

# automation

The B&R Technology Magazine

Special Edition

## Packaging 4.0

Intelligent transport systems

## The fast track to flexible packaging

**Packaging 4.0** Enabling operational excellence

**IIoT** Collaboration between OMAC and OPC Foundation

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## publishing information

### automation:

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

### Media owner and publisher:

Bernecker + Rainer Industrie-Elektronik Ges.m.b.H.  
B&R Strasse 1, 5142 Eggelsberg, Austria  
Tel.: +43 (0) 7748/6586-0  
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Graphic design, layout & typesetting:

Linie 3, [www.linie3.com](http://www.linie3.com)

Printing: VVA Vorarlberger Verlags-  
anstalt GmbH, Dornbirn

Edition: 100,000

Published at: B&R Strasse 1

5142 Eggelsberg, Austria

Cover photo: B&R

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Dear Reader,

"Enabling operational excellence" – that's the ultimate vision for how Industry 4.0 and the IIoT will transform the consumer packaged goods industry in the very near future. Global end users have set clear five-year targets, including a more than 20% increase in OEE paired with a 20% reduction in TCO.

If achieved, these ambitious smart manufacturing operations will be accompanied by exceptional agility that enables cost-efficient production at any batch size. These ultra-connected packaging lines will need intelligent subsystems – machine vision, digital printing, robotics, mechatronic units – able to collaborate seamlessly at dizzying speed.

A key supporting role in these systems will be played by a new generation of more robust, more user-friendly intelligent transport technology. In addition to unprecedented productivity and flexibility, we'll finally see the industrial-grade reliability and serviceability that have so far been lacking. These highly dynamic, independently controlled movers will boost output and make format changes more fluid than ever.

The fusion of automation, communication and manufacturing technology will pave the way for heightened levels of networking and integration between companies in value networks. The push for a set of common standards like OMAC PackML and OPC UA will bring consistency to packaging lines that enables operational efficiency while putting a wealth of performance metrics at the fingertips of those in a position to act on them.

Maybe you're looking for innovative solutions on the threshold of process technology and motion control or where the worlds of IT and OT 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-line" with your packaging needs. Find out how in this special edition of automation.

We look forward to seeing you at interpack 2017 in Düsseldorf.

Happy reading!

Maurizio Tarozzi  
Global Technology Manager – Packaging



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Intelligent transport systems

# The fast track to flexible packaging

From foods and beverages to cosmetics and beyond, CPG producers are demanding an ever expanding array of packaging options. Soon, not even servo-controlled conveyors will be able to keep up in a cost effective way. Intelligent transport systems with independent shuttles, however, make production processes much more agile, while at the same time improving asset efficiency.







Link to SuperTrak video on YouTube.



"Producers of consumer goods need to accommodate different kinds of packaging, different stacking arrangements, even different product content," explains Maurizio Tarozzi, B&R's global technology manager for the packaging industry. This presents machine builders with the challenge of providing quick changeovers and extreme flexibility.

"To a certain degree, many of today's machines are still able to provide this flexibility," says Tarozzi. Yet, each new option adds to the machine's complexity, eats away at its efficiency and eventually impacts the total cost of ownership.

#### **Step 1: Servo drive technology**

"This isn't the first time we've seen a major transition toward more flexible packaging machines," says Tarozzi. "Years ago, we witnessed the shift from mechanical cams to modern servo technology." As demand for flexibility and optimized OEE continues to rise, Tarozzi says it's time for machines to take the next step in their evolution.

Conventional packaging lines can be designed in one of two ways. They can be intermittent, with the product transported station to station – filling, gluing, wrapping – stopping at each step along the way. The disadvantage of this approach is that the cycle time is determined by the slowest station. The other possibility is continuous motion, where the stations move together with the conveyor. A filling carousel is a good example of this.



The magnetic shuttles can easily be added to or removed from the track.



Each shuttle can change speed, stop or even move backwards – independently of the others.

## Step 2: Intelligent transport systems

"With conventional servo technology, you have to pick one design or the other," explains Tarozzi, "but you can't mix them. That's where intelligent transport systems with long-stator linear motor technology come into play." These systems comprise a motor stator in the form of an oval track and any number of shuttles. In the most advanced design, the shuttles are held in place on the track by magnetic force alone and are propelled electromagnetically.

"The big advantage here is that you can move each shuttle independently of the others," says Tarozzi. The shuttles can move at different speeds, stop and even move backwards.

The speed and acceleration adapt to the respective production step. "This decoupling of product, process and mechanics opens up entirely new possibilities in flexibility and productivity." Shuttle movement can even be used as an additional axis in CNC or robotics applications.

### Reduced cycle times

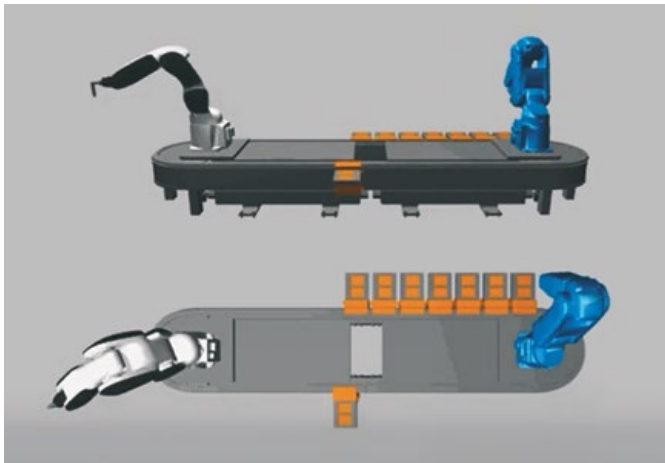
When you factor in their dynamic acceleration, intelligent transport systems are able to cut packaging cycle times dramatically, sometimes even in half. "When you isolate the process from the mechanical design," Tarozzi explains, "the motion profile is defined by each individual product rather than the physical constraints of the machine."

Despite significantly increasing production speed, intelligent transport systems don't require any changes to the packaging process itself. All they do is optimize the way items are transported between





The shuttle can be used as an additional axis in CNC or robotic applications.



The SuperTrak simulation tool even takes synchronized robots into account.

the steps in the process. "Essentially, intelligent transport systems allow you to synchronize asynchronous processes," summarizes Tarozzi.

#### Rapid changeover

"High production speed is great, but for the kind of flexible production and OEE improvements we're talking about, you need to combine it with rapid changeovers," notes Tarozzi. There are two ways that intelligent transport systems contribute to fast changeovers. On the one hand, they allow much of the changeover work to be mapped in software form. On the other, the magnetic movers are extremely easy to add and remove from the track.

#### High reliability

Intelligent transport systems can also greatly simplify a machine's architecture. Eliminating motor-driven chains, belts and gears, they replace mechanics with simple, effective software profiles. The cost of maintenance shrinks dramatically.

#### Transparent costs

"Some companies are hesitant to try new technologies, because the implementation costs can be hard to predict," explains Tarozzi. With B&R's intelligent transport system, however, that's not a problem. "The simulation tool we offer even takes synchronized robots into account."

This makes it possible to simulate what the track will need to look like in order to implement the existing packaging process with an intelligent transport system. Machine operators can define exactly how long the track has to be and how many shuttles are needed. The simulation tool can even be used to perform virtual commissioning. "This makes it very easy to improve asset efficiency with intelligent transport systems," says Tarozzi. ←



**Maurizio Tarozzi**

**Global Technology Manager –  
Packaging, B&R**

"It's time for machines to take the next step in their evolution."

Packaging machinery

# Performance is in the bag





In the highly competitive global market for packaging machinery, Masipack differentiates its products using three of B&R's latest innovations: mapp Technology, the Panel PC 2100 for integrated visualization and control, and the ACOPOS P3 family of servo drives.



Brazil-based Masipack supplies innovative, turnkey packaging equipment solutions with over 160,000 machines installed worldwide. Masipack machines run a broad range of consumer products, while machines from sister company Fabrima focus on the unique requirements of pharmaceutical packaging. Masipack systems range from primary to end-of-line, from economical systems optimized for small and mid-sized businesses to fully automated systems for the largest production facilities. Nevertheless, the company knew that to be competitive, they would need to innovate. Explains Mauricio Moreno, President of Masipack Group: "The market is constantly seeking better quality machines that increase productivity, have high availability and are easy and low in cost to maintain."

#### **A break from tradition**

Traditionally, Masipack had developed a bespoke control system in-house for multi-head scales. They saw the need – particularly for export sales – to adopt a commercial system in order to fulfill international certifications, meet customer specifications and assure the global availability of technical support. In their first application with a commercial control platform, the existing supplier was unable to provide vibration and strain gauge modules or sufficient processing speed to run the multi-head scales. B&R was able to meet these requirements – and a whole lot more.

#### **Change for the better**

The move to B&R began with PP400 and then PP500 Power Panels, using MATLAB Simulink simulation and subsequent programming in Automation Studio. Now Masipack has standardized on the Panel PC 2100 as its integrated control and operator panel running Automation Runtime embedded and featuring a customized black Masipack-branded HMI bezel. "The HMI design is a differentiator," continues Mauricio Moreno, "It is very elegant and a perfect fit with the machine design. Besides that, it is so versatile to integrate the VFFS with multi-head scales. And the large 12" HMI mounted vertically





The Ultra VS 300 design contributes to a cleaner work environment and continues to facilitate machine operation.



Masipack machines are completely enclosed in accordance with current international safety standards.



**Mauricio Moreno**  
President, Masipack

"The compact I/O, cabinet space savings and operator-friendly HMI complement B&R's great advantage in software development, with code that is easy to reuse in other types of machines."

allows you to display much more information." Once the multi-head scales were completely converted, Masipack developed the first VFFS (vertical form fill sealing) machine in its new product range with B&R in just one week, using mapp Technology and ACOPDS P3 motion. Whereas conventional control platforms require two separate controllers, the Panel PC 2100 integrates VFFS with scales in a single controller, saving both cabinet space and communications overhead.

#### **Precise, distributed multi-axis motion**

B&R's unique machine-mounted X67 stepper modules control two stepper motors per weigh hopper (head) – also saving cabinet space and wiring. The top of the head vibrates the feeder and pre-charge. When the bottom of the head is empty, the top motor then opens the hopper and the bottom of the head correctly senses the

product weight. A motor at the bottom opens the head to discharge material into the former. Machines are available with up to 28 heads, with a typical configuration featuring between 14 and 24. Accurate fill weights require a software filter, and with B&R control the measurement is more precise than ever before. A common application in North America is filling vitamins into plastic bottles. Filling by weight is a faster method for doing this than using a slat counter.

#### **mapp Technology adapts to new requirements**

Masipack's next step was to apply B&R technology to additional machines across the packaging line. Having used mapp Technology to generate modular, reusable code for the VFFS, the software was easily modified to run different machine types. Now, Fabrima is developing pharmaceutical cartoners and blister pack machines



Equipped with BSR HMI systems, the Ultra VS 300 bagger stands out through its flexibility and high performance.

with BSR that will comply to CFR 21 Part 11 through mapp Audit and mapp Recipe. These machines will benefit from standardizing on the Panel PC 2100, which provides full industrial PC capabilities and can therefore run Windows-based pharmaceutical software applications.

#### Efficient servo motion

The same Panel PC2100 controller used for the scales is combined with ACOPOS P3 servo drives to deliver a faster and more cost effective solution than the previous control supplier. Along with increased performance, the ability to run up to three servos from a single, compact drive contributes once again to cabinet space and wiring reduction. In the past, Masipack used conventional single-axis servo drives. With the multi-axis ACOPOS P3 drives, the machines are more energy efficient because they share a common

bus for regeneration. In cases where a volumetric feeder is used in place of a scale, the feeder is servo driven. One servomotor controls dosing by volume while another runs the horizontal seal bars. Continuous-motion machines use a third servo for film draw.

#### More machines, more servos

Sachet and stick pack machines use eleven servos to individually control the multiple filling heads. Masipack also uses three to five axes per machine on its horizontal flow wrappers. Fabrima changed from a third-party check weigher to develop its own check weigher controlled by BSR, with three servo axes for infeed, measurement and exit conveyors. Mauricio Moreno concludes: "The compact I/O, cabinet space savings and operator-friendly HMI complement BSR's great advantage in software development, with code that is easy to reuse in other types of machines." ←

# Enabling operational excellence

Industry 4.0 and the Industrial Internet of Things (IIoT) promise to reduce total cost of ownership (TCO) by making machinery easier to operate and maintain. Mass customization requires highly modular machines to enable automatic adaptation of production to real-time demand. Widespread adoption of PackML and OPC UA ensures operational consistency between all the machines in a multivendor packaging line – for a substantial boost in overall equipment effectiveness (OEE). Integrated condition monitoring and direct web connectivity down to the sensor level will serve big data analytics and enable auto-diagnostics. Complemented by augmented reality technology, access to comprehensive diagnostics via standard web technology enables total productive maintenance (TPM). The result is improved production with zero defects, zero breakdowns and zero accidents.





## Key findings



OEE

56%

of companies expect to increase efficiency by more than 20% over the next 5 years.



TCO

43%

of companies expect to lower costs by more than 20% over the next 5 years.



TPM

61%

of companies will use big data analytics within 5 years for more efficient maintenance.



### Overall equipment effectiveness

As a key component of the Industry 4.0 business model, collaborative partnership pushes for a single set of common standards. This not only provides consistency within packaging lines, but also enables operational efficiency and facilitates the computation of key performance indicators. Modular software technologies reduce the development time for new machines and allow easy management of machine options and variants. This minimizes changeover times and enables mass customization. As a key performance indicator, overall equipment effectiveness (OEE) provides reliable information regarding the actual production efficiency of a packaging line. It breaks the performance of a manufacturing unit into three measurable components: availability, performance and quality.

### Interoperability standards

PackML gives all the machines that make up a packaging line a common look and feel and ensures operational consistency. It helps to calculate and improve OEE on the machine and line level by more easily identifying the root causes of production inefficiency. The modularity and consistency of PackML, together with the OPC UA interoperability standard, will enable self-optimization and self-configuration of production lines and facilities.

### Easy options management

OEMs now have a much easier way of managing the many variants of their machines. New modular software technologies conveniently allow changes to the configuration and software at runtime,

which accelerates changeover and boosts productivity. Dedicated software components (such as mapp OEE) permit automatic collection of production data and provide OEE functionality without any programming.

### Integrated safety

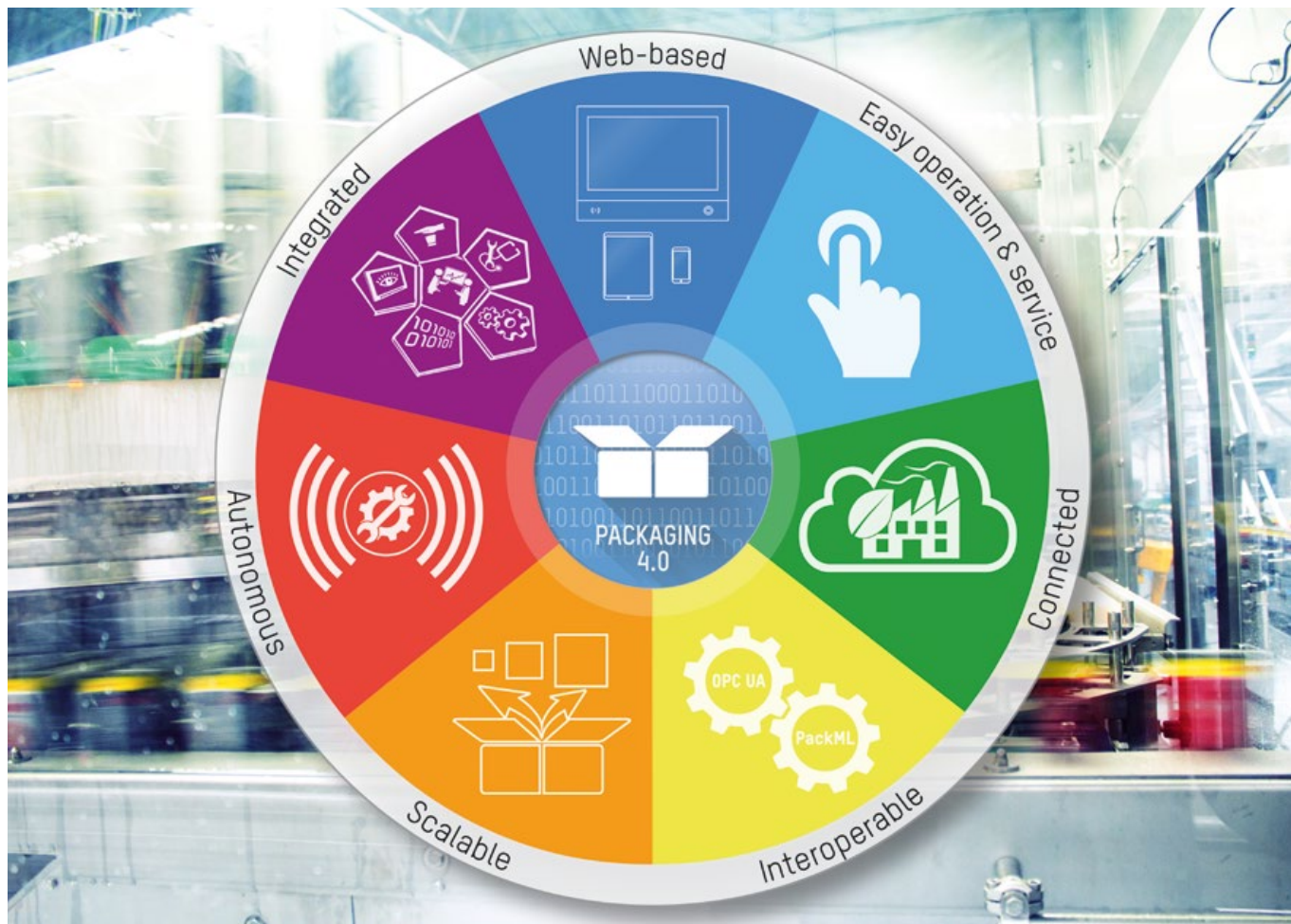
Integrated safety is a top priority for Industry 4.0. Safety strategies will be designed for open, collaborative subsystems belonging to different manufacturers and operators. Use of open and integrated safety technology will significantly increase line availability and reduce stoppages.

### Total cost of ownership

The total cost of ownership (TCO) for a piece of equipment or other asset involves much more than simply its initial cost. The TCO accounts for all the costs over the asset's entire lifecycle – from installation and deployment to operation and energy consumption to maintenance and upgrades. Although implementation of Industry 4.0 does require short-term investment, in return it generates long-term savings through increased efficiency and optimized energy consumption. To achieve the goal of mass customization at mass-production costs, machine design has to be highly modular and flexible to enable automatic adaptation of production to real-time demand.

### Flexibility in production

A new generation of service-friendly intelligent transport technology



The digital transformation of the packaging industry is fueled by converging Industry 4.0 and IIoT technologies.

combines optimized productivity and flexibility with industrial-grade reliability to ensure maximum uptime and minimum maintenance. With independent control of multiple movers, such highly dynamic material transport systems increase the production rate of packaging lines and make format changes faster and easier than ever. Assembly lines also benefit from this new transport technology. Low-latency, hard real-time synchronization with all types of servo axes – including CNC and robotic systems – guarantees high-precision, high-quality production output.

#### Mass customization

Industry 4.0 promises high levels of product customization at costs similar to mass production, allowing manufacturers to focus on differentiation with more personalized products. Mass customization needs fast production changeovers performed by non-specialist operators, so a highly modular machine design is essential.

#### Energy efficiency

With energy prices endlessly on the rise, machines are being equipped with embedded energy monitoring features to help optimize consumption. Energy metering modules incorporated into the control system provide access to real-time energy consumption data for a production facility. Centralized acquisition of oper-

ating and process data allows for online performance monitoring and optimization.

#### Total productive maintenance

Integrated condition monitoring capabilities and big data analytics enable auto-diagnostics. Direct web connectivity down to the sensor level allows machines to autonomously ask operators to perform maintenance tasks. Production, maintenance and engineering teams of machine builders and end users have easy access to key indicators and full diagnostics via standard web technologies.

#### Zero tolerance

TPM has since become a globally accepted approach to industrial equipment maintenance. Many industries rely on this model to achieve maximum equipment effectiveness and, ultimately, improved production with zero defects, zero breakdowns and zero accidents.

#### Big data analytics

Industry 4.0 makes it possible to aggregate data from all sources (operational data, production scheduling, condition monitoring, historical data). Predictive asset analytics turn this massive volume of data into proactive measures and help identify the right maintenance strategy to get the most out of every asset. ←

# AUTOMATION THAT MAKES PACKAGING MORE PRODUCTIVE

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The secret is simple.


Automation so sophisticated, it's easier to use.

B&R's modular application (mapp) technology enables packaging machines that are faster and easier to produce, commission, connect, operate, maintain and change over.

PERFECTION IN AUTOMATION  
[www.br-automation.com](http://www.br-automation.com)







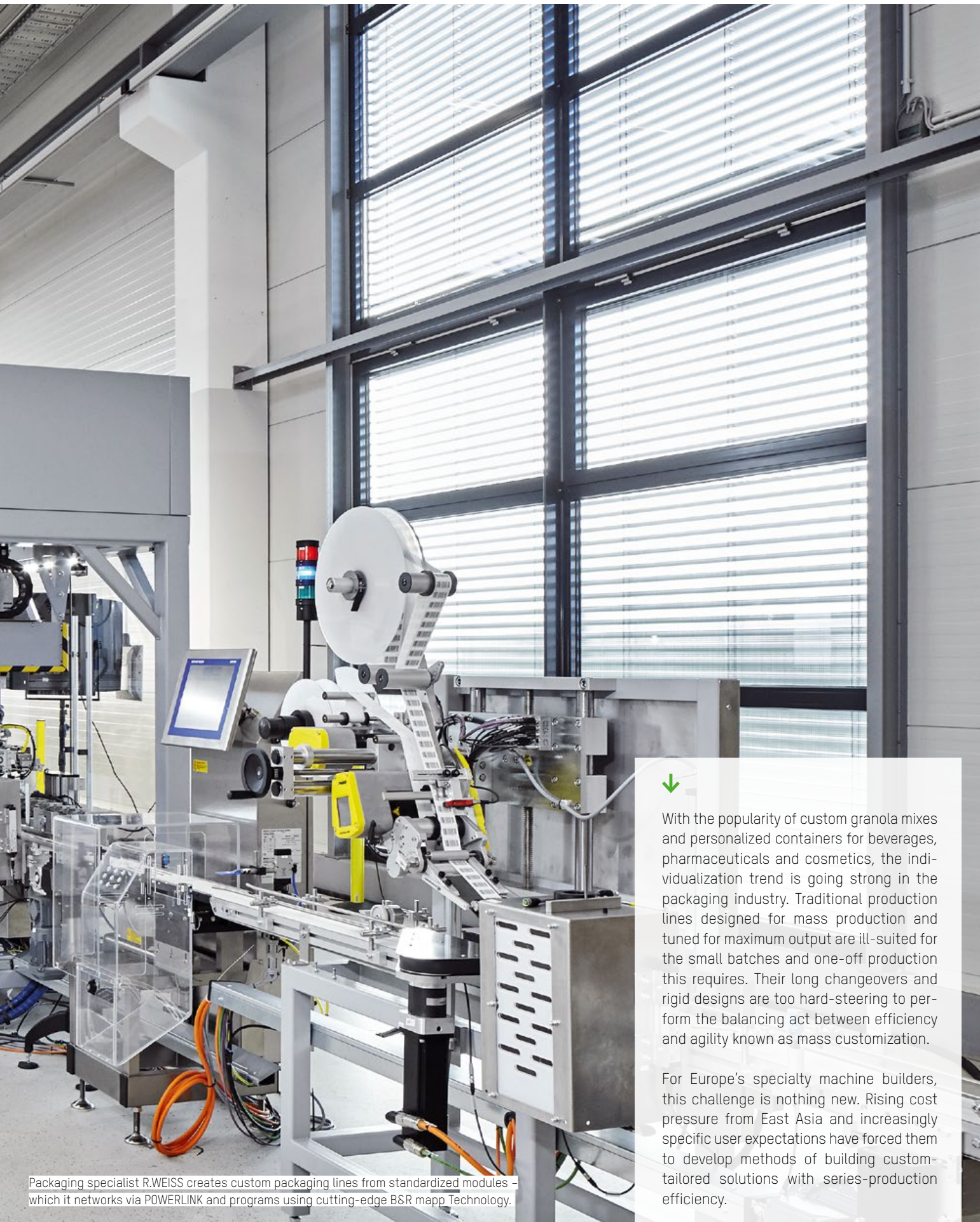
Modular packaging lines

# The mass customization balancing act

To build manufacturing equipment that can be readily adapted to specific user requirements and evolving consumer preferences, the most important component is modularity. A commitment to modularity and cutting-edge automation solutions from B&R allowed machine builder R.WEISS to develop an especially flexible packaging solution.

Source: R.WEISS



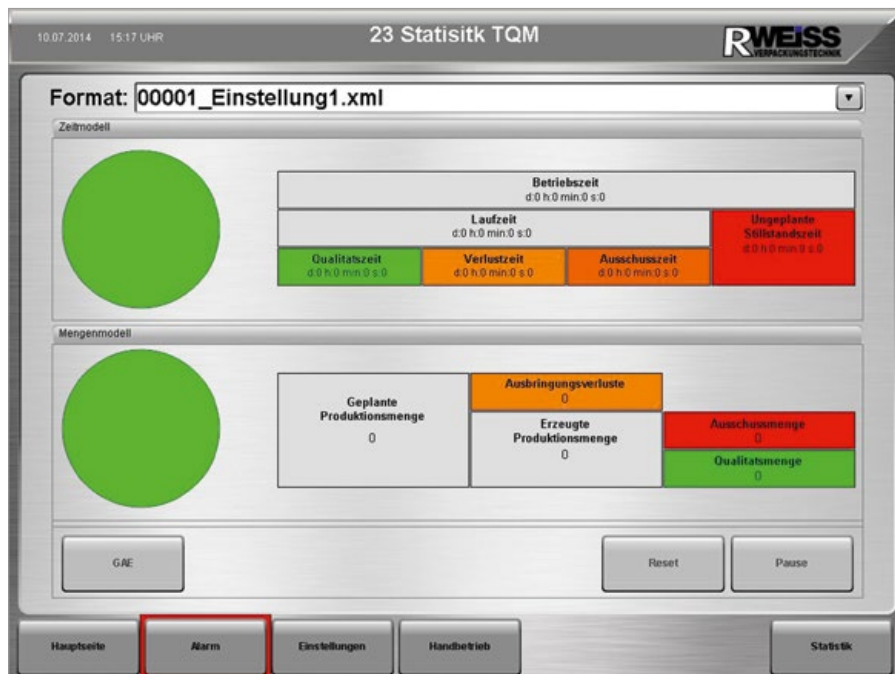


Packaging specialist R.WEISS creates custom packaging lines from standardized modules – which it networks via POWERLINK and programs using cutting-edge B&R mapp Technology.



With the popularity of custom granola mixes and personalized containers for beverages, pharmaceuticals and cosmetics, the individualization trend is going strong in the packaging industry. Traditional production lines designed for mass production and tuned for maximum output are ill-suited for the small batches and one-off production this requires. Their long changeovers and rigid designs are too hard-steering to perform the balancing act between efficiency and agility known as mass customization.

For Europe's specialty machine builders, this challenge is nothing new. Rising cost pressure from East Asia and increasingly specific user expectations have forced them to develop methods of building custom-tailored solutions with series-production efficiency.



B&R's integrated automation platform generates information about equipment status and the production process, which R.WEISS provides in the form of statistical reports.

The key ingredients have proven to be modularization and digitization. To achieve the necessary levels of efficiency in development and production, machine modules must be highly standardized and feature consistent electrical and mechanical interfaces. Adapting each module's functionality to a specific task must be handled primarily via software alone. This allows the specialty machine builder to focus development resources on adding value with new functions and modules.

#### Modular from the start: the UNIROB system

R.WEISS has perfectly demonstrated just how beneficial a commitment to modularity can be. In developing its UNIROB system, the company knew from the beginning that standardized machine components would be the key to offering custom packaging solutions that would be easy to adapt to the unique technical requirements and spatial

constraints of customers in a wide variety of industries, as well as the constantly evolving demands of global markets.

Since R.WEISS released the first UNIROB machine for individually packaged goods in 2001, the portfolio has grown steadily to offer configurable standardized modules for every step of the packaging process – from erection and top loading to case packing, sealing, labeling and palletizing.

Each of the modules uses the same machine housing. Large transparent protective doors provide an unobstructed view and easy access to the packaging process. Supply units and control hardware are tucked away in the roof of the housing. Each module can be operated as a stand-alone machine – yet the enormous benefits of the modular design really come into play when they are configured and assembled into a complete packaging line.

The heart of R.WEISS top loading and picker lines is a module with standard robots with 4, 6, or 7 degrees of freedom and high-performance delta pickers. Peripheral components and the material transport system for product and packaging are positioned below them.

Users enjoy added flexibility in production process design thanks to an innovative intelligent transport system. Individually-controlled shuttles allow freely programmable movement of product and packaging and enable R.WEISS machines to change over even quicker between formats, products or seasonal requirements.

#### Limitless possibilities, efficiently integrated

A great advantage for the user can be huge challenge for machine builders like R.WEISS, whose portfolio of configurable components and modules results in a dizzying array of possible combinations to be managed.

#### Siegfried Schust

Sales Manager, R.WEISS Verpackungstechnik GmbH & CoKG

"We were impressed by B&R's comprehensive portfolio and the performance of their components. The level of support they provided our development teams and their willingness to build us custom modules are also substantial arguments in their favor."





Delta robots and an intelligent shuttle system ensure maximum flexibility in packaging line operation.



Control of the delta robots is handled by the B&R controller. Users can easily adapt the robots' movements via the HMI when changing formats or products.

As components form modules and modules form lines, the complexity could easily get out of hand without a fully-integrated, scalable automation solution providing optimal support for the modular design. For years, the machine builder has trusted this task to B&R.

B&R first appeared on the radar for R.WEISS thanks to the compact design and superior performance of its automation solutions. The availability of combination devices like B&R's Panel PCs, which serve double duty as both controller and HMI panel, was another important factor. B&R's modular solutions – like ACOPOSmotor, which fully integrates inverter and motor into a single unit – allow the control and drive technology to mirror the design of the machine modules. As a result, the modules can be set up individually for testing prior to final commissioning. All of the packaging specialist's components and machine modules are networked via the high-performance POWERLINK communication bus, making it easy to expand, with plenty of bandwidth for expansive lines and large numbers of bus nodes. B&R's comprehensive portfolio and scalable control system – from simple X20 compact CPUs to high-end industrial PCs – give R.WEISS the freedom to choose just the right hardware platform for any situation. ←

# New IIoT building blocks with OPC UA

OMAC, the Organization for Machine Automation & Control, and OPC Foundation have signed a Memorandum of Understanding to proliferate communications standards crucial to the success of the Industrial IoT. While much of the Industrial IoT talk has been about big data up in the cloud, the fact is that good data starts at the machine and production line level. That's where the two organizations had previously been working in parallel.



## Companion specification for TR88 and OPC UA

OMAC is perhaps best known for developing ISA TR88.00.02-2015. Better known as PackML, TR88 is now finding broader application throughout manufacturing. It defines machine modes, states and tag naming conventions.

TR88 does not, however, specify a communications protocol. That's where OPC UA comes in. In Spring of 2016, Sari Germanos, open automation manager for BSR USA, volunteered to organize a task group of OMAC and OPC Foundation members to develop a companion specification for TR88 and OPC UA by the end of the year.

At the Automation Conference in May 2016, Germanos met with OPC Foundation president and executive director Thomas Burke, standards consultant Dennis Brandl and OMAC chair Dr. Bryan Griffen of Nestlé Foods to kick off the cooperative effort.



**Eelco van der Wal**  
Managing Director, PLCopen

"The combination of OPCF, OMAC and PLCopen promises transparent communication 'right out of the box' and

independent from network architecture and protocol, using TR88 tag naming and machine states, providing standardized access between any OPC client and server via a secure channel."



#### OMAC, OPCF and PLCopen join forces

PLCopen worked with OPCF to define a set of IEC 61131-3 compliant function blocks providing OPC UA client functionality and mapping the IEC 61131-3 software model to the OPC UA information model. The latest version was released in 2016.

Since most automation controllers support the IEC languages, it makes sense for the three organizations to get together and avoid redundant developments. OMAC has for many years recognized IEC 61131-3 as the preferred programming language standard in its Packaging Guidelines document.



**Thomas J. Burke**  
Foundation President &  
Executive Director, OPC UA

"The value of our organizations' collaboration will be to provide simple building

blocks for suppliers facilitating seamless interoperability for the end users. In this world of continual technology advancement, by working together, the organizations will allow legacy systems to be easily integrated with systems of the future – which is the key to the Internet of Everything."

#### Flatter architectures needed for network communication

At the same time, it's clear that standards are needed to support communications from the plant floor up to the interface standards that will be established for big data analytics as well as those de facto interfaces that are in place today. OMAC, OPCF and PLCopen are well positioned to serve in this capacity, working alongside organizations like the Industrial Internet Consortium, which recently launched a Smart Factory Task Group. These organizations share a dedication to international standards and a hands-on approach – which the Smart Factory Task Group seeks to define as building blocks for IIoT architecture requirements specific to automated manufacturing.

Today, there is more reason than ever to believe that open communications standards will proliferate, as the IoT drives the need to flatten network communication architectures. These organizations are actively engaged to do just that. ←



**Dr. Bryan Griffen**  
Chairman, OMAC

"A standard communication protocol, used consistently across the industry, is vital for the implementation of automation

standards such as TR88.00.02-2015 (PackML) that will feed data into the IIoT. A companion specification between TR88 and OPC UA will fill this need."



Digitization

# From brownfield to smart factory



Having set its focus on bringing existing plants up to speed for Industry 4.0, the next step for Nestlé is to optimize the cost and effort involved in getting there. At its plant in Osthofen, Germany, the company has implemented a pilot project with a B&R solution that satisfies all the requirements it has outlined for the transition: the Orange Box. This elegantly simple solution helps brownfield sites take a giant leap towards smart-factory effectiveness.

↓ Author: Inge Hübner, VDE Verlag, [www.digital-factory-journal.de](http://www.digital-factory-journal.de)

Nestlé averages one or two new greenfield plants each year, such as the one in Schwerin, Germany, that began operation in 2014 and now produces hundreds of millions of coffee capsules per year. The Schwerin plant relies on the absolute latest technology to ensure that the coffee produced there is up to the highest quality standards. "While today's greenfield developments are indeed equipped with highly advanced technology," notes Nestlé MES / E&A Engineering Manager Ralf Hagen, "what you have to keep in mind is that they don't yet have the level of standardization envisioned by Industry 4.0. There's still a lot of work to be done in that area."

#### Seamless connectivity in smart factories

After all, in addition to the one or two highly productive greenfield plants built each year, there are also the 430 brownfield plants to deal with. "We need to be able to achieve competitive levels of productivity at those sites as well," says Hagen. "And that means optimizing them for the demands of Industry 4.0." Some of the machines at these sites began operation as many as 50 years ago. "Back then, the net-

work infrastructure was completely different from what we think about today in terms of smart factories," Hagen explains. "In a new plant, you have seamless communication that shares data with the ERP system in real time."

Describing the current situation at the existing plants, Hagen explains: "In many cases, we're still pulling data off machines manually. There are all kinds of communication interfaces, and not all of them are designed to handle our current requirements. Sometimes the data we would need to do things like condition monitoring is already there – we're just not using it."

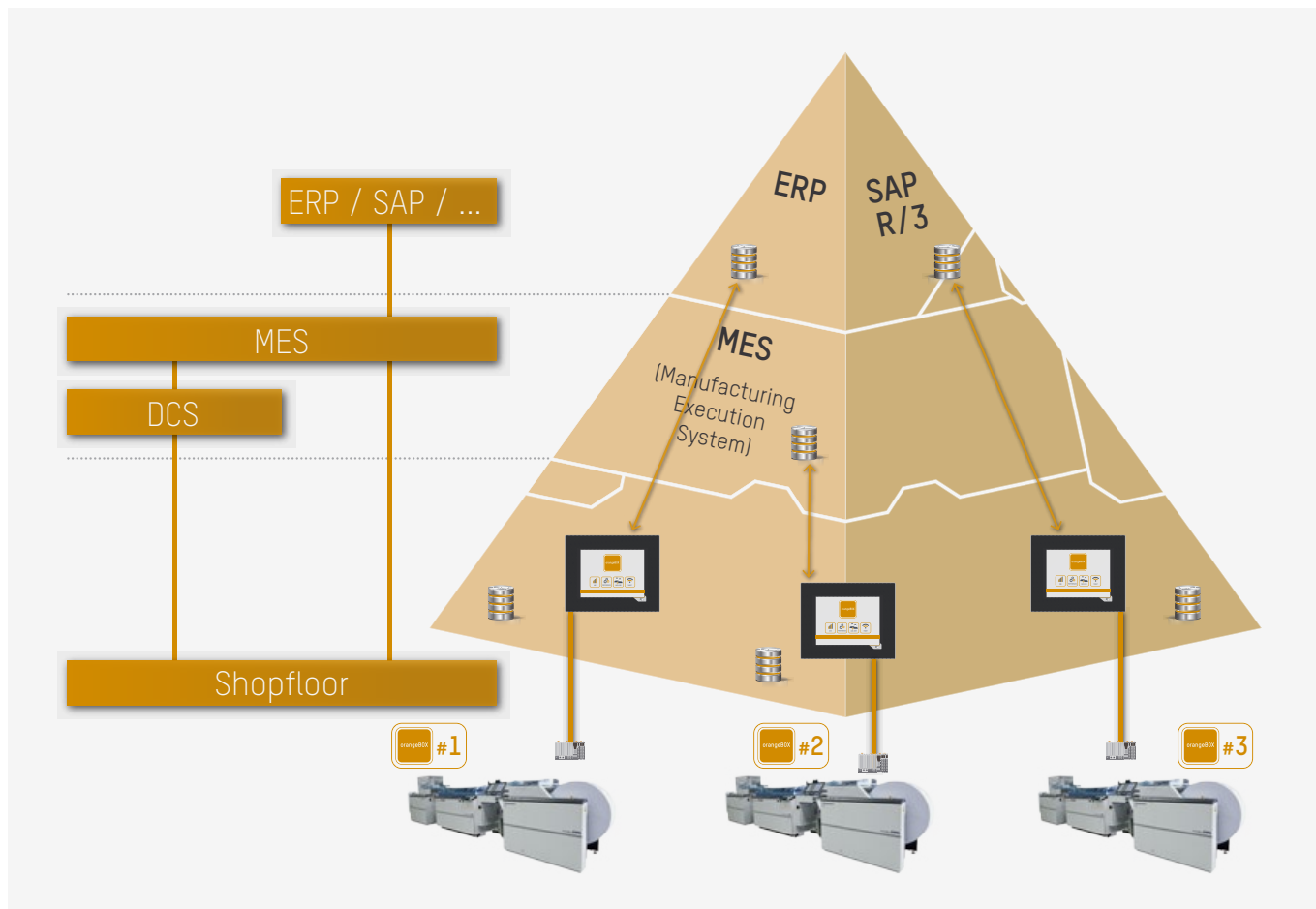
#### The challenge

Nestlé approached a number of automation providers with the challenge, among them B&R. Karl-Heinz Mayer, who heads B&R's technical office in Bad Homburg, Germany, identified multiple opportunities for using intelligent automation to boost the potential for optimizing existing assets. According to Mayer, when it comes to reducing the cost of production, the best metric to use is overall equipment effectiveness (OEE). "Im-

proving your OEE score can cut production costs by 10 to 20%," he says.

Nestlé was convinced. "To get our OEE scores up, we need to significantly reduce the frequency of unplanned outages," says Hagen. "We need to have real-time access to digital production data from all of our lines. That includes not just our newer, fully integrated systems, but our older, less automated lines as well. It's also important that we have either a direct or indirect connection to the ERP system. Furthermore, the solution must be up to Nestlé's safety standards."

The requirements are in part based on a future with fewer and fewer skilled technical personnel. What they were looking for was something similar to Apple's approach: see it – tap it – it works. On top of that, it should serve as an effective intermediate solution to bridge the next three to five years until an optimal cloud solution could be found. Other challenges arise from the fact that the individual plants use different generations of control systems from different manufacturers. They also vary in the level of automation know-how available on site.



mapp-based factory automation by B&R.

### The solution

In light of the requirements, B&R developed a solution comprising hardware based on Scalability+ and software based on mapp Technology: the Orange Box. "The Orange Box represents an optimal combination of our modular hardware and software tailored exactly to our customer's requirements," says Mayer. "Control, HMI and mapp Technology come together to create a perfect platform for Industry 4.0 production." Customers are able to choose one of two options for connecting their machinery and equipment. They can either tap into the signals of I/O modules on third-party controller or receive data directly via ISO on TCP or TCP/IP.

With mapp Technology, the specialists at B&R were closely aligned with the customer's requirements. "mapp Technology provides an array of standard functionality right out of the box," explains Mayer. "OEE calculation, user management, PackML, data acquisition – all these functions are

available as ready-made mapp components that can be installed as easily as a smartphone app." There are some key differences between the mapp concept and the conventional function block approach. "mapp components are interactive – they can be linked together and exchange data automatically," says Mayer. As an example he describes how the mapp Energy component evaluates energy consumption data it obtains from other mapp components.

### What is Scalability+?

B&R solutions are built from a fine-grained selection of homogeneous products that cover every area of automation. And whether you're talking about a standalone machine, an integrated production line or an entire factory, they are implemented using the same universal software tool: Automation Studio. By seamlessly combining integrated automation, software packages and machine technology, B&R opens up a whole new generation of machine automation.

mapp components are seamlessly integrated into the B&R Automation Studio development environment. They are easy to configure and relieve the developer of having to program every single detail. Another important facet of mapp Technology is the mapp View HMI solution. "Automation engineers have all the tools they need to create powerful and intuitive HMI solutions. There



**Ralf Hagen**  
ESA Engineering  
Manager, Nestlé  
Germany

"The Orange Box gave us immediate transparency into our production data. The system is modular and can be adapted at any time. It's everything we were looking for."





The Orange Box offers complete freedom in hardware platform selection.

is no need for them to deal directly with HTML5, CSS or JavaScript technology," says Mayer. Based solely on web standards, B&R's HMI solution ensures optimal viewing on any device.

It is also easy to link controllers from other vendors to the HMI application via OPC UA. "With menu-guided operation and configuration instead of programming, we were able to satisfy one of Nestlé's main requirements: installation by non-specialists," notes Mayer. "We've also given them the ability to manage their software centrally – performing installation, backups and updates either over the network or via USB." Communication can take place over various channels, such as LAN or WLAN. In terms of protocols, the solution relies on standards like OPC UA and ISO on TCP.

#### Pilot plant Osthofen

The first pilot application for the Orange Box is underway at the Nestlé plant in Ost-

hofen, Germany. The plant's 300 employees produce sip-feed oral supplements sold by Nestlé Health Science to help patients with special nutritional needs. "The complete scalability of both its hardware and software make the Orange Box compatible with every machine and line we have here," says Hagen. "And in terms of connectivity, the commitment to open standards provides the solution with flexible connections to process control systems – whether it's B&R's APROL or a third-party solution – as well as an MES like the plant's Wonderware system." In addition, installing the Orange Box doesn't require any modifications to legacy software.

"The system is so straightforward there's no need to call in an expert. The menu guides you intuitively through every operation," emphasizes Hagen. Raw data from the machine can be collected locally in digital form. Security can be implemented either as a standalone solution or via the protocols

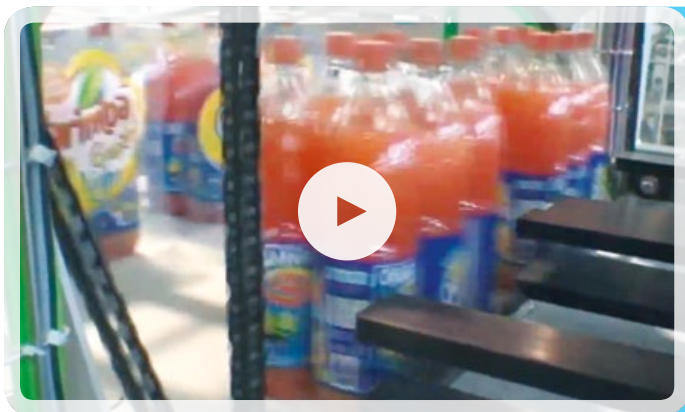
provided by standard IT systems. "With a relatively small investment, the Orange Box gives us immediate transparency and lets us make targeted improvements that are well informed and highly effective. It's also exceptionally modular, so we can easily adapt or expand it at any time. It's everything we were looking for," concludes Hagen. ←



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

# Real solutions in action

In the consumer packaged goods industry, a product's packaging plays a crucial role in its success. As the intermediary between consumer and product, packaging must strike a perfect balance between functionality and design, and it must do so within the constraints of technical and economic feasibility. Below are five examples of how industry leaders have tackled the requirements of the packaging industry in real-world applications.



#### Cermex

The VersaFilm shrink bundler from Cermex reduces the need for corrugated material and achieves 1,000 bottle per minute throughputs with over 98% efficiency using a new B&R automation platform.



#### Dividella

Using one hundred servo axes, the modular, reconfigurable, GMP-designed Dividella cartoner from Koerber Medipak provides rapid changeover, recipe management, data access, detailed diagnostics, and simplified parameterization instead of programming – all from a graphical HMI.



Link:  
B&R on YouTube



#### TopTier

TopTier's new L7 All Electric palletizer features Perfect-Pattern™ technology, guaranteeing precise placement of cases on the row-build

section, as well as confirming case rotation and size. The modular B&R ACOPSMulti drive system allows for easy configuration and the option to control up to 30 drives on a single Ethernet IP connection.



#### Krones

Krones presents its award-winning EvoLite packaging machine. To provide safe, highly repeatable and reliable machine automation, B&R

solutions are fully integrated with the machine automation system.



#### Z-Italia

Z-Italia offers the only labeling machine on the market featuring SafeMOTION, a unique capability provided by

B&R networked safety technology.



Thermoformers

# The perfect seal



VARIOVAC automates its machines with a BSR solution.

In addition to being efficient and cost effective, film packaging must meet strict hygienic requirements when it is used to conserve foods, beverages and pharmaceuticals. Thermoformers from packaging machinery specialist VARIOVAC meet these requirements considerably faster than other comparable machines on the market thanks to a technology package from B&R.



Quite often, it's the little things that determine the success of a product. In the case of film packaging, one of these decisive details is the haptic experience of opening them. "How many times have you struggled to get a grip on the pull tab or had it rip off and leave you stabbing at the package with a knife?" asks VARIOVAC production manager Thomas Charwat.

To prevent these unpleasant consumer experiences, the process parameters must be maintained precisely, even at high speeds. There's a lot of know-how involved at every step along the way, such as creating the lower tray out of base film. "With our patented RAPIDAIRSYSTEM, we're able to achieve premium quality while maintaining maximum productivity and minimal material consumption," says Charwat proudly. The only way to meet these requirements simultaneously is with a high-performance automation solution.

#### **Ergonomic operator panel accentuates machine design**

Founded in 1970 east of Hamburg in Zarrentin, Germany, the machine builder and its 150 employees develop each new product with a focus on appealing design and user-friendliness. The transition to a new B&R automation system in 2010 was no exception, resulting in a customized VARIOVAC operator panel. "That was actually where the whole project started. We wanted to give our products a distinctive design and saw that B&R would allow us to do that,"



Based on a B&R Panel PC 2100, the custom operator panel sets new standards in terms of ergonomics and hygienic design.



Skin packs enhance product value through appealing presentation under a transparent film. B&R's high-precision temperature control guarantees a perfect seal.

says Dirk Schumacher, VARIOVAC's chief electrical engineer. "It was only then that we began to realize that a B&R automation solution would allow us to do a whole lot more."

#### The advantages of integrated control

Replacing its heterogeneous control system with an integrated one brought the developers numerous advantages. Schumacher points in particular to the newly gained ability to execute a variety of functions directly on the servo drive – such as precisely positioning the cover film for registration mark control. "Moving more intelligence to the drives lets us work faster while at the same time improving quality. We're also able to do all of our development with a single tool and have remote access options that allow us to offer our customers exceptional service."

Though designed to specific customer requirements, machines in this relatively conservative market segment have very few options to stand out through unique selling points and must instead rely on performance, quality and high-availability to compete. That's why the company is now using B&R technology in every machine series it builds. This includes not only its flagship thermoformers, but tray sealers and leak testers as well, which can be combined with other equipment such as labelers.

#### B&R software package stands for quality

The range of potential packaging materials – some of them in questionable quality – can really put VARIOVAC's engineers to the test. "In order for our customers to use what in some cases is very inexpensive packaging material, we needed a controller able to regulate the temperature to within  $\pm 1$  Kelvin. We need to do that to guarantee sufficient quality when forming the tray or applying the cover film at high speeds," says Schumacher, describing the main goals in the development of VARIOVAC's high-performance Primus series.

The developers found a full set of temperature control software components in a B&R Technology Package that provides highly effective, highly robust closed-loop control and meets demands for disturbance compensation at the operating point and setpoint tracking performance. The required parameter sets are identified using a completely automated tuning process that is tailored to the requirements. "Our priorities were to create a highly precise and reliable tuning process that is quick and easy to implement," emphasizes Martin Staudecker, technical manager of B&R's automation software business unit.

#### Total package seals the deal

Integrated machine control with safety technology, remote motion control, a custom stainless steel operator panel, the Automation Studio development software and comprehensive support from B&R engineers: it was the total package that convinced the VARIOVAC team. Looking at the development challenges ahead, Charwat expects a continued increase in the number and variety of axes in each machine, as well as in the demands on productivity and quality. With regard to the company's plans to continue expanding its presence globally, he concludes confidently: "With the automation system from B&R, we're well equipped for what the future holds." ←

#### Thomas Charwat

Production & Quality Manager,  
VARIOVAC PS Systempack GmbH

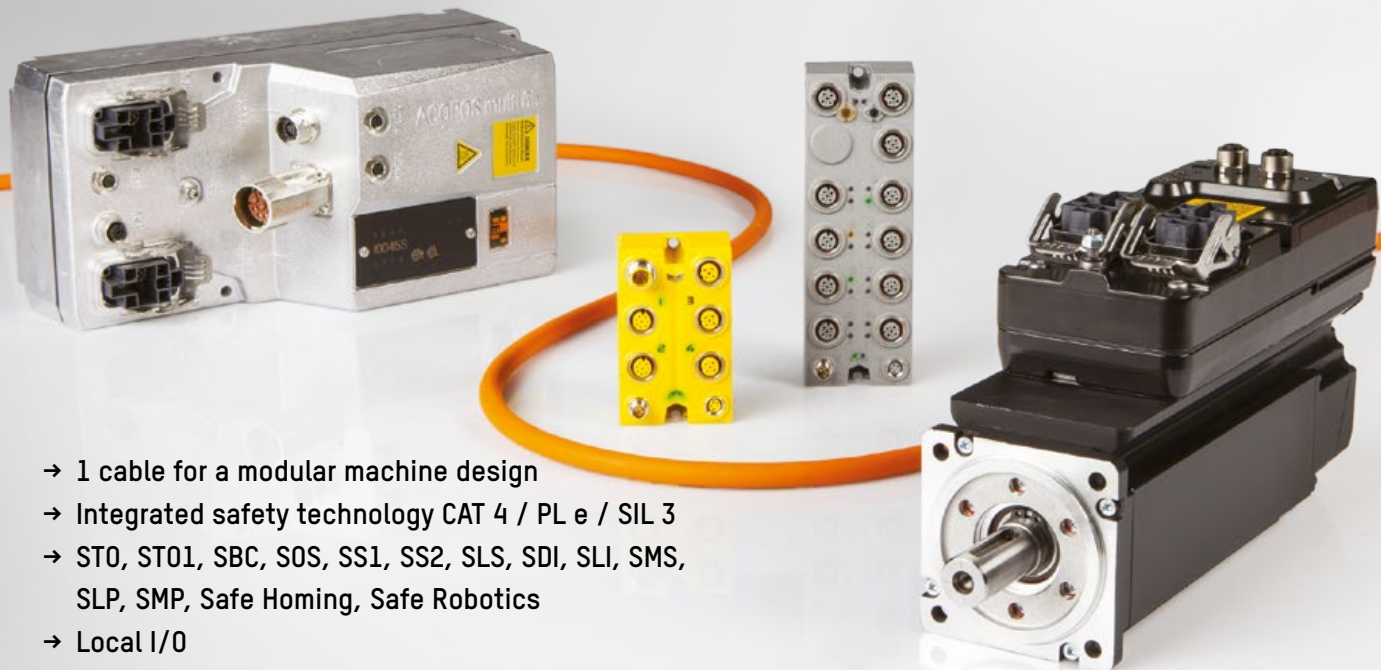
"The ability to rely on a single development tool and the comprehensive, straightforward support from B&R's engineers helped us reduce our development time."





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Filling and sealing

# Continuously successful



Photo: IMA



Gasti and B&R have been implementing flexible cup filling and sealing machines for more than a decade. To meet the requirements of Gasti's international customers, they have successfully navigated the narrow path between innovation, cost effectiveness and continuity – a path of collaboration with no end in sight.









More than half of Gasti's customers order their filling and sealing machines with servo technology in place of the conventional line shaft to handle more complex filling techniques such as layers or swirls. [Source: IMA]



The broad selection of servo motors and servo drives in B&R's portfolio allows Gasti cover the required power range from 3 to 25 amps with a consistent solution that minimizes overhead for design, inventory and parts diversity.

"That first project showed us the high level of technical support B&R was able to offer both locally and in collaboration with the R&D teams at its headquarters in Eggelsberg," praises the Gasti manager. "That was especially important to us, because, when a user does encounter a problem, we need to react quickly."

#### More power for HMI

Based on its positive experiences with B&R's drive technology and support, Gasti was open to the proposal to use B&R HMI solutions in its filling and sealing machines as well.

When it came time for Gasti to modernize its HMI design and integrate production data acquisition, B&R was ready. The previous solution had exhausted the limits of its potential and was replaced with higher-performance B&R technology.

The harsh environmental conditions that prevail at a dairy plant – including high humidity and the use of aggressive cleaning agents – place particularly high demands on the robustness of automation components.

#### Custom HMI for the food and beverage industry

B&R developed an especially robust display for Gasti with an attractive stainless steel IP67K housing able to withstand the conditions in the field, and without any dirt-collecting edges for optimal cleaning. The HMI application and PDA system run on a powerful B&R industrial PC in a climate-controlled cabinet. In the current generation of machines, this is an Automation PC 910, connected to the HMI via SDL. Gasti is now using this solution in all of its installations.

"As a builder of specialty machines, this kind of standardization is crucial, because it allows us to concentrate on the aspects of a solution that are unique to a specific customer, as well as minimizing purchasing, inventory and maintenance costs," adds Wolf. "For this to work, you need the kind of long-term component availability that B&R offers."

#### Well-designed motion control

These are the same reasons Gasti uses the B&R motion control solution consistently throughout all of its lines. A pocket-sized controller from B&R's X20 system handles motion control with minimal space requirements. The 6 to 18 B&R servo axes on each line are controlled by B&R ACOP0Smulti servo drives.

"We don't make changes to our automation architecture unless we know they will result in tangible improvements for us or our customers. The switch in 2015 from ACOP0S to ACOP0Smulti, for example, substantially reduced our space requirements," explains Wolf.

#### Technology with a future

It was at the same time that the company began using mapp Technology. Among its many advantages, what Gasti's engineers particularly value is how the innovative approach to programming facilitates their modular software design – making it easy to integrate new functions or adapt the software for new machines or variants. "Our programmers welcome all the new possibilities that mapp opens up. It's another case where we're out on the front lines, advancing technology that will fuel innovations for our users long into the future," says Wolf. ←

# Infused with innovation



With its new packaging concept, Twinings provides improved carton opening and closing and an innovative single teabag format that will help drive differentiation among tea products.



In its timeless pursuit of the perfect tea-drinking experience, Twinings turned to long-time machine manufacturing partner IMA to build a new production line for its reinvented tea bag and packaging. In only eight months, IMA and automation partner B&R equipped the new machines with the intelligence and flexibility Twinings will need to achieve Industry 4.0 production.



Delivering great flavor to consumers around the world, Twinings has been a driving force in the increasing popularity of healthy teas. Tea bag design has been a key factor in this success, and in the spirit of innovation, Twinings is always looking for new ways to delight tea connoisseurs.

With its new packaging concept, Twinings now delivers an improved consumer experience with better carton opening and closing and an innovative new single tea-bag format that will help drive differentiation among tea products. Consumer research has confirmed that the new packaging design and teabag format have met their mark – with strong scores on both flavor and freshness.

The relaunch also represents a major investment in the Twinings UK production facility, calling on the latest technology to support their relentless drive for excellence in product quality and customer service. As it embarked on the development of a new production line that would reinvent the heat-seal teabag – a cornerstone of UK tea culture for decades – Twinings was delighted that it could rely on its long-established relationship with machine manufacturer IMA.

#### **The right partner for innovation**

Years of collaboration had proven IMA's dedication to quality and service, as well as its impressive ability to challenge the status quo of process engineering, overcome traditional constraints of established technologies and embrace the art of the possible. "Many suppliers are content simply bringing variations of decades-old technology to market," says Ian Kavanagh, head of supply



The operator interface is an Automation Panel that IMA integrates into its own HMI housing system.



The new C59 machine combines advanced handling technology with a sophisticated new tea bag design.



**Sauro Rivola**  
Automation Manager, IMA

"B&R has supplied us with PC and I/O systems for many years, and we've always appreciated their performance and reliability. With the compact dimensions, B&R's fully integrated control system - including the integrated Automation Studio development environment - made a huge difference."

operations UK&I at Twinings, "which is why a partner like IMA is so incredibly important to our organization. They are curious, open to new possibilities and willing to invest the resources necessary to turn theory into applied benefits. Collaboration with research institutions and innovative suppliers enables them to unlock fresh-thinking solutions to design constraints."

Excited about where emerging technologies like those implemented by IMA can take their operations, Twinings believes that cyber-physical systems will play a key role in achieving their full potential.

These intelligent solutions will guide them in focusing resources where they can have the most impact and vastly improve their ability to translate data into valuable information.

As the first new C59 machines enter production, Kavanagh notes that Twinings is very impressed with the support and expertise that IMA has brought to this latest joint development journey - and excited about the possibilities that lay ahead in their more technologically-advanced future.

#### The right technology to meet the challenge

When the schedule for a product launch is set in stone, development targets must be met 100% in order for the project to be a success. The strict and binding timeline required by Twinings for this launch was the primary challenge that drove development of the new C59 machine right from the start.

IMA has accumulated considerable experience applying cutting-edge R&D in the development of new machines, while the cooperation and expertise of reliable suppliers has also played an undeniable role in the company's success. For this challenging project, IMA decided to single-source the automation to B&R. As the first comprehensive collaboration between the two companies, the



#### Automation Studio - Best solution for IMA

Advanced simulation features directly in Automation Studio allowed critical parts of the machine to be accurately sized early in the conceptual design phase. Together with B&R's

modular software functions, this significantly reduced development time.



**Ian Kavanagh**  
**Head of Supply Operations UK & Ireland, Twinings**

"Our partners are curious, open to new possibilities and willing to invest the necessary resources. Collaboration with research institutions and innovative suppliers enables them to unlock fresh-thinking solutions."

strict timeline posed a calculated risk – but, with the right mix of courage and trust, it certainly paid off.

"B&R has supplied us with PC and I/O systems for many years," says Sauro Rivola, automation manager at IMA, "and we've always appreciated their performance and reliability." It was those qualities that led IMA to select B&R for the development of the new Twinings machine. "With the compact dimensions and significant use of electrical axes that had been specified," adds Rivola, "B&R's fully integrated control system – including the motion platform and Automation Studio development environment – made a huge difference."

The binding timeline with the end customer had a substantial impact on development strategy. One way that IMA met this challenge was with B&R's ready-to-use software modules. Furthermore, the excellent support of B&R personnel and advanced simulation features directly in Automation Studio allowed critical parts of the machine to be accurately sized early in the conceptual design phase.

B&R's drive-integrated safety technology and single-cable hybrid motor connectors helped IMA considerably reduce the time required for wiring and obtain CAT3 (EN 13849-1) certification for safety applications as specified by Twinings. Finally, the use of an energy recovery system helped achieve a significant reduction in both energy consumption and heat dispersion in the electrical cabinet.

#### **Right the first time with simulation**

Simulation of the dynamic behavior of the entire IMA system, including drives and loads, allowed each mechanical component to be precisely dimensioned to optimize the relationship between inertia and resistance to breakage. The ability to complete this step directly in the development environment before constructing a prototype was fundamental to completing the project on time.

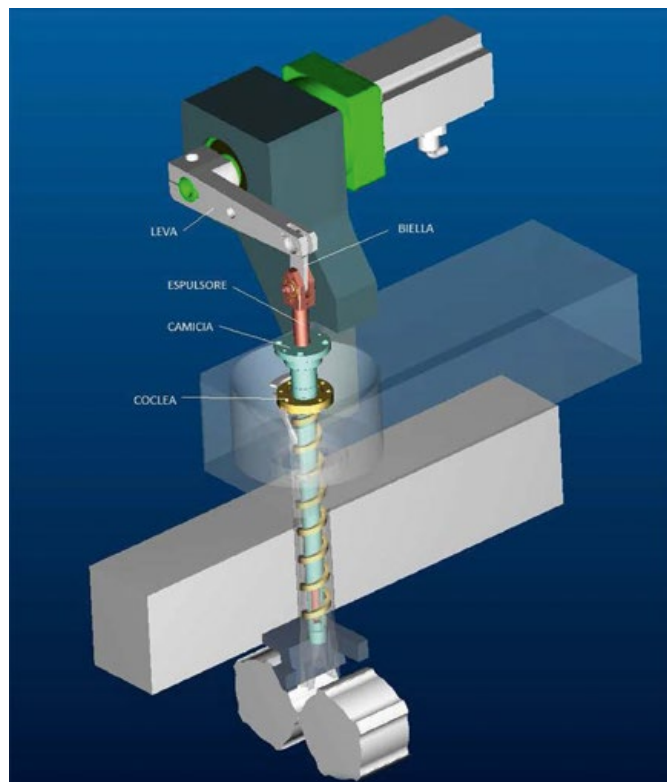
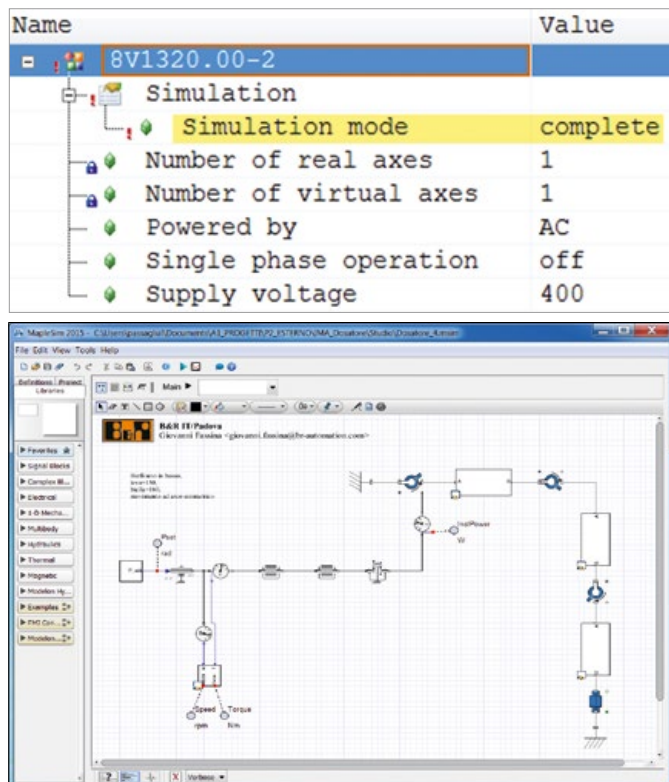


Perfect synchronization and safety-related communication between more than 20 axes on the machine is provided via openSAFETY over POWERLINK.

Simulation also ensured a high level of accuracy in sizing the electric motors. IMA observed excellent correlation between the theoretical torque curves obtained through motor simulation and those achieved by measurements on the machine itself.

With such reliable results, simulation proved to be a beneficial tool for avoiding mistakes in the selection of electrical components.





Advanced simulation features directly in Automation Studio allowed critical parts of the machine to be accurately sized early in the conceptual design phase.

The time of machine development has been reduced significantly, since there was no need to replace either mechanical or electrical components due to errors that were not revealed prior to operation.

This approach also enabled IMA to perform numerous tests on mechanism geometry and motion profiles in advance, helping predict their dynamic behavior with a minimum margin of error. By drastically reducing the number of tests on the actual machine, this allowed commissioning to proceed smoothly without continuous interruption.

#### A slice of orange in your tea

B&R joined IMA early in the project to collaborate on a new approach to tea bag production where it was necessary to respect a record delivery time of only several months. With such demanding requirements, the project would rely on full mutual reliance between IMA and B&R.

The solution presented by B&R features state-of-the-art technology, including their new motor series with EnDat 2.2 encoders connected via a single hybrid cable and controlled using the sophisticated SafeMOTION algorithms and power regeneration functions integrated in B&R's ACOPOSmulti drives. Perfect synchronization and safety-related communication between more than 20 axes on the machine is provided via openSAFETY over POWERLINK. Multiple

small racks host blocks of drives that mirror the modularity of the machine itself, while the common DC bus helps maximize energy savings.

Dozens of X20 I/O modules provide digital and analog signals, while a SafeLOGIC controller supervises safe motion control for all the axes. An Automation PC 910 handles real-time operation, including the machine control logic as well as safety and motion control – achieving a control cycle time for the motors of only 1200 microseconds.

The HMI application runs on a second Automation PC 910 along with IMA's Windows-based SCADA system. The PC is connected via SDL3 to the operator interface: an Automation Panel customized as a “naked” touch panel that IMA integrates into its own HMI housing system, combining it with the specific components needed for each machine type.

The web-based System Diagnostics Manager included in the B&R automation platform makes it possible to check the status of machine operation using a standard web browser. Rather than programming diagnostics routines on the machine, simply activating the native self-diagnostics embedded in each B&R device makes extensive machine and production data readily accessible from any location in the world. ←



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