits all the ink for each dot in the image in a single pass. An ultraviolet LED lamp immediately dries (or "pins") each dot to prevent unwanted mixing. Once complete, another ultraviolet lamp cures the finished image so that the product is immediately ready for use.

The Jetmaster Dimension 250 features a four-axis robot that positions and rotates the object for each of the fixed processing stages – measurement, surface preparation, printing and curing. To achieve good quality at a resolution of 300 dots per inch, these positioning movements have a tolerance of less than 20 micrometers. That means the robot axes need to be controlled with absolute precision and perfectly synchronized with the printhead controller.

Leading technology partners on board

"We knew from the start that we wanted to team up with partners who are specialists in their fields," says Beier. "The idea is that this approach gets us access to the most advanced technology and ensures that projects run quickly. And we were right – it only took us ten months to get from the first CAD drawing to a working prototype."

Going into the project, the requirements for the drive and control technology demanded not only extreme path precision, but also an automation system open and flexible enough to incorporate the various subsystems into single, homogeneous unit. "We were looking for automation technology that offered the functions we needed," explains Holger Leonhardt, who headed Heidelberg's 4D technology team. "But at the same time, it also had to be suitable for series production, which many of the controllers on the market are not."

For Leonhardt, a controller is only suitable for series production if it can be commissioned without having to go through the development environment and if it can be configured at runtime. Also, a source control system must be in place for the control software, and it must be possible to update the controller and connected automation components automatically.

100% series production friendly: B&R technology

The first exploratory discussions at drupa 2012 were soon followed by more intensive talks with B&R experts. "We were surprised to see that B&R met 75% of our requirements right from the outset," notes Leonhardt. "That was impressive."

One of B&R's most convincing arguments was its suitability for series production. The Automation Studio engineering environment features built-in source control. As Heidelberg required, software can be loaded onto B&R controllers via USB drives or via an Ethernet connection. Each time the system is started up, the controller checks a definable location for updates and installs them automatically.

ACOPOS drives also draw their software from a central location on the B&R controller without requiring any manual intervention. "Since the control software can be configured at runtime and the wiring lists can be manipulated using the tools provided, we're able to use the same software project for multiple machine configurations," says Leonhardt. "B&R's technology is 100% series production friendly and fits perfectly into our production process."

Technological convergence made easy

With that, B&R was a sure thing for Heidelberg. Its expansive portfolio of fully scalable products played a pivotal role in helping the company keep pace with its ambitious development schedule for the Jetmaster Dimension. The openness and flexibility of B&R's solution made it easy to bring together new and diverse technologies to be handled by a single controller.

Leonhardt was equally impressed by the support his team received before and during the project: "After a less-than-enjoyable experience with a very large controls supplier, we were pleasantly surprised by B&R's service, which far exceeded our expectations," praises Leonhardt. "Their employees are experts in their fields and extremely knowledgeable on the topic of automation. They were able to see the challenges from our perspective and find appropriate solutions." ←



The Jetmaster Dimension from Heidelberg introduces one-off custom printing for 3D objects such as cans, balls and athletic shoes.



B&R's control and automation technology is perfect for series-built machines and grants the Jetmaster Dimension the precision it needs for optimum printing results.



Printing registration

Intelligent integration of register control

BST eltomat International has equipped its proven RHS registration mark sensor with a POWERLINK interface. This makes it substantially easier for OEMs to boost the performance and efficiency of their printing, coating and laminating equipment through integrated register control.





ETHERNET POWERLINK

The POWERLINK interface and seamless integration in Automation Studio make it easy to integrate register control logic into standard B&R controllers.



“The option of integrating register control directly into their own machine control solution really strikes a chord with many machine builders,” says Volker Reinholdt, product manager for print inspection at BST eltromat International. “B&R is a respected partner for automation in the printing industry. With the combination of B&R controllers and POWERLINK communication featured prominently in many successful printing solutions, there is naturally a great deal of interest in the prospect of integrated register control.”

The sensor offers reliable and high-resolution detection of block and arrow registration marks – even with minimal contrast or color differences and on highly reflective materials. It can also handle specialty paints, finishes and transparent substrates without a problem. As a result, it is not only suitable for synchronizing subsequent processing steps in a printing press, but also for use in coating and laminating lines.

Reliable detection

The highly reliable detection offered by eltromat’s intelligent sensor is owed to the sophisticated, specially-developed signal processing technology. Light from a white LED is transmitted via fiber optic cable to the substrate bearing the registration marks, which can move past the sensor at a rate of over 1,000 meters per minute. The reflected light is carried by the fiber optics back to the sensor, which then evaluates the red, green and blue components. There is no need for separate lighting. The RSH sensor is not sensitive to web flutter, and thanks to the ATEX-certified fiber optic cable it can also be used in potentially explosive areas.

POWERLINK for fast control loops

With its onboard intelligence, the RSH sensor calculates the

longitudinal and side register error and sends this information to the controller in hard real-time via the integrated POWERLINK interface. If required, the sensor can link this information with position data from an encoder or drive in order to identify the absolute position of the marks. POWERLINK allows cross-communication with the drives in the network, which makes it possible to create especially fast control loops. With this approach, the machine controller handles register control as well – eliminating the need for a dedicated controller and making the solution extremely compact, reliable and efficient. Processing stations can be readjusted much more quickly, which helps minimize prepress waste.

Configuration and updates over the network

Integration of the register control technology in the Automation Studio engineering environment streamlines and simplifies the development process. Users enjoy full access to all sensor data, and can integrate the register control solution seamlessly into the user interface.

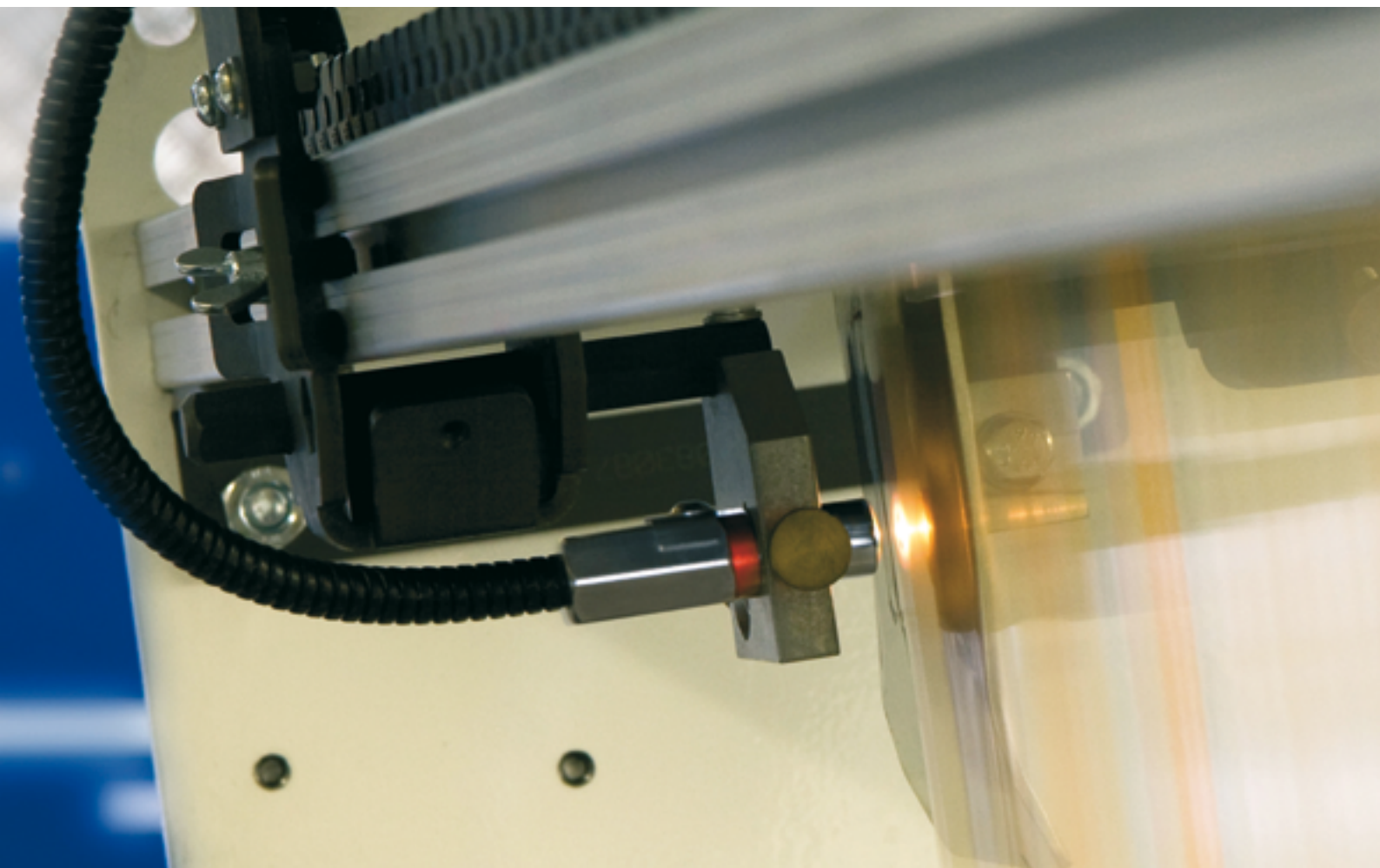
Like all B&R components, the sensor can be configured and new software can be installed via the machine network, the intranet or the Internet – without ever interrupting operation. Since eltromat’s sensor doesn’t require a manual teach-in step, there are no long delays during product changeover.

This powerful sensor makes it easy for OEMs to implement register control and make their machines even more efficient and productive. In response to the high level of interest, BST eltromat International is working on a POWERLINK version of a camera-based sensor that will open up even more design possibilities for register control solutions. ←

Volker Reinholdt

**Product Manager - Print Inspection,
BST eltromat International**


“B&R is a respected partner for automation in the printing industry. With the combination of B&R controllers and POWERLINK communication featured prominently in many successful printing solutions, there is naturally a great deal of interest in the prospect of integrated register control.”



BST eltromat International developed the ATEX-certified RSH registration mark sensor specifically for block and arrow marks.



Photo: shutterstock



Flexographic printing

Flexible flexo

With consumers growing increasingly environmentally conscious, the soft package market has seen rapid growth. This is good news for Qingzhou Ekofa, one of China's largest flexo press manufacturers. Over the past decade, Ekofa has provided hundreds of flexo presses for customers all over the world. Thanks to B&R control technology, Ekofa's new machines have the flexibility it takes to meet the changing demands of an evolving market.



Machines that use water-based ink have unique design requirements, which Ekofa meets with its new upper web-passing design.



With the rapid development of the domestic economy, Chinese producers face heightened demands on product quality, food safety and green packaging. As a result, there is a growing market for flexo presses that use water-based ink. This places new requirements on machine design, which the Ekofa XLS series solves with a new upper web-passing design for faster drying. In designing these new machines, Ekofa created a faster and more efficient flexo press.

When Ekofa began seeking a control solution for its high-end machines, they were immediately drawn to B&R's integrated register control solution, as well as its universal engineering platform, Automation Studio. B&R's extensive experience in the printing industry gave the Ekofa team the confidence they needed to move ahead with developing the new machine based on B&R technology.

Register control as standard software

For Ekofa, one of the most attractive features offered by B&R is that its register

control technology is fully integrated, unlike a traditional solution with separate units for logic, motion and register control. A Power Panel from B&R is able to handle everything from motion and register control to logic and HMI – a clear jump in competitiveness and cost-efficiency compared to the previous system.

B&R's specialized library of register control algorithms is based on more than a decade of experience in the printing industry. Standardized and modular, these functions can be effortlessly reused to reduce the time and cost of development. B&R's tension control module, for example, is widely used in web printing to implement open-loop, closed-loop and various other control modes for rollers. Adapting to any paper or film with different tension requirements is a simple matter of adjusting a few parameters.

B&R's register control functions form the core of the printing process. By combining the modules for color mark detection, registration control and electronic gears and

cams for motion control, B&R has drastically shortened the development cycle for the machine's processes and systems. Ekofa uses this software for more efficient development of its XLS and Kangtai III series.

Double the flexibility

During project development, Ekofa engineers benefit from Automation Studio's extensive libraries without having to switch back and forth between different software tools. They can also customize modules, such as the automatic mark locking function, to encapsulate their expertise and reuse it with maximum efficiency.

The printing industry demands machines with greater flexibility – including online adjustment and fast changeover – to adapt to ever-changing requirements. Ekofa machines feature servo controls for printing pressure and anilox ink transfer. By simply setting a few parameters, operators can easily achieve a high degree of accuracy without the extensive experience required to adjust the pressure manually.



Wang Haifeng, General Manager, Ekofa

"Ekofa aims at long-term market innovation. We hope that our strength in this area can be encapsulated and continued. Automation Studio from B&R is very suitable for our ideas."



Beyond its impressive technical specifications, the ACOPOSmulti is a universal solution for any automation task where efficiency, ROI and high availability are important.

Energy-efficient drive system

A printing machine should provide high quality, but needs to do so at minimal cost. Experienced plant operators know how vital the topic of energy consumption really is when it comes to long-term success. That's why Ekofa selected ACOPOSmulti servo drives with a common DC bus, which are able to regenerate braking energy back into the mains. The power factor of an ACOPOSmulti drive is close to 1 – an impressive advantage over other systems. Its power input range from 230 to 480 VAC ensures reliable operation, which is especially relevant in China's western regions where grid stability is an issue.

gister process quickly. It also improves efficiency by reducing the risk of deviation. Sets of process configuration parameters (roller size, pressure and temperature) can be stored in recipes, which operators can easily call in order to save time and reduce waste. Automatic roll changing helps implement continuous printing as well as ensuring printing quality.

Reduced waste and increased yield

Roll changing, proofing and register control are processes that can easily produce waste. With its full servo mode, the new machine reduces waste through smart software design. The automatic mark locking function avoids the need to confirm mark position manually. It can achieve automatic confirmation with only a few internal parameter calculations in order to enter the re-

Expert cooperation

Developing a printer this complex takes the expertise of a well-versed engineering team. "We were deeply impressed by the ability of B&R's team to quickly find cost-effective solutions to each challenge encountered," says Ekofa's general manager Wang Haifeng. The new machine achieves speeds up to 180 meters per minute and helps keep Ekofa at its leading position in the printing industry. End users are also satisfied with the reduced waste. "Having satisfied customers means we gain the benefit of long-term cooperation," notes Wang. "In the future, we will continue to develop machines to meet our customers' demands. It is our common vision." ←



Automation Studio is the foundation for smart development. The platform integrates all tasks and objects and is essential to the efficient long-term development of customized machines. Automation Studio allows Ekofa to encapsulate and expand their expertise.

Glass decoration with metallic effect

Isimat – printing specialist for glass and plastic containers – has added a new machine to its portfolio. The new series of rotary printers also offers inline foiling for glass and plastic bottles. With the new series, Isimat is also introducing a new drive and control architecture based on B&R technology. The combination of POWERLINK and distributed components such as the ACOPOSmotor has introduced whole new levels of modularity, flexibility and availability.



With its recently introduced R-series, Isimat offers its customers – for the first time – the ability to combine familiar screen printing with flexo printing and its patent-pending inline foiling process. The inline foiling process makes it possible to apply metallic coatings to glass or plastic containers without excessive pressure or heat. This makes it considerably easier to use than conventional hot stamping, and even suitable for thin-walled glass. The inline foiling system can create virtually any metallic tone by overprinting a single type of foil – making the process not only reliable but also extremely cost-effective.

Product changeover in under 90 minutes

The RF-8 is the first of Isimat's new R-series to hit the market. Its eight printing stations allow for a custom constellation of screen printing, flexo and inline foiling modules to meet the needs of any print job. Exchanging the printing modules is easy enough to be handled by semiskilled workers. "You can exchange a printing module on the R-series in a matter of minutes without any tools," explains area sales manager Robert Kovačević. "Even changing over to a whole new product with different design generally takes less than 90 minutes."



The new R-series printers from Isimat combine screen printing, flexography and foiling to beautifully decorate glass surfaces with graphics and metallic effects.



The RF-8 features a fully modular construction based on B&R technology, accommodating up to eight exchangeable printing units on a very small footprint.

These fast setup times are only possible thanks to the machine's complete modularity and automation of the setup process in the control software. The foundation for this was laid by a complete re-vamp of the drive and control architecture based on B&R technology.

Compact performance: ACOPOSmotor

A key element of the new architecture is the ACOPOSmotor. This servo motor with an integrated inverter is designed specifically for applications that demand distributed drive solutions in limited space. On the RF-8, these conditions apply to nearly every machine component, including the printing units and the rotary table – which is why some configurations feature more than 60 ACOPOSmotor modules. The printing modules alone are each equipped with up to three ACOPOSmotor modules, which allow the screen printing module, for example, to print even non-cylindrical items with Isimat's preferred straight screen. The outgoing POWERLINK bus connection on the ACOPOSmotor can be used to connect additional components, such as B&R's IP67-rated I/O modules or a stepper motor to give the printing modules an additional axis for adjustment. "This feature allows us to build and test the RF-8 as an autonomous production unit," says Isimat's chief electrical engineer, Norbert Fuchsloch. "That simplifies diagnostics and drastically accelerates installation and commissioning."

Minimal cabling

The printing modules are connected to the drive system using a single hybrid cable that includes all the power (DC bus) and signal lines, as well as the POWERLINK communication network. While the power modules are located in the control cabinet, the DC bus and

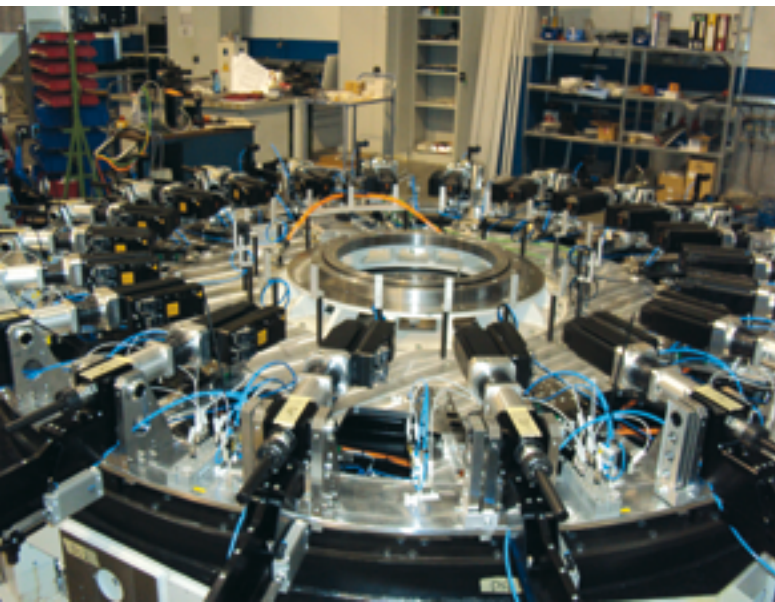
POWERLINK can be distributed via remote IP67 connection boxes outside the cabinet. This approach further simplifies installation and commissioning, facilitates the modular design and accelerates product changeover. It's more than just the flexible cabling that makes POWERLINK so helpful during commissioning, however. "Prior to the B&R solution, we had to set the addresses of networked components using jumpers on each of the connectors – a tedious job that was prone to errors," explains Fuchsloch. "On top of that, we had to implement the evaluation logic in the program ourselves. In a POWERLINK line topology, node number assignment occurs automatically without any help from the control application."

Plug-and-play printing modules

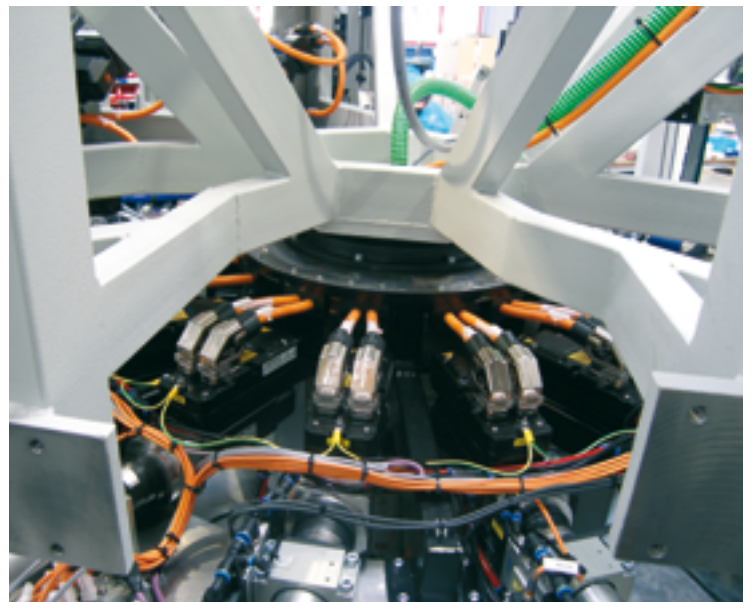
With Isimat's new drive and control solution, it's not just POWERLINK bus nodes that are detected automatically. The control application also identifies newly added printing modules and handles all the necessary configurations automatically. This makes it significantly faster to train new operators. "What made this possible was the openness and flexibility of B&R's software," says Fuchsloch. "In fact, that was one of the main reasons we chose B&R." Of particular value to Isimat is that the B&R software solution allows them to encapsulate the software in components that mirror the modular design of the machine. As Fuchsloch explains: "The Automation Studio development environment allows us to program in a high-level language. Object-orientated programming is ideal for modular machinery and makes the software more readable."

One software project – many machines

No less important for Isimat: the software is also easier to create



The rotary table on the RF-8 20 is equipped with 20 compact ACOPOSmotor modules that rotate the printed item in sync with the printing units.



The outgoing POWERLINK connection on the ACOPOSmotor can be used to connect I/O modules from B&R's X67 system. This allows Isimat to build and test its printers as autonomous production units.

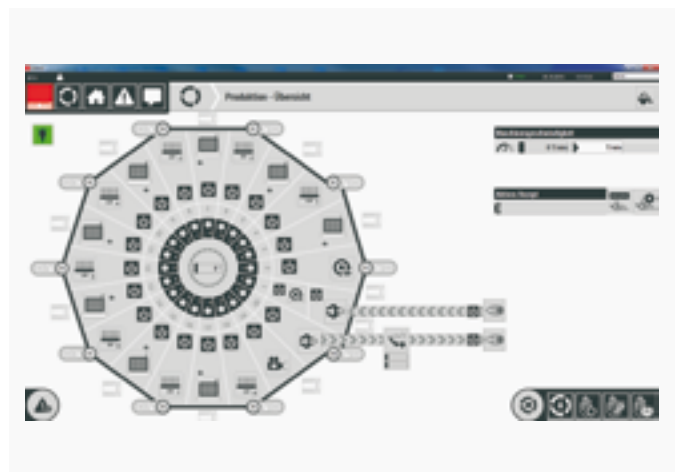
Norbert Fuchsloch
Chief Electrical Engineer, Isimat GmbH

"The countless tool and configuration options offered by the RF-8 need to be represented in the software, which we then have to maintain. That's why it was so crucial for us that the B&R system allows us to manage all of these variants in a single software project."

and maintain. "The countless tool and configuration options offered by the RF-8 need to be represented in the software, which we then have to maintain," explains Fuchsloch. The modular printing stations alone result in thousands of possible combinations. "That's why it was so crucial for us that the B&R system allows us to manage all of these variants in a single software project, so that any maintenance only has to be done in one place." This approach has proven itself so reliable and flexible that Isimat is already working together with B&R experts to expand the control application for the company's T-series printers, which are used for plastic tubes.

A safe investment in the future

Fuchsloch already has his sights on new developments that will bring additional savings. "Our next project will be to revamp our safety solution with B&R's integrated safety technology." The ACOPOSmotor is sure to play a key role here, too, with its integrated STO (Safe Torque Off) and SLS (Safely Limited Speed) functions. "We found that B&R offers a total package that just performs flawlessly and harmoniously across the board," concludes Fuchsloch. ←



The control application automatically recognizes which printing module is installed at each of the eight stations on the RF-8. This makes it significantly faster to train new operators.

Gravure printing

Beyond accuracy





Shaanxi Beiren is one of China's largest manufacturers of gravure presses for flexible packaging, decorative paper, tobacco products and printing. To ensure that its control technology is equally advanced, Shaanxi Beiren has cooperated with B&R since 2003 to develop integrated register control and shaftless drive technology.



The flexible packaging, printing and tobacco industries have a strong need for high-quality gravure printing. As a pioneer in this field, Shaanxi Beiren knows that its customers' expectations are rising – and their requirements are growing more dynamic. Staying at the technological forefront is essential to winning customers' trust, so lean production, efficiency and quality are a constant pursuit.

Direct drive as the foundation for accuracy

At the end of 2003, Shaanxi Beiren began development of the new SY400 machine, with the goal of achieving higher efficiency and quality with a speed of 400 meters per minute. The mechanical transmission, electric drive and control presented a great challenge. When the Shaanxi Beiren technical team began conceptual design for the project, it was immediately clear that a direct drive solution would be the best choice.

Since direct drive motors provide low speed and high torque, it is possible to control rollers without a deceleration mechanism. Having fewer mechanical components not only simplifies machine design but also reduces the risk of downtime. The direct drive solution reduces the footprint of the machine as well as its price tag.

Often, the trouble with direct drive motors is that the low speeds result in what's known as the slot effect. When the rotor passes the slot it produces jitter that can reduce transmission accuracy. B&R's ACOPOS servo drives, however, easily eliminate this

problem with integrated compensation technology that lowers jitter and improves accuracy.

Together with an EnDat encoder, this gives the machine the accuracy it needs for high-quality printing. Testing of the completed machines in 2014 proved the effectiveness of this technology – with good transmission even at speeds of 400 to 450 meters per minute.



The modular drives in B&R's ACOPOS multi family offer maximum flexibility and return on investment.

Dedicated module for dedicated application

High-precision drive technology is a solid basis for printing quality, but it is not enough. The truly decisive factor in printing accuracy is register control. For many years, Shaanxi Beiren has cooperated with B&R on an integrated register control system that has proven highly competitive on the market. Shaanxi Beiren's engineers also wanted to improve the ability to capture



weak color marks in order to meet its customers' most demanding requirements.

This is where B&R's new X67 module comes into play. It was developed specifically for color processing in the printing industry. Its sampling time of 5 microseconds supports printing speeds of 600 meters per minute, and it can achieve 1 microsecond interpolation calculations to collect offset signals more accurately. High-precision register control with microsecond cycle times is achieved by synchronizing the POWERLINK network, drive system and master control system, all on a single platform.

With their excellent sampling, the new X67 module allows detection and analysis of weak colors such as light yellow, white and silver for high-quality printing across the full range of colors.

With its IP67 rating, the module can also be mounted directly on the machine. M8 or M12 connections with a high degree of protection simplify wiring and save cabinet space. A POWERLINK interface ensures efficient synchronization.

Energy-saving design

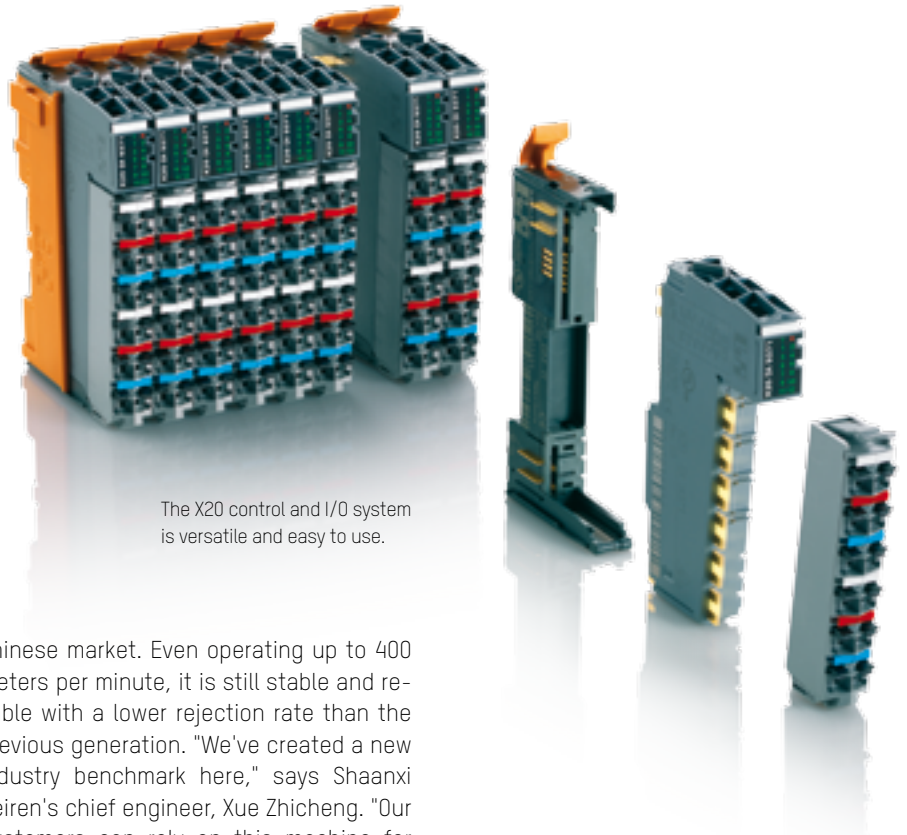
The new press features a variety of energy-saving optimizations. The new drying tunnel is designed for energy savings. The previous solution used hot air drying, which meant that the hot air could be recycled but not effectively utilized. The new machine uses heat exchange, which converts the hot air into hot water for reuse. This system can be intelligently adjusted to accommodate different inks, materials and printing speeds. With B&R's temperature control library, it is easy to achieve precise control with minimal waste.

Easy to use for end users

Complex machines can be quite daunting to use, and the cost of training operators is something that shouldn't be underestimated. Engineers from both Shaanxi Beiren and B&R therefore put a lot of effort into usability.

For operators, recipe management is an important feature. With a flexible interface for recipe management, users they can configure printing process parameters including offset compensation and the phase of each printing plate.

For new orders, this makes it easy to achieve fast proofing and to avoid material waste. At the same time, the machine can also perform auto-zeroing, plate correction and registration error monitoring in real time. A dedicated service report provides informa-



The X20 control and I/O system is versatile and easy to use.

tion for the mechanical service team to indicate necessary service tasks. There is also a vibration monitoring solution that can be directly added in the future to implement predictive maintenance.

Electrical service technicians, on the other hand, are more concerned about features that make it easier to run diagnostics on the I/O and electrical systems. The BSR printing solution comes with built-in web-based diagnostics, which make it very easy to diagnose I/Os, wiring and even the drive system. Additionally a remote maintenance package allows immediate access to distant factories.

Stunning debut

In November 2015, the new printing machine made a stunning debut showing off its new industrial design – a novelty on the

Chinese market. Even operating up to 400 meters per minute, it is still stable and reliable with a lower rejection rate than the previous generation. "We've created a new industry benchmark here," says Shaanxi Beiren's chief engineer, Xue Zhicheng. "Our customers can rely on this machine for high efficiency, high quality and low operating costs."

Yet, even with the success of its new machine, Shaanxi Beiren has no plans to slow its pace of innovation. Together with BSR, they are planning a factory operation management system for a factory-level printing solution based on lean production. "In

line with the principles of Industry 4.0, we want to provide our customers a more personalized, more intelligent production system that helps them meet their market needs," says Li Yanfeng, general manager of Shaanxi Beiren. "BSR's open platform and hardware/software in compliance with international standards will provide us with excellent support in pursuit of these goals." ←