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Consistent exploitation of packaging trends

**Digitalization:** Machine builders and system integrators have a wide range of products and solutions that they can utilize to stay ahead of the game in the packaging industry and offer customers key benefits in terms of quality, productivity, and flexibility.

Decreasing batch sizes, growing cost and quality pressure, short delivery times... all while creating sophisticated and dynamically evolving products. The drivers of fundamental change can be felt all over the packaging industry. The demands placed on machine manufacturers are as clear as they are contradictory: plants must be able to deliver ever-increasing quality with an ever-decreasing time to market, at the same time as becoming more productive and facilitating increasingly extensive customization of products and packaging, right down to batches comprising a single item. As a result, the degree of complexity and automation is increasing from one generation of machines to the next. One solution to the increasing demand for customized mass production is an especially adaptable production facility: the digital factory. Here, integrated digitalization of the entire engineering chain forms the technical basis for flexible, self-configuring lines, and a complete restructure of value chains. The technical prerequisites for this key innovative step are now in place. All that is left to do is make effective use of the opportunities.

**Digital twin increases efficiency**
The pressure to achieve increasingly rapid engineering according to the principle “the faster, the better” represents not only a challenge but an opportunity. One possible key to success in this area is virtual commissioning: the development of a digital twin as a precursor to the actual machine facilitates easy and cost-effective testing and optimization of the plant. In addition, alternative solution concepts can be tried out during the planning phase without too much effort. In this way, the efficiency check becomes an integral component of the plant design, and the optimized engineering permits simplified mounting and commissioning, as well as subsequent adaptation, of the machine.

The route to the digital factory does, however, have some obstacles in store. It is not just about generally breaking away from familiar processes and business models. Other key conditions for optimized and flexible processes are integrated networking and uniform data management. One thing that is important here is standardization of interfaces and

The development of a digital twin as a precursor to the actual machine facilitates easy and cost-effective testing and optimization of the plant.
communication in line with specifications such as OMAC, Weihenstephan, or OPC UA. After all, only reliable standards can permit rapid, cost-optimized machine integration that is also future-proof.

And finally, the security of data, expertise, and products has to be guaranteed throughout the entire process. OEMs must develop intelligent solutions that reconcile and make effective use of three related trends: the increasing digitalization of plants, the advancing flexibilization of processes, and the associated requirements of industrial security. Against this backdrop, concepts such as “Defense in Depth” from Siemens, which encompass plant safety, network security, and system integrity, facilitate the development of specific safety and security concepts that are precisely tailored to the needs of end customers.

**Knowledge-based production**

Just like digitalization, the increasing customization of products and packaging represents a big opportunity for innovative engineering solutions. The most important factors in leveraging higher performance while achieving greater flexibility lie in breaking down rigid transportation chains, or developing modular machinery concepts and handling systems, for example. Personalized synchronization of transportation processes and motion control tasks on the basis of a tried-and-tested control platform creates new freedoms, and offers maximum dynamism. A good example of this is the Multi-Carrier-System jointly developed by Siemens and Festo, in which the containers to be filled are moved individually on multiformat-capable, individually controllable, self-driving carriers. The necessary information is channeled through the process on the carriers via RFID, therefore facilitating data-based production in which the product itself becomes the controlling element.

**New business models**

Further opportunities of digitalization lie in putting together service bundles that combine benefits and services and offer considerable added value for the customer. Consistent digitalization plays into machine builders’ hands here: ultimately, the data that is continually being generated can also be used to develop innovative services, such as for interactive troubleshooting, or predictive maintenance. It also allows for availability guarantees or pay-per-use models – in short, an entire range of data-driven services, with which OEMs can give their customers a clear gain in productivity.

In order to make the development of data-based services easier for packaging machine designers, Siemens’ MindSphere offers a platform that is designed as an open IoT operating system and facilitates the collection and analysis of large quantities of production data, as well as providing a development environment in which machine builders can seamlessly integrate their own applications and services. Consistent encryption of communication and use of certified data centers to process and store data ensures a high degree of security.

**Always one step ahead**

Anyone who wants to take advantage of the opportunities of digitalization and flexibilization must minimize the associated risks, and break away from the norm. Technology and partners are ready and waiting. Those who manage to do this will be able to offer their customers a real benefit: sustainable productivity.
Our Packaging Team ensures your success

Want to take advantage of the new technological opportunities of the packaging industry in terms of digitalization and flexibilization? Then talk to Siemens. We offer a worldwide network of packaging experts, who – in addition to their outstanding industry expertise – have a deep understanding of the typical solutions and necessary products. Our global Siemens Packaging Team is supported by highly trained application engineers, who can be called upon for technical support at any time. We are more than just a supplier: the digital age calls for a partner that can provide holistic support in the field of digitalization, and will help its customers to exploit the resulting competitive advantages.
Food: With their integrated automation, Hacos’ flexible chocolate-making machines allow ambitious chocolatiers to make functional expansions and include their equipment in a new line at a later date – supporting everyone from individual artisan producers to series manufacturers.

The Belgian company Hacos is one of the world’s leading manufacturers of machinery for chocolate production – on any scale. “We support everyone, from small businesses all the way up,” emphasizes sales and marketing manager Raf Tuytelaars. “Many of our machines can be used as stand-alone units in small-scale operations or special labs, or as part of a partially or fully automated production process.”

When the time comes to expand production, the user simply adds more modules to the existing machines, or integrates them into the new line – but always continues to use them. This reduces the need for further investment and makes the jump from a small artisan business to a machinery-based operation much easier.

Flexible and connective, with automation from a single source
Hacos uses automation technology from Siemens for its machines. The integrated nature of this technology facilitates a high level of connectivity between machinery modules, and makes expansion easy. Even the smallest of Hacos’ machines has a built-in Simatic LCD display. “This means that they can be easily configured to account for changes in circumstances,” explains Kristof Vangenechten, who is responsible for electrotechnical equipment at Hacos. “To achieve this, we expand the function and operation as required in the TIA Portal engineering framework or in Simotion Scout. The result is that our customers can use their machines in many different configurations over a long period of time.”

Many of Hacos’ machines imitate work by hand, which calls for a coordinated movement of several different machine axes. “In this respect, we benefit from the fact that Siemens also has a motion control system in its portfolio. One major plus is that in addition to offering all the functions of a traditional PLC, the motion control system Simotion also handles temperature control, which is extremely important in chocolate production,” says Vangenechten, describing the advantages. “This makes the automation of all Hacos machines – even the most complex ones – streamlined and simple.”

One-shot mechanism: chocolate and filling in one step
One noteworthy example is the Hacos Minos 9, an ultracompact one-shot depositor that can create filled chocolates in a single step. It can fill molds or form chocolate products directly on a carrier plate, and can deposit chocolate onto other products, such as baked goods.
Depending on the number of nozzles in the installed head, this means that several identical chocolate products can be made at once. The necessary vertical movements are actuated by the servo-controlled machine head, with hoppers for chocolate and filling. Horizontal movements are managed by the conveyor belt, which is also servo-controlled. The motion control system coordinates both movements: The machine software evaluates recipes, which are entered or loaded via the graphical interface ChocoCAD, a G-code interpreter that is available as a standard Simotion component works directly with the data generated by ChocoCAD. This saved Hacos considerable engineering work.

In addition to the 2D version, the Minos 9 also has a 3D option for additional lateral belt movements. This enables production of a very wide range of products, from chocolate rings that look like they have been piped by hand to handmade-style truffles. The 3D option means that the machine can even be used for decorating, including chocolate lettering.

Simple operation and cleaning
These features mean that the extremely compact and versatile Minos 9 is appropriate for smaller companies that have a broad and varied range of products. However, as with other Hacos machines, it can also be easily integrated into small and medium-sized production lines. Tight-fitting, easy-to-remove covers made of stainless steel facilitate quick and thorough cleaning in all systems.

**Ultrafine decoration for larger quantities**

Another Hacos machine that incorporates the motion control system Simotion specializes in eye-catching decorative flourishes: the MDeco. Even its basic version includes 3D motion that is defined by a programming interface or interactively through ChocoCAD. MDeco is normally used in automated production lines, where Hacos also provides pick-and-place modules, stacking and de-stacking mechanisms, enrobing and dusting stations, and cooling lines. These are assembled flexibly in line with the customer’s requirements, thanks to integrated automation.

**Automation increases value and useful life**

“Chocolate manufacturers all over the world value the flexibility and intrinsic value of our machines,” says Tuytelaars. To live up to this standard, the company has a large manufacturing range and performs all installation work itself. “The ease of remote maintenance and the long-term availability of spare parts for Siemens technology are very beneficial to us,” adds Vangenechten. “It all fits very well with our goal of standing with our customers as they grow over the long term.”

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**The principle of one-shot depositing:**

The chocolate for the base and covering is drawn into one dosing nozzle; the filling is drawn into another. During application, the two dosing devices work intermittently on the same nozzle so that the mixtures are ejected in a sequence: “chocolate – filling – chocolate.” Coordinated movements of the head and conveyor belt combine to form a filled chocolate, truffle, or other chocolate product in just one step.

![Image of MDeco machine head](image-url)
From the high-speed ST800 to the modular MS400, Viking Masek a.s. claims intelligent, top-of-the-line packaging technology as its own. Headquartered in Vlasim in the Czech Republic, the company designs, manufactures, sells, and services its vertical-form, fill, and seal (VFFS), multi-lane stick pack, and cartoning machines worldwide. These machines put food, beverages, pharmaceuticals, nutritional supplements, hardware, and many other products into suitable vessels. Viking Masek is a market leader in the packaging sector thanks to its global sales, service, and support network – as well as innovative technology from Siemens.

Innovation squared
BTW Siemens is a long-standing partner of the company and supplies the PLC, drive, HMI, and low-voltage components that are used as standard systems in all machines. By using standard automation, Viking Masek can offer unique

Food: When products get bagged, Viking Masek is usually involved. And the expert has once again placed its trust in Siemens for its latest packaging machines.
The weight of each stick pack filled on the machine can be checked using an integrated individual check-weigher with an automatic feedback system: this reports incorrect weights to the Siemens-controlled servo-feed screw so that the weight can be adjusted. A stand-alone Simatic S7-300 controller (ET 200S-PN CPU) with Siwarex CS modules measures the weight, which is then transmitted to the motion control system Simotion in the ST800 by the Profinet I-Device function. The machine is operated using a 12- or 15-inch Simatic Comfort Panel. Viking Masek machines also provide extended functions, such as parameter and recipe backup on a USB memory stick, recipe call-on with handheld QR scanner, and a camera connection for an instant view of the HMI in locations with poor visibility.

**MS400: the modular packaging wizard**
Viking Masek’s latest development in the field of VFFS machines is the MS400. Modular, flexible, and fast, it can meet any conceivable packaging need. In the MS400, state-of-the-art Siemens technology is paired with a robust structure in hygienic stainless steel. The machine’s modular design is unique on the packaging market, making the MS400 sufficiently adaptable to produce any bag style possible on a VFFS, including Quad and Doy bags. A modular, exceptionally smooth Sinamics S120 servodrive for the sealing jaw ensures that the individual packaging steps can be executed extremely quickly and repeatedly. The machine is controlled by a Simotion D motion controller. It meets the requirements of OMAC PackML thanks to use of the Simotion software library. The integrated data interface facilitates connection to higher-level systems and so offers users access to information such as production time and downtime and the number of packaged products.

**Everything from a single source**
Using the Siemens platform enables Viking Masek to use the same control solutions across all machine variants. Development, manufacturing, and assembly are all handled by a single supplier. And this is not just beneficial to the company itself. Jan Masek, CEO of Viking Masek, confirms: “We always get really great technical support, which makes our lives a lot easier. Our customers benefit, too, because they can also use the worldwide support offered by Siemens. With our customer base spread throughout the world, Siemens is, of course, our first choice.”

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The FlowPack M254 from M.C.M. can be used to package ice cream and snacks fully electronically.

Back up and running in no time
Food: M.C.M. is increasing the transparency and flexibility of its packaging machines with the motion control system Simotion and the fail-safe Simatic S7-1200F control system.

“Many customers are skeptical about electronic solutions, because they worry that machine breakdowns will take too long to fix,” says Gianluca Marzaroli, owner of M.C.M. (Macchine Confezionatrici Marzaroli). However, working with Siemens, the Italian manufacturer of packaging machines for flow packs and filling machines for foodstuffs managed to find a reliable solution. This solution involves the motion control system Simotion, Sinamics drives, Simotics motors, and fail-safe Simatic S7-1200 controllers. “Defective components can now simply be replaced without having to recalibrate the parameters or use special software tools,” says Marzaroli, highlighting the benefits.

The highest standards of flexibility and safety
M.C.M. has over 40 years of experience in building packaging machines for flow packs and filling machines for foodstuffs. Because the Italian firm places great emphasis on reliability and efficiency in its machines, it did not switch from mechanical to electronic components until after 2000 – when it was convinced they were sufficiently reliable. Today M.C.M. uses servodrives and brushless servomotors. The machines improved dramatically with the switch to electronic components, and their operators can now run them much more flexibly, quietly, expediently, and intuitively.

M.C.M.’s goals are to sell top-quality products that combine the utmost safety and flexibility and can be adapted to customer requirements – and Siemens helps the company realize their aims. “The most important thing is for the machine to be up and running quickly,” Marzaroli stresses, because he was looking for an efficient, flexible, inexpensive system. “Simotion meets these requirements perfectly. Along with the Simatic S7-1200 controller, it allows us to access and diagnose all parts of the machine.”

Reducing downtime
The fully electronic M254 wrapping machine, for example, packages ice cream and snacks. On these machines it is especially important for faults to be detected early on in order to minimize downtime. The fail-safe CPU 1214FC quickly shows where the problem lies, so that it can be remedied quickly and efficiently. “We’re now able to tell which safety mechanism on the machine has been activated, either automatically or manually,” explains Marzaroli. “This makes the process diagnostics of plant and safety equipment much more precise. Thanks to the Simatic S7-1200 controller, we can find out what is happening in the individual parts of the machine and react accordingly.” However, it is not only machine downtime that is minimized – cabling is also significantly reduced: Thanks to Safety Integrated, the safety functions can be programmed directly in the controller and changes can be made quickly and easily during configuration.

Scalable configuration
Modularity, efficiency, ease of use – these are just some of the advantages of the Simatic S7-1200 controller. The control system is connected to other automation devices by the built-in Profinet interface. In addition, the modular system is flexible and scalable in configuration. With the fail-safe CPU 1214FC and the fail-safe SM 1226 I/O modules, even the lower performance range has integrated safety solutions and standard automation in one device. M.C.M.’s products meet the safety class SIL 3 required for this type of machinery. However, the machine offers benefits over and above its hardware: Simatic S7-1200 is programmed in TIA Portal, with special functions and libraries available to the user.

“We’ll be using this fail-safe controller from Siemens again in the future,” says Marzaroli. “It allows us to create a more efficient emergency-stop circuit for our machines, which we can even adapt for complex configurations and safety requirements.”
The gentle touch for delicate wafers

Food: Two technology experts have accomplished their first joint project: an efficient cut-and-feed system for wafers, equipped with the latest control system and drive technology from Siemens.

FHW Franz Haas Waffelmaschinen GmbH, a wafer machine manufacturer from Leobendorf, near Vienna, Austria, and Patreider SRL, an Italian specialist in cut-and-feed systems, will be working together on innovative solutions for future wafer production. Their first joint project was to integrate Patreider’s patented dual-belt technology into the wafer machine manufacturer’s portfolio, along with a switchover to the latest integrated control system and drive technology from Siemens. The result is the extremely efficient HESZ-PAT300 cut-and-feed system.

Fast and reliable, from the wafer sheet to the packaging
The integrated – and therefore very compact – in-line system cuts one or more wafer sheets in the standard size of 350 x 500 mm into strips. Thanks to an optional rotary table, this can be done either horizontally or vertically, which minimizes waste. The wafer strips resulting from the first cut are inserted laterally into the first of two dual-belt systems. This forms packets, with a user-definable number of strips moved laterally into the second dual-belt system by another cutting frame. Here the wafer strips are assembled into complete packaging units and fed directly into the feed chain for the packaging machine.

The centerpiece of the patented dual-belt technology is two servo-motor-driven conveyor chains with slider bars, which can be moved independently of each other. This allows strips of different sizes to be brought together or split up as desired. The timed production flow at the inlet translates to a very fast and continuous production flow at the outlet. One key benefit is the fact that the wafers can be fed carefully through...
the entire plant. This prevents the slipping, jamming, or sticking of the products, which ensures the greatest possible process reliability. In addition, the dual-belt technology increases the output to up to 300 end products per minute – about double that of a traditional feed. In a comparison of two otherwise identical lines with a pilot customer, the HESZ system immediately provided a 5 to 12% increase in output.

New, seamless automation
A key factor in achieving acceptance among FWH’s customers was the fact that the Patreider system had been switched over to the latest automation technology from Siemens. This is the foundation of all new developments and the preferred standard for the wafer machine manufacturer. The clock generator and master is the packaging machine, which communicates with the HESZ’s Simotion D445-2 motion control system. This coordinates the interplay between up to eleven servo-axes highly dynamically and precisely via two CU320-2 control units and a Sinamics S120 converter. User-definable electronic gear synchronization is achieved by means of several virtual control axes. This means that all procedures can be perfectly tailored to the product at any target speed. Absolute value encoders on the Simotics S servomotors facilitate a seamless restart after any malfunctions in the packaging machine without causing product losses.

Thanks to integrated servodrive technology, format changes can be achieved in less than 10 minutes. The Sinamics V90 servodrive system—a combination of converter and Simotics S-1FL6 servomotor through which the table plates are positioned automatically—also contributes to the faster production. Format changes are initiated on an adjustable TP1500 Simatic Comfort Panel with 15-inch touch display, which saves the recipes. To avoid mix-ups, the machine manufacturer optionally offers coding of its modules by Simatic RFID.

All requirements met
Thomas Patreider summarizes: “With 30 years of experience in servo technology, I can say that the Siemens drive system leaves no wish unfulfilled. The selection options in the sizer tool are especially good. We did a lot of calculations during the system changeover and found that the results were absolutely identical.” Peter Buczolits, technical manager at FHW, adds: “The whole Siemens package of motion controllers, converters, servomotors, and HMI meets all of our requirements. The integrated engineering in the new TIA Portal is more expedient, and also offers various mechanisms for effectively protecting our specific expertise.”

»The whole Siemens package of motion controllers, converters, servomotors, and HMI meets all of our requirements.«

Peter Buczolits, Technical Manager at FHW

The new HESZ-PAT300 cut-and-feed system from FHW forms up to 300 packets of wafers per minute, which it continuously feeds directly into the packaging feed chain.
The designers at SN Maschinenbau GmbH in Wipperfürth, near Cologne broke new ground when they designed the new FMH 80, a horizontal form, fill, and seal machine (HFFS). The usual processes and principles were scrutinized and creative solutions were developed across departments. “The basic idea was to meet rising customer demands in terms of hygiene and freedom from allergens,” explains Jürgen Beininghaus, head of development and redesign at SN. “The key is to create an open machine structure with a reduced number of parts to rule out exposed areas and edges, and thereby facilitate extremely easy cleaning.” But how can safety be ensured in a machine with an open design and free access? “During the redesign we really reconsidered each individual element – including the safety concept and control system,” says Beininghaus.

**Food:** High yield, rapid format changeover, easy cleaning: Packaging machine experts SN Maschinenbau have developed two innovative machines that combine performance, flexibility, and hygiene.
Fast and precise
“We use Simotics S-1FK7 servomotors, Sinamics S120 frequency converters, and the new Simatic S7-1500T control system for the drive concept in the FMH 80,” explains Thomas Berger, head of electronic development at SN. The new T-CPU is 10 times faster than the previous model, so it offers major benefits in terms of highly precise motion control, especially when traversing motion curves that change during ongoing operation. Added to this are so-called virtual masters and functions for synchronized coupling and uncoupling: the S7-1500T is perfectly suited to these complex processes. “The S120 converters offered the requisite positioning accuracy,” adds Berger. “Ultimately, the type must fit precisely on the pouch, and it must be perfectly sealed. At the same time, the converters’ integrated safety functions that interact with the T-CPU were key in achieving the open design of the machine.” The new design principle can be transferred to all of SN’s other FFS machine types, and lays the foundation for a new generation of pouch packaging machines. The new FMH 80 is suitable for manufacturing pouches for foods such as sauces, snacks, precooked meals, and other products.

Virtual commissioning
In addition to the prototypes of the FMH 80, SN also developed a digital twin that illustrates each individual part in dynamic operation and can be used to study the benefits of virtual commissioning. For SN, virtual testing of the new machine enables the time for actual commissioning to be cut by half (“vertical commissioning”) and saves up to one week spent on assembly at the customer’s site. For example, scale drop can be checked and optimized in advance, with customized specifications for fall heights and times. “The routines specified by the PackML standards can also be tested efficiently. In addition, the digital twin is ideal for training the end customer,” says Berger, listing more benefits.

Filling through the spout
The second newly developed machine from SN also impresses with its innovative concept. Each hour, the SF 400 spout filler fills about 15,000 units of portioned packaging with spouts, known as “squeezey pouches.” Filling is done through the welded spout, which is then sealed. It is possible to use either premade pouches that are fed in via a rail system or pouches produced directly from the film roll. For this process, SN offers its FM 400 pouch machine, which forms the pouch, inserts the spout, and then brings it into the SF 400. The combination of the FM 400 and SF 400 forms a complete production line that, among other things, offers a high level of flexibility with different pouch formats. The SF 400 provides an output of 240 pouches per minute as standard. However, even higher outputs of up to 480 pouches per minute are possible at the highest hygiene standards, because the movement of the liquid in the pouch does not affect the filling process when filling through the spout.

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Flexible transport for shipping cases

Food: Packaging machine manufacturer Brenton is part of the Pro Mach group, and relies on the Multi-Carrier-System developed by Siemens and Festo to ensure flexible transport of individual shipping cases from the former to the palletizer.

Brenton Engineering, headquartered in Alexandria (Minnesota), designs, manufactures, and integrates a wide range of end-of-line packaging equipment. It is an industry leader in servo-technology applications and integrated automation solutions for complex packaging needs. The company’s extensive product portfolio includes case packers, shrink wrappers, palletizers, and robotic solutions for most end-of-line packaging and material handling needs, such as for the food industry. Brenton Engineering is part of the Pro Mach group, which provides reliable packaging equipment and integrated solution sets for the F&B and pharmaceutical industries.

Modular and freely configurable
Brenton recently designed and realized a packaging system that operates as if it were a single machine controlled by one operator. The compact system provides manufacturers with a low total cost of ownership, high flexibility, and complete control of every package from forming to palletizing. This is made possible by the Multi-Carrier-System (MCS), which was jointly developed by Festo and Siemens. The MCS is a freely configurable, modular transport system in which linear motor-driven product and workpiece carriages (carriers) move flexibly to the individual stations. Acceleration and speed can be set freely and individually, providing the possibility of transporting each of the packages individually between the forming, top loading, and palletizing sections of the machine.
but several carriers can also be grouped together and moved in sync. The advantage for the customer is that each of the packages can be individually transported between the forming, top loading, and palletizing sections of the machine as required.

The basic mechanical system is modular, which allows easy adaptation to the requirements of your machines and applications, and means that you can incorporate it perfectly into your existing material handling and logistics solutions, for example for a pallet return path or intermediate zones where precise position control is not required. Carriers are fed in and out, accelerated, decelerated, and positioned seamlessly: the motion profile of each carriage is freely adjustable. It is also possible to use different carriers and product configurations in a single system.

**Maximum flexibility and efficiency**
The Multi-Carrier-System makes packaging processes not only significantly more flexible, but also much more efficient. This freely configurable transport system can be precisely synchronized with the process. It supplements traditional material handling solutions specifically where it is needed in the process while the other conveyors remain unchanged. Linking up traditional transport paths – which are usually long – using the Multi-Carrier-System increases the dynamic response, and therefore the efficiency, of the plant.

In addition, the modular concept and the multiformat-capable carriers allow changeover to different formats and product types to be implemented quickly without time-consuming mechanical changes. This results in minimal retooling times and considerably higher utilization of the plant.

The transport system is controlled by an efficient Simotion controller from Siemens, which integrates all control system and motion control tasks for the entire system. In addition to controlling the motion of the transport system, the Simotion can coordinate motion with other servo-driven machine modules, which not only considerably reduces the number of interfaces, but also ensures maximum flexibility throughout the system.

Highlights

- Highly flexible: infeed and outfeed of the carriers without additional transfer couplings
- Freely adjustable acceleration, speed, and grouping
- Easy integration of the modular Multi-Carrier-System section into existing intralogistics
- Synchronous movement of multiple carriers
- Cam disk mode and movement synchronized
- Just one controller, even with additional machine modules
- Dynamic and fast, even with large loads
- Independent control of carriers allows them to be synchronized to handling kinematics or robots

Brenton Engineering, powered by Pro Mach, relies on the Multi-Carrier-System jointly developed by Siemens and Festo

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Food: Quick product changes and a reject-free process right from the start: the new, compact flowpacker from Belgium featuring innovative box motion technology makes it happen.
Belgian Industrial Machines – BIM for short – is a specialist in flowpacking applications. The company has numerous high-throughput machines with rotating cross-sealers on the market, and maintains close contact with its customers: "More and more businesses are looking for a highly flexible packaging solution for special promotions and small series, or different versions of packaging for different chains," says Sven Geukens, general manager at BIM. "Unlike large series, we deal with small quantities that imply frequent changes – of product, of packaging format, and of printed lettering and logos."

**A flexible response to increasing customization**

BIM has now developed a packaging station that is optimized to provide the utmost flexibility: it switches over to new products completely electronically. There is no need for adjusting settings manually or switching format parts. The operator simply enters the length, height, and width of the product, or accesses the information from a stored data set. The sealing time and temperature may also need to be adjusted for special films. Then all that remains is to insert the correct film and start the process. "Even operators unfamiliar with our new machine can manage a product change within five minutes," Geukens notes.

The basic structure of the new flowpacker matches that of BIM’s tried-and-tested machinery series and has a small footprint. Because it is equipped with casters, it can even be moved to whatever output belt is currently producing a small series. This adds significant flexibility to production operations.

**A fully parameterized motion sequence**

Using preset operator entries, the implemented motion control system Simotion calculates all movement sequences and set values automatically, and then accurately executes them using servomotors. The sealing jaws and film cutter are lifted over the passing products to the next sealing point, and then they travel along with the continuously moving film during the welding and cutting process. The motion sequence is brief and economical because it takes into account the product height – a time advantage compared with machines that fix the opening height at the maximum pack dimensions.

"We've combined the classic box motion concept and the flying saw principle to facilitate a production process that avoids rejects to the greatest extent possible," Geukens explains. "If there’s a critical sealing time for special films, the Simotion application calculates the sealing path dynamically based on the current winding speed and adjusts the motion sequence accordingly." The result is cleanly sealed packaging every time – even during run-ups or if the machine needs to slow down for operational reasons.

**Greater process quality and availability**

The application software in the new machine uses the LPac Simotion Packaging Library. Basic functions included in the library – like print mark control, film winder regulation, and temperature control for the sealing jaws – ensure the correct positioning of the film and the sealing and cutting sites. The standard software has been extensively proven in practice and provides the end user with substantial benefits in terms of process quality and availability.

In addition, the LPac library supports the OMAC (Organization for Machine Automation and Control) state machine and interface model – and therefore offers standardized communication with OMAC-compatible machines and line environments. Thus, integrating the new flowpackers into production is relatively easy – as can be seen in their flexible, demand-driven use on different production lines. "The OMAC state machine also avoids several typical causes of rejects," adds Geukens. "For example, if there is no product in place, the film is not wound out, and if there is no film in place, the product is not ejected. This prevents output of unpackaged products or empty film pouches." The result is an improvement in process quality, including downstream stations.

> The OMAC state machine avoids several typical causes of rejects.«

**Sven Geukens, General Manager at BIM (Belgian Industrial Machines)**

**Successful on the increasingly digital market**

The new, electronically convertible, OMAC-compatible flowpacker can be very quickly implemented, allowing operators to reap the benefits from increasing digitalization and acceleration. It means keeping up with the state of the art in flowpacking, too. Packaging does not get any more flexible than this!
Rapid format changes, versatility, security, flexibility, and availability are becoming increasingly important in today’s packaging industry. This is partly due to the market’s need to adapt swiftly to the changing tastes of the consumer, and partly to the need to combine different packaging production processes on the same machine and get the most out of these investments. The good news is that these goals are easy to achieve with the right motion control systems, as the example of Bossar Packaging S.A. demonstrates.

Since it was founded in 1992, the Barcelona-based company has become one of the global market leaders in the development and manufacturing of horizontal packaging machines. Throughout its history, Bossar has come up with a multitude of technical innovations that have helped to advance flexible packaging machines in general and horizontal packaging machines in particular.

One step ahead with servo control
To keep up with the demanding requirements of the packaging industry, Bossar has designed machines based on the motion control system Simotion from Siemens, such as the servo-controlled BMS series. These units produce bags with seams in a wide variety of formats and designs—all at a quality level matching that of pre-formed bags. The latest development from Bossar is the BMS 4.2 Full Servo series, a completely servo-controlled horizontal packaging machine that produces and fills up to 240 bags holding up to 1,600 cm³ per minute. The size of the bags can be varied between 80 x 120 mm and 210 x 300 mm. This means that the machines are

Food: Compared with traditional mechanical packaging machines, servo-controlled machines with the right motion control system offer many advantages. One company in Spain is benefiting from them.
especially suited to packaging food products such as fish, pet foods, liquid soups, sauces, precooked meals, vegetables, and pâtés.

**Less effort**
To control movement in the BMS 4.2, Bossar uses the motion control Simotion system, which is based on a combination of motion control with PLC and technology functions. This approach enables axis motion control and machine control in the same system. In Simotion, axis movements in the BMS 4.2 are monitored by the electronic cam control and their exact position is controlled according to the relevant phase of the production cycle.

Optimal operating positions for the axes can be programmed in advance, and manual intervention by the operator is no longer required. This significantly reduces the time spent on machine commissioning and format changes. One special feature of Simotion is the option to expand the basic functions by loading technological packages, such as the Tcontrol temperature control package. This package provides temperature channels with extensive functions and can be used, for example, to facilitate perfect temperature control for bag sealing, meaning that no external controllers are required beyond the main control system.

**Standardization with OMAC-based libraries**
Motion control systems are increasingly being implemented in different areas of production machines, and this is producing a growing variety of solutions and products from different manufacturers. The knock-on effect is that the end user has to be retrained with each purchase of a new machine. The standardization initiative OMAC (Organization for Machine Automation and Control) was founded to limit this excessive diversification in the market.

The aim of the organization is to define uniform guidelines and thereby create standards that enable reduced development and delivery time while utilizing existing resources more efficiently. As a components supplier, Siemens is also active in this organization and provides its customers with libraries based on OMAC standards, such as OMAC PackTags. This standardizes the operation of the machines and greatly simplifies handling and maintenance – just one of the benefits that Bossar’s customers have been enjoying since the company decided to opt for Siemens standards for its packaging machines.
Many production and packaging machines are stand-alone systems that are coupled mechanically by conveyor belts and sensors only. This means unnecessary downtime, complicated diagnostics, and reduced efficiency. In the food and beverage industry there is significant potential to increase the efficiency and productivity of existing and new production plants. One important element is the consistent, end-to-end networking of all machines and plants – from raw material intake to production and packaging to product dispatch – as well as gap-free recording of all production parameters, such as quantities and machine runtimes. To realize this, plant operators need concepts that do not interfere with the internal automation of the individual machines but still allow line integration with standardized data interfaces and network connections.

**Standardized monitoring and precise diagnostics**

With its Line Integration Concept, Siemens is providing the food and beverage industry with a machine integration concept that can be put to work immediately. It supports a standardized approach in which all relevant processes can be depicted in a central line-monitoring system. Extended diagnostic tools enable the precise calculation of downtime and KPIs for the entire production or packaging line.

The Line Integration Concept also ensures effective line control that guarantees a harmonious flow of products and minimizes the critical ramp-up and ramp-down phases. The benefits of these functions are less wear and fewer rejects, higher yield, lower energy consumption per product, the ability to continually increase production efficiency, and less noise. A standardized data interface and network architecture at the machine level ensures that new and existing machines and lines can be added and that a production or packaging line can be easily integrated into the network of the entire plant. Optional integration with a Manufacturing Execution System (MES) makes it possible to combine data from the line level with information such as product ID, order ID, and batch ID.

**All data at all levels**

Bidirectional communications make the relevant data available at all levels, from the machine to management. The necessary software and data blocks for Siemens PLCs, HMI, and motion control systems are developed and tested by Siemens, and are available for download from Industry Online Support. Security concerns are handled from the beginning with a properly laid out defense-in-depth network architecture in conjunction with an enhanced remote solution with high security standards.

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**Food:** Efficiency and productivity can be increased through the consistent, end-to-end networking of existing and new production and packaging lines. And Siemens’ ready-to-go machine integration concept does exactly that.

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The Line Integration Concept from Siemens enables the depiction of all relevant processes in a central line-monitoring system.
Beverages: Elopak has developed a filling plant for UHT products that can be cleaned and sterilized entirely automatically. Homogenous automation makes this versatile machine easy to operate and maintain.
Elopak gable-top cartons are primarily used as beverage packaging, but they can also hold viscous products like yogurt and creamy desserts. The Norwegian company supplies roughly 13 billion cartons to its customers each year, and also provides the machinery required to fill and package them. Some of this production comes from an external partner firm.

The portfolio comprises fresh and ultraclean machines that package products with relatively short shelf lives, like fresh dairy products and fresh juices found in cooler sections. Long-life, ultra-heat-treated (UHT) products, however, must be packaged in sterile conditions. Elopak Equipment Supply GmbH (Elopak EQS), based in Mönchengladbach, Germany, is part of the Elopak group. The machinery manufacturer has developed an aseptic, sterile machine for filling Pure-Pak cartons for the UHT market: the E-PS120A. The A stands for “aseptic” and means that the machine can be used for both low-acid and high-acid products. It has been newly designed and constructed from the ground up in order to meet the highest demands of the global market.

**Fully automated cleaning and sterilization**

One highlight of the sterile Elopak EQS filling plant is the machine’s self-cleaning and sterilization process, which runs entirely automatically at the touch of a button. The “cleaning in place” (CIP) process cleans everything that is in constant contact with the product, including pipes, valves, product outlets, and the product tank. The “foaming in place” (FIP) process foam-cleans the entire filling and aseptic area. The result? A sparkling clean machine interior. The sterilization of process components like the tank, lines, valve seats, and outlets, which is key to the product’s long lifespan, is achieved with hot steam (HST) at a temperature of over 120 degrees C. In addition to steam sterilization, hydrogen-peroxide sterilization is used to treat the aseptic areas of the machine that cannot be sterilized with steam.

With the help of Hepa filters, the aseptic chamber is continually flooded with sterilized, purified air during operation, ensuring that no germ-laden ambient air gets into the product. The cartons are then sterilized on the inside using hydrogen peroxide steam, filled, and sealed in the aseptic chamber.

**Flexibility in product, carton, and seal types**

High-acid products, low-acid products, viscous products, granular products like pulps, fibers or chunks of fruit: the machine can package various liquid products in different carton sizes and shapes, including the new Pure-Pak Sense version. It fills eight cartons at once in a 2.4-second cycle as standard. The variation in volumetric flow of each individual filling valve permits a rapid and froth-free filling process in a single cycle without inserting the filling nozzle into the packaging. The motion-controlled servo transportation system then transports the filled cartons slosh-free to the sealing station in just
600 milliseconds. The cartons, which are still open at this point, accelerate and decelerate on a motion-compensated curve to ensure that the liquid does not slosh around. This provides a clean process, even in the case of low outputs and smaller cartons.

The application of caps is fully integrated into the plant, which supports different sizes and types of seals. The filling plant can be adapted to suit each product by means of recipe pre-selection, which is extremely helpful if you need to package a wide variety of products or want to test the filling characteristics of a new product.

A lean system structure despite complex functionality
The company’s collaboration with its automation partner has an important role to play in the machine’s complex functionality. Tammo Zorn, who is responsible for the Electric & Controls division at Elopak EQS, explains: “We opted for Siemens because we needed a globally accepted automation system for the international UHT market. Being able to obtain all of the necessary control system and drive components from a single source – and already installed, at that – is of great benefit to our engineering strategy. We send our empty machine-specific control cabinets and modules to Siemens’ System Engineering Plant in Chemnitz. They come back from there fully equipped and pretested, and we can then integrate them directly into the machines.”

Zorn also highly values the company’s interaction with the Application Center in Cologne. It developed from an intensive collaboration during the initial phases of machine development and established the foundation for a lean and powerful system structure that can be developed and expanded over the long term: a Simatic S7 controller handles process control and general safety functions complemented by a motion control system Simotion. “It benefits us that Simotion itself is modularly structured. That way, the required functionality can be quickly and logically distributed to the drives, where it is directly implemented,” says Zorn, adding, “Simotion’s trace function has also proven to be a very valuable tool for telediagnostics. It allows us to keep the plant’s availability at a permanently high level. The UHT market is generally quite cost-sensitive: reliable operation and a high level of availability are very important for profitable production.”

The compact machine layout is completed by Sinamics Booksize devices with Safety Integrated, the Simatic ET 200S distributed I/O system, which is suitable for the food industry, and a flexible visualization system based on Simatic WinCC. Despite the overall large number of functional units, modules, and assemblies and the comprehensive functionality of this flexible machine, the result is a lean system structure that is easy to maintain.

An attractive complete package
After sending the initial experimental machine to the parent company in Norway back in 2013, and installing a reference plant in Mönchengladbach, complete with upstream process technology, Elopak now has ten high-performance plants out in the field at dairy companies and filling plants. More of these self-cleaning and self-sterilizing filling plants for gable-top cartons are currently under construction. “Users value the high repeat accuracy of the filling process and the low-wear, servo-based drive technology, which keeps maintenance effort and cost to a minimum,” says Zorn, summarizing the advantages. “Furthermore, the E-PS120A allows the user to cover a very wide product range with a single machine.” Combined with the attractive gable-top carton packaging, it represents a very tempting package for the UHT market – both for filling companies and the products’ end consumers.”

»It benefits us that Simotion is already modularly structured. That way, the required functionality can be quickly and logically distributed to the drives, where it is directly implemented.«

Tammo Zorn, Manager of the Electric & Controls Division at Elopak EQS

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**Beverages:** Hot drinks made using pods are booming. And to meet the growing demand, reliable packaging machines with efficient automation concepts are needed.
The Gima 590 is a rotary packaging machine.

Hot drinks made using pods are booming right now. One prerequisite for manufacturing these pods is reliable packaging machines with efficient automation concepts.

The new 590 series facilitates packaging speeds of 100 to 200 pods per minute.

Gima SpA, an Italian manufacturer of packaging machines, has many years of experience in the field of innovative packaging solutions, including for the food and beverage industry. The company’s 590 series is an expansion of its machinery portfolio to include filling and packaging soluble products like coffee and tea pods. The machine was primarily developed for small and medium production volumes. However, the Gima 590 does not just fill a gap in the midrange market: it is also ideal for large end clients, who often want to test new recipes or products – all at a packaging speed of 100 to 200 pods per minute. The machines in the new series are rotary packaging machines, meaning that the rotating units are designed as concentric rather than linear work-stations.

Customizable
One benefit of the new 590 series is its compact design: its footprint is 70% smaller than that of a traditional linear machine. Because the new packaging machine has a modular structure, it can easily be customized to meet different customers’ production requirements. The mechanical submodules are quick and easy to replace, which means significantly less maintenance effort than traditionally required for large machines. The footprint is just over four square meters, meaning that the machine can be moved without having to be completely dismantled.

Top technology for precise production
The automation concept is truly the brain of any machine – and in the case of the Gima 590, it is based entirely on Siemens technology. Davide Azzolini, head of electrical engineering at Gima SpA, explains: “We opted for Siemens technology in our development of the 590 series for various reasons. The priority for us was the performance and flexibility of the motion control system, Simotion D. It allowed us to implement the entire control system within a single automation environment, from the typical motion control functions and axis handling to the drive technology and motors.”

The Simotion D445 coordinates 23 ultradynamic servo-axes using a virtual master. This project called for functions like an electronic gear and cam disk. With rapid measuring probe inputs, positions can be corrected on the fly by means of print marks. The Simotion controls the entire machine cycle, including axis management, synchronization of all drives, and ultraprecise weighing of the coffee or tea powder that will be put into the pods. Miniature Siwarex WL260 SP-S AE-type aluminum load cells communicate the fill weight of the pods to Simotion quickly and accurately. At the same time, the entire handling of I/O modules and alarms is covered, recipes and statistical analyses are stored, temperature control is implemented, and winding and unwinding processes are managed. All of this ensures an extremely precise and efficient production process.

Efficient product selection for space-saving automation
Siemens was chosen not only because of its high level of market acceptance and top-quality product portfolio, but also because the company offers a complete solution. Azzolini outlines the benefits for Gima: “The aspect that we value most is the availability of high-performance products. In our case, these were the Simotion D445-2 controller, Sinamics S120 drives, Simotics S-1FK7 servomotors with Drive-CliQ interface, ET 200SP I/O peripherals, and the Panel PC with embedded Windows operating system.” All of the automation components are linked via Profinet, and full remote access to the entire system via the Internet is ensured by a secure SSL VPN connection.

Because the architecture is based entirely on Profinet, special or detailed diagnostics of all components can be implemented within the network. Thanks to the web server integrated into the automation components, it is possible to access system data without needing an additional development tool. In addition to communication, another key benefit of Profinet is the Safety Integrated function via fieldbus. This saves space in the control cabinet and significantly reduces cabling. Gima now has an integrated solution that is perfectly tailored to the compact machine.

Technology at a glance
- Simotion D445-2 controller
- Sinamics S120 drives
- Simotics S-1FK7 motors with Drive-CliQ interface
- Simatic ET 200SP I/O peripherals
- Simatic Panel PC with embedded Windows operating system
- Siwarex WL260 SP-S AE
**Beverages:** One Saudi Arabian producer sees 40,500 bottles of juice or milkshake race over its conveyor belt every hour. Production, packaging, and palletization are all performed at high speed and fully automatically.

The biggest manufacturer of juice and milk-based beverages in Saudi Arabia expanded its PET bottle production in 2016. It obtained the conveyor, packaging, and palletizing stations for this expansion from Belgian machinery manufacturer Delta Engineering, which also linked the single stations into a whole plant. Delta Engineering chose to use Totally Integrated Automation from Siemens for this project in order to keep its complexity to a minimum.

**11.25 bottles a second**
The high-speed blow molding machine generates an enormous product flow: every second 11.25 bottles have to be received, transported along at 1.2m/s, and distributed across several packaging stations. The required availability of 98% was more or less at the limit of technical feasibility.

Suction belts stabilize the empty PET bottles as they whiz through the plant. Eleven 7.5-kW vacuum pumps are needed to transport the bottles reliably through all the stations. These are controlled by distributed Sinamics G120D-type converters. This means that the modules do not need any external units and require less cabling to the central control cabinet, which considerably speeds up factory testing, on-site construction, and commissioning.

»When it comes to this type of project, close collaboration between all involved is essential. Siemens’ enthusiastic support significantly reduced both our objective and subjective project risks.«

Koen De Lausnay, Project Manager at Delta Engineering
Packaging at the right speed
The project was implemented in two phases. Phase one involved the plants for producing the bottles and their packaging into large bags. Three packaging stations each shrink-wrap 418 bottles into a large bag. Their excess capacity creates time to change the film rolls during ongoing production and to perform any necessary maintenance work. The biggest challenge was distributing the bottles across the packaging stations. “For the separating station, we worked with Siemens to develop a completely decentralized automation system. This system is also based on G120D drives and ET 200 distributed I/O stations, which are integrated into the control system level via Profinet and Profisafe,” explains project manager Koen De Lausnay from Delta Engineering. “The big advantage is that if an additional input or output signal is required, the changes remain local.”

The bottles need to be slowed down for packaging. With this in mind, the distribution strategy had to factor in gradual changes in speed and different lengths of infeed belt. “High-tempo production creates effects that simply don’t exist at lower speeds,” says De Lausnay. “Thanks to the open control system and drive technology from Siemens, we were able to translate these insights into the programming.”

Fully automated palletization
In the second phase of the project, Delta Engineering initially installed a manual palletizing station. Then, the fully automated system was shipped to Saudi Arabia following extensive testing in the factory. The manual station now serves as a link to the automatic palletization and can be reactivated quickly in the event of a malfunction. Delta Engineering also used distributed Siemens drives for all of the key palletizing functions – and has already benefited from the opportunity to test the modules individually. Since the bags of bottles need to be taken to the palletizing point above the plant for space reasons, some stations had to be completely rebuilt and tested.

Good collaboration reduces risk
The production of PET bottles is very cost-sensitive and is only economical within a stable process. “When it comes to this type of project, close collaboration between all involved is essential,” De Lausnay emphasizes. “Siemens’ enthusiastic support significantly reduced both our objective and subjective project risks.”

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A standard solution for quality products

**Beverages:** CFT SpA has developed a machine to fill and seal cans of beer that is equipped with integrated Siemens technology from the control system to the motors to the peripherals.

“We want to offer our customers first-class quality, and we can achieve that using the integrated solution package from Siemens.”

Filippo Tedeschi, Packaging Automation Manager, CFT-Group

“Innovation is based on continual research and development.” In line with this motto, CFT SpA (Catelli Food Technology) developed its new monoblock filling and sealing plant MasterBrew. “Thanks to our skill and experience, we managed to integrate both functions into a single machine very efficiently. This guarantees smooth functionality in terms of both product feed and machine throughput,” explains Giuseppe Colombi, the CFT Group’s technical manager for fillers and seamers. CFT plans and constructs processing lines for raw materials like tomatoes, fruit, milk, and chemical products as well as plants for packaging canned vegetables, foods, cooking oils, lubricants, and drinks. The company is now one of the sector’s global market leaders.

**High throughput with integrated automation**

Beer is a very sensitive product, and high hygiene and cleaning standards must be met during filling. The MasterBrew prevents all types of contamination – such as oxidation and mold formation – that would impair the organoleptic properties of the drink. With 36 filling valves, the machine is perfect for small and medium-sized breweries. It can fill 20,000 cans of beer, each measuring 330 ml, in one hour. In order to achieve this high throughput, the MasterBrew is fully automated using Siemens products – from the control system to the communications to the motors. “Siemens is known worldwide for its outstanding and reliable solutions. We want to offer our customers first-class quality, and we can achieve that using the integrated solution package from Siemens,” says Filippo Tedeschi, packaging automation manager with the CFT Group.

**Innovation in controllers, motors, and engineering**

The automation architecture is based on the fail-safe Simatic CPU S7-1513F, which for the first time can be programmed entirely via the TIA Portal engineering system. “This not only gives us technical advantages, it also makes our day-to-day work easier because we can program and operate the PLC, safety, and HMI in a single development environment,” Tedeschi explains. The integration of PLC, HMI, and I/O into TIA Portal also allows for cross-system telediagnostics. In addition, the MasterBrew uses the flexible motion control system Simotion D425 with an integrated Sinamics S120 drive system. The ability to access the drive technology and the servo-axes, including the motors, makes configuring the machines and the corresponding communications structure much easier. “Another key factor for us was the safety concept that is integrated into the fieldbus. It not only allowed us to make our control cabinets smaller, reduce cabling and downtime, and therefore increase productivity, it also made it possible to develop a high-end machine in which all systems are fully integrated,” says Tedeschi, describing the benefits.

Another new feature of the MasterBrew is the Simotics S-1FK7 servomotors. In addition to greater energy efficiency, they also provide better accessibility, making cleaning, format changes,
maintenance considerably easier. For less dynamic movements there are the new Simogear asynchronous geared motors, which perfectly complement the portfolio of Siemens motors. The machine is operated via Nanobox 227E Simatic industrial PCs with 19-inch multi-touch monitors.

Secure and trouble-free communications
All Siemens systems are connected to the Profisafe protocol via Profinet. This provides for the machine's secure integration into the network as well as for precise and extensive network diagnostics. Thanks to the web server integrated into all components, it is also possible to access the relevant system data without development tools.

The Scalance W700 family is another of the machine's new developments. “This allows for easy connection of the machine via WLAN, which saves money because the cabling is reduced,” says Tedeschi. CFT has been able to connect all of its sensor technology to the Simatic controller via the IO-Link communication protocol and therefore increase the machine's productivity with clear signals that are less susceptible to interference.

The best support at every stage of the project
Consistent support is ensured by Siemens' Packaging Competence Center in Bologna. The application engineers there use industry-specific standard packaging solutions that allow them to react quickly to market demands. "We are delighted with our collaboration with Siemens – not only in terms of the technical elements but also in terms of the support we received, from project planning through the testing and acceptance phases. That's why we plan to use Siemens solutions for future projects as well – along with all of the benefits that they bring for the integration and security of our machines," Colombi affirms in conclusion.

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KHS GmbH, headquartered in Dortmund, Germany, is one of the world’s biggest manufacturers of filling plants, and is considered a technological leader and key innovator in the industry. The company is constantly living up to this reputation with innovative solutions along the filling line – including packaging and palletizing of products that are ready for dispatch. And it is here, at the end of the filling line, that we find the latest innovation from KHS: the machine manufacturer is planning to use a camera-controlled delta picker to construct pallet layers. For the first time, packages will be transported between the packaging machine and palletizer without backup pressure. Thanks to the robot’s camera-based guidance, the usual package guide will no longer be necessary. If different sizes of package are being handled, this will result in a considerable time saving when changing over from one product format to another.

**Beverages:** A camera-controlled, energy-efficient delta picker groups different packs of beverages as they will be arranged on the pallet, without package guides or separate robot control.
KHS is setting a new standard in flexibility, efficiency, and ease of maintenance in palletization with an innovative, camera-controlled delta picker.

**Direct access to packages without guides**
The innovative machine has been developed and constructed at KHS’s site in Worms, Germany, the group’s “product center for palletizing technology.” Hans-Werner Holzer, head of development and product management at KHS, explains what prompted the innovation: “The market is constantly asking for new packaging units. In order to meet the market’s demands, plants have to adapt to the new products quickly. This also applies to the package feed in palletizers. In order to be able to grip packages securely, package guides used to have to be precisely matched to their dimensions. By using a camera system combined with intelligent robot control, we have made it possible for packages to be held securely without guides, ensuring a high level of availability in the plant.” In addition, the new concept taps into extensive synergies, for example in automation and visualization, in the motion sequence and safety technology, in maintenance and energy efficiency, and in system integration and machine-machine communication. All of this increases the efficiency of palletization in a sustainable way.

**Streamlined, integrated automation**
The automation is based on the modular motion control system Simotion from Siemens. It controls and coordinates all of the palletizer’s axes – including the drives for the delta picker. Motion control is taken care of by configurable program components from the “Simotion Handling Toolbox” Top Loading library. This supports Delta 3 kinematics as standard, but has been expanded for the motion sequence required at KHS: sliding instead of lifting. The connection to the Simatic-based line control and master computer has also been simplified significantly. And because all data is now within one system, it is much easier than before to achieve extensive visualization of the process.

The picker’s Simotics S-1FK7 servomotors are integrated into the palletizer or line segment’s intermediate circuit energy compensation. They can use the energy that is released during regenerative braking of axes, improving the application’s energy efficiency. The motors in delta pickers are stationary, and therefore do not move with the unit. This means that their relatively thick power cables do not have to be routed over cable carriers or through curves. This reduces maintenance costs and increases availability.

**Optimized motion sequence**
The motion sequence for gripping and grouping packs and packages has been extensively reworked. It is now faster and more economical. Thanks to the integration of the robot into an integrated motion control system, and with the help of its camera-based guidance, products do not need to be picked up at a rigidly defined point in the process cycle – or even in the same position. Instead, the robot can go directly from one end position to the next product and grip it “on the fly,” even if it is facing the wrong way on the belt. The machine control system takes the movement of the conveyor belt into account, and integrates it into the motion sequence so that packages can be handled continuously.

To achieve a high level of process reliability, the developers dimensioned the drives using the sizer configuration tool. In addition, the new algorithms were extensively checked, refined, and optimized by means of simulation before and during the engineering – and coordinated with the automation partner, Siemens. KHS has worked with Siemens to develop a group-wide, standardized automation concept.

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For a swift reaction to format changes

Beverages: Gebo Cermex has now converted its WB46 wraparound carton packer to motion control technology from Siemens – with far-reaching benefits for users.

The beverage sector is one of many industries that is seeing the number of different products and product variants increasing – and with it the number of retailer- and customer-oriented packaging solutions. This is in turn intensifying the demands on packaging processes. The greatest potential for increased efficiency today is in the interaction between the operator and the machine. Product and format changeovers, filling, cleaning, troubleshooting, and maintenance all must be made extremely easy, as trouble-free as possible, and above all very fast in order to facilitate maximum machine utilization and productivity.

Retaining the basic principle: using state-of-the-art technology
To make the processes around end-of-line equipment even easier and faster, Gebo Cermex, a specialist in the field of packaging line engineering, subjected the WB46 wraparound packer to a fundamental redesign – and converted it throughout to electronic motion control. In addition, a robot-supported feed station with a continuous product feed ensures smooth packaging of products despite the more compact footprint of the new generation of machines.

The most important goal in redesigning the WB46 was to simplify and accelerate the machine procedures. What was not overhauled, however, was the...
Intelligent operator interface

Gebo Cermex has skilfully and ergonomically integrated a panel into the machine for user-friendly operation. The operator panel is a Simatic IPC277D that has been configured with WinCC Advanced in the TIA Portal engineering framework. The OMAC Mode & State Manager that is also integrated into the HMI and the machine software provides a good overview of the machine's status and operating modes – a big help when commissioning, maintaining, and servicing a line-integrated machine.

Simplified mechanical components and fewer maintenance requirements

The consistent use of the motion control system Simotion has enabled drastic reductions in both the number of mechanical components and the size of buffer zones. This has a favorable effect on process manageability – and simplifies cleaning the machine. There are hardly any areas in the innovative, extremely solid frame structure where dust or humidity can accumulate, which considerably improves hygiene in the machine. New, significantly more stable protective doors facilitate maximum visibility and help to lower the noise level. Another plus of the motion control technology is that the vacuum gripper in the case erector now adapts automatically to the size of the blanks.

Electronically supported format changeover

Quick-release systems and electronic setting aids simplify and accelerate format changeovers on the new machine generation. This is because even in the standard version of the machine with manual format changeover, the motion control technology means that many settings can now be made via the new, convenient human machine interface (HMI). The HMI is based on intuitive navigation similar to that of a tablet in order to expand the user experience, and it includes powerful media tools for preventive maintenance work.

A host of improvements thanks to motion control

The first few operators are already delighted with the new generation of the WB46. “When you modify such a popular machine so fundamentally, there has to be genuine added value for the customer,” emphasizes Benoît Poutot, R&D manager at Gebo Cermex. “Simotion-based motion control has opened up new approaches for making end-of-line equipment more versatile, simple, and hygienic.”

Gebo Cermex has subjected the WB46 wraparound packer to a fundamental redesign
Modular machine concepts enable the quick development of customized applications such as packaging machines. Alongside the mechanical elements, the hardware and software must be modularized because this is how each mechatronic machine module becomes a unit that can be handled independently during configuration. If implemented consistently, this allows machine software to be automatically generated to match the machine setup. For this, the software for each function group need be designed in such a way that it can be adapted to suit all planned variants in the machine line via parameters, and can communicate with the entire plant through standardized interfaces.

**Modularized software**
The LPac Simotion Packaging Library from Siemens, for example, shows how this might look. This library provides configurable software modules and a sequence control for all functional units in a packaging machine. It includes all obligatory and optional functions and HMI screens required for operation, diagnostics, commissioning, and maintenance – in an integrated format that is compatible with OMAC or the Weihenstephaner standard, if required. Software modules from the respective machinery manufacturer may supplement and expand this library, and the standard modules can also be adapted to suit specific requirements.

**Easy to assemble and configure**
Thanks to the link with Siemens’ Simotion easyProject project generator, it is now enough to simply select the modules present in the machine setup.
and the desired optional system functions, without having to program a single line. This is because easyProject loads the specified software components and the modules for obligatory system functions and links them during generation to form a sequence-stable machine software. The software can be put into operation immediately, or the created project can be used as a basis for ongoing customized optimizations. The result is software for a variety of completely different packaging machines from various manufacturers.

For a small or large number of projects
To create the software for a customized machine, the software components are selected and configured for each module installed in the machine. This can be performed interactively on the screen. The procedure saves time compared with the usual method of working with software libraries, especially if only a few projects will be implemented each year. Work with the project generator can also be automated if there are a greater number of projects. In this case, it reads the necessary information by means of XML import and processes it in silent mode.

Configured by macro
KHS GmbH, one of the leading manufacturers of beverage filling plants, has been using Simotion easyProject for some time to create machine- and order-specific software for its modularly structured machines. At KHS, the design of the configuration table that serves as an input for easyProject and the launch of the project generator is increasingly being managed by macros that are based on existing engineering data. At KHS sites, macros evaluate the information for the axis drives defined in EPlan. They use the data obtained in this way to identify the modules installed in the machine, from which the necessary software modules and their parameters can be derived. Simotion easyProject then implements the data compiled by the macros in silent mode to form a complete machine software. For the beverage filling plant manufacturer, this procedure leads to group-wide synergies because it promotes cross-location standardization and quality assurance in the machine software. The objective is to integrate software creation with Simotion easyProject into joint data management for mechanics and electrical design across sites.

Acceleration of engineering and commissioning
Ultimately, working with the project generator significantly speeds up both engineering and commissioning on-site. This is because the machine software is now based completely on standardized, quality-assured software modules, and a tried-and-tested automatic process creates the runtime version. The result is a dramatic reduction in errors and a trusted software structure for the person performing the commissioning. These two benefits save time and simplify commissioning. Plant maintenance, including telemaintenance by the machinery manufacturer, is also considerably easier.

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Pharma: In order to fulfill the strict regulatory requirements of the pharmaceutical industry, manufacturers in the production of medicines are now able to collect and centralize information from their packaged units, providing a central place for data visualization and batch review.

Pharma plants are frequently audited by international authorities, such as the FDA, which are tasked with ensuring that medicine is produced to the right standard and safety for patients.

Such audits focus on the different steps in pharmaceutical production that are classified as primary or secondary processes. In the primary manufacturing process the active pharmaceutical ingredient (API) is manufactured via a chemical or biological process. In the secondary manufacturing process, other ingredients are added to produce a final formulation, which is then transformed into solids or liquids, that are packaged. In both primary and secondary pharmaceutical manufacturing, a number of manual operational steps often need to take place. Ensuring that manual steps are followed properly is subject to the creation of a large amount of documentation.

It is all about the data
The proper recording and archiving of information as well as the management of data is therefore a key concern for pharmaceutical manufacturer. Critical Quality Attributes (CQAs) or Critical Process Parameters (CPPs), such as raw material quantities and potency, or equipment status and parameters, must appear in the final batch record, which is increasingly being developed in a paperless, electronic format. Electronic batch recording in the pharmaceutical industry is managed with an MES (Manufacturing Execution System), which is connected directly to automation and ERP (Enterprise Resource Planning) systems.

Centralization of data for more efficiency
In secondary manufacturing, the challenge is to connect the packages units, consisting of different pieces of equipment with different controllers, to a centralized system. Therefore, the packages units require information from the MES system in order to contextualize the unit operation. Once manufacturing starts, data such as material usage and process parameters must be sent back to the MES. Commonly, each individual unit is connected on an individual basis to the MES. With Simatic IT eBR Siemens now provides a concept for the centralization of data in secondary manufacturing. It is based on a standard interface that connects the units. With native drivers available for different control systems, OEMs are able to use standard controllers and connect easily into the overall system. It is possible to envisage a stepwise approach for different package units, providing a hybrid solution that gathers information both electronically and manually and, thanks to the centralized data collection model, is simpler and makes it easier to engineer and validate the solution. In addition, consistent data management and the audit trail provide strong responses to the concerns around regulatory requirements. One of the most important benefits of a centralized, faster, and consistent approval of the manufacturing of the batch is the reduction in the cost and improvement in production efficiency. This enables pharmaceutical manufactures to improve manufacturing efficiency.

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Automatically filled vials

Pharma: The pharmaceutical equipment manufacturer Tofflon relies on advanced motion control and the SCADA system Simatic WinCC to ensure precise, stable, and integrated processes in its aseptic filling solution.

Based in Shanghai, China, Tofflon develops and manufactures leading-edge machinery for the pharmaceutical industry, specializing in solutions for the aseptic processing of lyophilized injectables. The company operates plants in China, India, and the United States and supplies pharmaceutical manufacturers worldwide with applications for freeze-drying systems – from stand-alone freeze dryers, auto-loading, and barrier systems to completely automated filling lines for vials and ampules.

Manufacturing processes in the pharmaceutical industry need to meet stringent requirements and fulfill international standards like the cGMP and FDA guidelines that ensure consistent high product quality and therefore patient safety. Tofflon designed a fully automated filling line for the production of aseptic drugs that integrates the serial washing, tunnel, filling, and capping processes with a motion control system Simotion D435 at its core. “After repeated demonstration and validation, we chose the Siemens solution because it integrates all the required motion control functions, for example, reference-point, positioning, and synchronization. Plus, it is easy to program and debug and supports high-speed communications between the function extensions and the various actuators,” explains Jackson Zhao, director of Tofflon’s technical department.

At the heart of the filling line
Thanks to the central control of all process steps in the line, the filling speed and velocity can be synchronized in real time with the Simotion electronic cam curve guiding, effectively avoiding errors like liquid dropping or spilling while also maintaining high filling precision. Tofflon also integrated the SCADA system Simatic WinCC into the filling line, which optimizes the interaction between HMI and control based on the integrated flow of information used for visualization. Thanks to the Simatic WinCC application, the batch manufacturing processes of the Tofflon automatic filling line can be compiled by the operator in the control center. With the collected data, the monitoring system can automatically generate batch records. Using these records, the system can then process orders by automatically executing the required manufacturing tasks. The entire process is monitored and managed in real time, because all relevant data are transmitted to the control center. This allows Tofflon to integrate several fully-automated manufacturing tasks in its filling line.

Data integrity guaranteed
Tofflon also relies on Simatic WinCC to fulfill the industry’s high standards for auditing and tracing records. Process variables, alarms, and manufacturing data are reliably archived and adopted into the redundant server design. All of the data generated on the filling line and user authorization management are secured for efficient operations control and intelligent production analysis.
The digital twin comes to life

Pharma: The demands in special-purpose machine manufacturing for the pharmaceutical industry are changing. The strategy of the mechanical engineering company Bausch + Ströbel in Ilshofen, Germany, is based on achieving significant increases in efficiency using digital twins of its machines in order to be able to meet requirements faster.

The pharmaceutical industry is a demanding clientele and expects more than "just" technological innovations from mechanical engineers: "On the one hand, clients are asking for highly specialized plants with extensive customer service. On the other hand, there is a trend toward standardized machines with a high degree of flexibility and short delivery periods," explains Dr. Hagen Gehringer, managing director of Bausch + Ströbel. In order to meet both goals, he maintains a close collaboration with Siemens in the areas of digital engineering and automation. He has also adapted the structure of the company’s work groups to the possibilities afforded by digital technologies. Their goal is to increase engineering efficiency by at least 30%.

Virtual testing of machines
In the past, a full-sized wooden model based on customer specifications was produced to test factors such as mechanical characteristics, ergonomics, and transport routes. It was not until the tests had been completed that the actual machine was built and then programmed.

Bausch + Ströbel, which has been using NX for CAD construction and Teamcenter as its data backbone, began taking a new direction as early as 2012. The data from the digital design of the machine with NX for Design are used, among other things, for mapping the new machine at a scale of 1:1 and in 3D on a large screen in the company’s virtualization center. In this early concept phase, it is possible to simulate complete motion sequences. That allows both Bausch + Ströbel clients and engineers to see the design and functions of a machine at a very early stage in a virtual environment. Special glasses and stereoscopic 3D vision provide a realistic impression, because the movements of the users are also recorded and reproduced on-screen. The effects are so lifelike that users quickly forget they are only dealing with a virtual model.

“What helps us enormously is the parallel between the physical construction of the machine and the digital model. It enables us to align the digital images with the client and start programming,” says Dr. Gehringer. The development teams that up to now had been separate units at Bausch + Ströbel were merged to form interdisciplinary units. Today the opportunities of digitalization can be leveraged so that all work relating to design, electronics, mechanics, and programming can happen simultane-

»What drives us when it comes to digitalization is that it will bring added value to the client.«

Dr. Hagen Gehringer, Managing Director of Bausch + Ströbel

Mechanical engineering company Bausch + Ströbel
It is hard to miss the Bausch + Ströbel Maschinenfabrik Ilshofen GmbH & Co. KG production plant in the outskirts of the peaceful little village of Ilshofen in Baden-Wuerttemberg, Germany. For nearly 50 years, filling and packing plants for the pharmaceutical industry have been manufactured here with great success, and have to a large extent been exported worldwide. The mechanical engineering company has been relying on the strong market acceptance of Siemens hardware for a number of years. The company uses software and digitalization as a key to consistency in its engineering.
ously and as a joint effort. All findings from the simulations and testing with the digital twin of a machine go back into the data pool, which is managed with Teamcenter. The digital twin enables a virtual commissioning where flaws can be reliably detected and corrected. This significantly shortens commissioning time.

**Anticipated improvement**
The digital twin is used beyond the construction phase and delivery of the actual machine. Findings and data gathered during operation are remitted to Bausch + Ströbel, so the company has a virtual copy of each machine at hand at all times. This is ideal for providing customer service and is a real competitive advantage.

Another advantage is the time saved during engineering. Dr. Gehringer expects an increase in efficiency of at least 30% until 2020 – and Bausch + Ströbel has joined forces with Siemens to achieve this goal. Totally Integrated Automation Portal (TIA Portal) will support the company from now on to reduce isolated solutions and increase engineering efficiency.

This is the goal defined by Dr. Gehringer: "We know that we have the right take on digitalization if the client approaches us with an order and we can configure it within two days on-site, so that processes and modules are defined and we can get started with the development process very soon." The digital twin plays an important role in this process.
The design makes the difference

**Pharma: An intuitive and efficient workflow is made possible thanks to the user-friendly HMI design of the XT 600 tablet press from CaderaDesign GmbH and Korsch AG.**

What began with the era of smartphones and tablets has now worked its way into machine control systems: a modern multi-touch display and targeted usability engineering aims to make operating machinery as easy as possible for all users. One prerequisite is a well-thought-out operation and navigation concept that precisely meets the needs of diverse users and supports them in all their processes. Other important aspects are a consistent interface, a navigation system that is easy to follow, icons that are easy to remember, and uniform shapes and colors. Design agency CaderaDesign, founded in 1992 and based in Würzburg, Germany, specializes in user-friendliness and aesthetics in the conception and design of products, user interfaces, HMIs, software, and icons.

**A modern machine concept for top performance**
The Berlin-based Korsch AG, a manufacturer of tablet presses for the pharmaceutical industry since 1918, relies on CaderaDesign’s long-standing expertise. Korsch is reknown in the industry for its in-depth know-how as well as its extensive and innovative product range. One particular highlight is the XT 600 high-speed double-rotary press, which manufactures large batches of single- and bilayer tablets at maximum output and productivity: it can produce over 1,000,000 single-layer tablets and up to 306,000 bilayer tablets per hour. To ensure flexible, high-speed production, the machine is equipped with a new type of exchangeable turret technology and uses a completely new, state-of-the-art Simotion control system.

**Even better performance with innovative visualization**
When it comes to machine operation, the manufacturer relies on innovative technology, too. Korsch opted for a combination of an industrial PC and multi-touch-capable industrial monitor for visualization. The efficient Simatic IPC427D Microbox PC was specifically developed for use in industry, and,
thanks to its compact design, can even be used for machine applications. The Simatic WinCC V13 Runtime Advanced visualization software runs in the TIA Portal environment on the IPC. Visualization is output on a Simatic IFP1900 Industrial Flat Panel monitor with a scratch-resistant, anti-reflective glass front, which can be operated using up to five fingers and gestures thanks to its PCT (projected capacitive touch) technology. This allows operating the machine by swiping, zooming, and scrolling. The monitor automatically detects non-gestures like the heel of the hand, dirt, and water droplets and provides for efficient and rapid operation even when wearing thin work gloves.

**The right design for intuitive operation**
CaderaDesign undertook the design of the touch-based user interface in close collaboration with Siemens. One particular challenge was the high level of usability and user experience design required. This meant taking controls and interaction concepts that users are familiar with from other systems or from their smartphone or tablet into consideration – and reinterpreting them appropriately from a designer’s point of view. An operator’s activities and primary tasks when working with Korsch’s tablet presses needed to be incorporated as intuitively as possible in the interface. The result was a main and subnavigation display, which is structured according to user level. At the heart of this concept is a precise chronological sequence of recurring activities in the production process, including the setup menu for accessing production preparation activities, the home screen that shows all of the important production information, and the “batch end” menu, which is displayed once the order has been completed. When the operating concept was created, it was deemed particularly important for each interactive step to always take operators back to the home screen, allowing them to make amendments to the production process where necessary. This approach was implemented using context-dependent dialog boxes, which can be accessed from elements on the production screen.

**The design concept as an investment in the future**
The result of the new design concept is a high level of operating safety but low training demand. The context- and task-oriented approach and the process-oriented structure minimize the number of clicks. In the future, the design concept will be transferred to other Korsch AG machines, giving them another positive, pioneering, and unique selling point against their competition.

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1,000,000

single-layer tablets per hour and up to

306,000

bilayer tablets per hour can be produced using the XT 600 high-speed double-rotary press

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A pared-down design with state-of-the-art technology: the XT 600 from Korsch
Secure and gentle cartoning

**Non-food:** Econo-Pak’s specially tailored solution facilitates efficient and careful packaging of aluminum tubes into folding boxes – without deformations or marks caused by dropping. At the heart of this solution lies the innovative Multi-Carrier-System.

“Given the specific product requirements, we quickly became aware that we would not be able to achieve our aim with conventional solutions such as collators.”

Markus Zerbe,
Sales Manager at Econo-Pak
Top-quality shoe polishes in aluminum tubes have been one of the premium products offered by a globally leading household chemicals company for many years. In view of constantly growing demand, particularly from Eastern Europe, in mid-2016 the long-standing firm decided to move its existing production line, in the process not only increasing the line’s capacity from 70 to 120 tubes per minute, but also increasing its efficiency through the integration of a powerful cartoner.

**Each tube travels alone**
For Econo-Pak GmbH, the firm commissioned to design the cartoner, the response was clear from the beginning: everything hinged on maximum product security, and on developing a tailored solution for the logistics between the filling plant and cartoner. Maximum product security is required because the aluminum tubes of shoe polish demand particular care during packaging: there must be no dents or fingerprints affecting the shine of the tubes. Markus Zerbe, sales manager at Econo-Pak, describes the challenge: “Given the specific product requirements, the fact that we take the tubes from the filling plant, which has a 4-inch spacing configuration, and put them into the cartoner, which has a 6-inch spacing configuration, and the fact that there was to be no real buffer, we quickly became aware that we would not be able to achieve our aim with conventional solutions such as collators or robot-based portal systems.”

With this in mind, the specialists at Econo-Pak opted to construct a carrier system that lifts the tubes lying down, without any drop, and then synchronizes with the cartoner. It was quickly decided that the Multi-Carrier-System designed by Siemens in collaboration with Festo would be the best choice. First, because Econo-Pak has been working successfully with both companies for over 30 years. And second, because the Multi-Carrier-System gave packaging specialist Econo-Pak, based in the state of Rhineland-Palatinate, Germany, an opportunity to really utilize its expertise – for example, in the design of the material carrier, or the engineering. Zerbe confirms: “We were really just waiting for an opportunity to put the Multi-Carrier-System into action.”

**Horizontally into the box**
The core of the solution that has been created is a Simotion D 455 controller, which controls both the 36 linear axes of the Multi-Carrier-System and the 10 servo-axes of the cartoner. The linear motors and the Simotics 1FK7 motors used are controlled via efficient Sinamics S120 frequency converters. This makes it possible to control all movements within the system individually, highly precisely, and synchronously. The latest Multi-Carrier-System differs from previous versions in terms of its construction: rather than being combined with a conveyor belt, the material carriers hang at a 90-degree angle to the linear motor rail on a linear guide from Hepco. This design feature makes it possible for the tubes to be inserted into the upright, felt-lined material carriers on one level – at an angle optimized to suit the shape of the box. They are then accelerated to the speed of the cartoner, and finally pushed – with their lids facing forward – by a rod into the boxes, which are by this point moving in synchronization.

**Numerous uses**
Even during the initial test runs at the start of February 2017, the developers from Econo-Pak were won over by the system’s performance and precision. The error rate at a production speed of 120 tubes per minute is less than 1% – and decreasing. Zerbe believes that it will possible to achieve even higher cycle rates with Multi-Carrier-Systems in future. There is certainly no shortage of uses for solutions like this.

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The Multi-Carrier-System gave Econo-Pak the opportunity to utilize its expertise – for example, in the design of the material carrier.
Tonics for machine builders

Non-food: How can frequently changing products be filled, sealed, labeled, and packaged flexibly and cost-effectively on a single line? Answer: With the new Multi-Carrier-System (MCS) that Optima is deploying on a shampoo packaging line for the first time.

Custom products that are “personalized” by online configurators – along with their packaging, in small quantities down to a batch size of one – will be the rule rather than the exception in more and more industries in the future. The trendsetters in the packaging sector usually include manufacturers of cosmetics and pharmaceutical products. Because of the growing product variety, many operators want a continuous flow of materials, with smaller or preferably no intermediate buffers and minimum setup time.

Material flow is modularly optimized
For the transport tasks that are transforming these plants, Siemens and Festo implemented an innovative solution with their joint development of the Multi-Carrier-System (MCS). The MCS is a modular linear drive system that makes the transport of multiformat-capable goods or workpiece carriers more flexible and dynamic. The core components are primary parts available in several lengths, from which transport routes of any length can be constructed. The associated secondary parts are integrated into the carriers, which traverse both forward and backward. They are either controlled individually or in groups that can be changed from one motor segment to the next, depending on the process requirements. The carriers rest on secondary parts of the Festo linear motors and can be custom-designed, for example, to accommodate various guide systems or for meeting special hygiene requirements.
Performance on tried-and-tested basis
Siemens implemented the high-performance drive and control system for the MCS in just a few months. The already existing standards were crucial for this success: the motion control system Simotion, proven in many industrial applications, the closely matched modular Sinamics S120 drive system, and a patented software solution for high-end applications for precise control across motor segments (closed-loop mode with encoder) or carrier control (sensorless open-loop operation). Speeds of up to 4 m/s and acceleration of up to 50 m/s² are possible. Where the motion control is combined with special drive functions like Vibration Extinction (VibX), sophisticated control algorithms actively counteract the spillage of liquids during rapid acceleration and deceleration. The rapid cross-controller communication via Profinet with IRT (isochronous real time) in every case provides the shortest cycle time and therefore the highest (drive) performance.

The implementation of increasingly complex machine designs is simplified by the Mechatronic Concept Designer, a simulation tool from the Siemens software suite. It enables different production and material flow scenarios to be virtually compared and validated. By exporting the simulation results to the Simotion easyProject project generator, an executable machine program can be automatically generated and loaded directly into the motion control system.

The standardized hardware and software means that the Multi-Carrier-System can be combined with any established workpiece carrier system and subsequently expanded. The carriers can easily be inserted and removed as required, which significantly speeds up production changeovers.

Flexibility into the future
One of the first users of the Multi-Carrier-System in day-to-day production is Dr. Kurt Wolff GmbH & Co. KG, based in Bielefeld, Germany. The company fills, seals, and labels nearly 20 bottle formats of its Plantur 21, Plantur 39, and Alpecin shampoo series, with constant changes and in different groupings, using a system from Optima Consumer GmbH. The keys to achieving the required output of at least 120 bottles per minute were a detailed material flow analysis, the simulation in the Mechatronics Concept Designer based on that analysis, and the perfect cooperation of all partners involved in the project. The implemented Multi-Carrier-System comprises more than 100 MCS linear motors and more than 60 additional servo-axes synchronized to it in the (drive-based) motion control system at a total of nine stations. Now the plant is as flexible as required and, as the completely satisfied operator notes, bottlenecks in production, as were often the case with previous machine generations, are definitely a thing of the past.

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120 bottles output per minute with frequent product changes
4 m/s speed
50 m/s² acceleration

The motion control system Simotion and the modular Sinamics S120 drive system form the basis of the Multi-Carrier-System.
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