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Compact and exceptionally gentle filling of a wide variety of product containers



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Innovating the future of packaging together

Packaging machine manufacturers are constantly having to adapt to an ever-evolving set of trends; from artificial intelligence, predictive maintenance, and connectivity to resource efficiency, process reliability, flexibility, speed, cost pressure, sustainability, and cybersecurity. Technological progress no longer follows a linear path, but rather moves forward in exponential leaps. What was seen as a bold pilot project yesterday is now just a basic requirement for competing in global markets. In this environment, the crucial question for mechanical engineering is no longer just about functionality, but about how to create an architecture that can keep pace with this continuous evolution.

At Beckhoff, our mission is not simply to supply components, but to give our customers the freedom to innovate. We believe the answer to increasing complexity lies not in ever more complex subsystems, but in radical simplification and the centralization of intelligence instead. That is why the philosophy behind PC-based control is more important today than ever before, as it provides the stable foundation that makes all of these trends workable in practice.

When we talk about vision, artificial intelligence, or a combination of the two, we are not referring to isolated black-box solutions, but rather the seamless integration of these algorithms directly into the real-time control system. This not only enables simplified engineering without the hassle of a tool patchwork, but also ensures perfect synchronization of the entire machine. This synchronization forms the basis for precision at high speeds and makes a significant contribution to the quality of the end product.

Balancing resource efficiency and sustainability with increasing cost pressure presents a real paradox for many manufacturers. This is exactly where our system solutions make a difference. With the MX-System, we have fundamentally redefined the control cabinet and, in many applications, eliminated the need for it altogether. This cabinet-free automation approach reduces system footprint and lowers environmental impact through reduced

Daniel Rostan,
Global Business
Management Packaging,
Beckhoff Automation



material usage and energy consumption, while also significantly accelerating installation and commissioning. It is a prime example of how technological excellence can drive both economic efficiency and the transition to a modern circular economy.

Speed must no longer come at the expense of flexibility. With ultra-fast EtherCAT communication and the precise motion control of our XTS and XPlanar product transport systems, we deliver flexibility down to a lot size of one – without sacrificing throughput.

Ultimately, this all goes beyond technical specifications. It is about the partnership between Beckhoff and you – the engineers and visionaries shaping machine building. We understand the pressure your industry is under: faster cycles, more sustainable packaging, and smarter machines, all while margins continue to tighten. Our role is to give you the support you need. We deliver the technological sovereignty that allows you to respond calmly to every new trend, safe in the knowledge that your control platform will grow with your requirements.

In the following articles, we showcase pioneering applications that demonstrate how challenges can be turned into competitive advantages. We invite you to continue pushing the boundaries of what is possible together with us! Even though there is no end in sight to emerging trends, one thing remains constant: the innovative strength of a community that sees technology as the solution to the pressing challenges of our time.

I hope you enjoy this inspiring read and look forward to shaping the future of the packaging industry with you.

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www.beckhoff.com/packaging

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The AM8100 servomotors with One Cable Technology (OCT) can be integrated into the labeling area to save space.

When developing its weLABEL labeler, packaging machine manufacturer Weber Food Technology faced the challenge of finding the most compact possible way of executing dynamic and precise motion sequences. It successfully achieved this with the help of compact drive technology from Beckhoff, which minimized the installation space, the load that needed to be moved, and the installation requirements.

Compact drive technology for a labeler used with food packaging

Flexible, dynamic labeling using servo technology in a terminal format

Compact drive technology for a labeler used

Flexible, dynamic labeling using servo technology in a terminal format

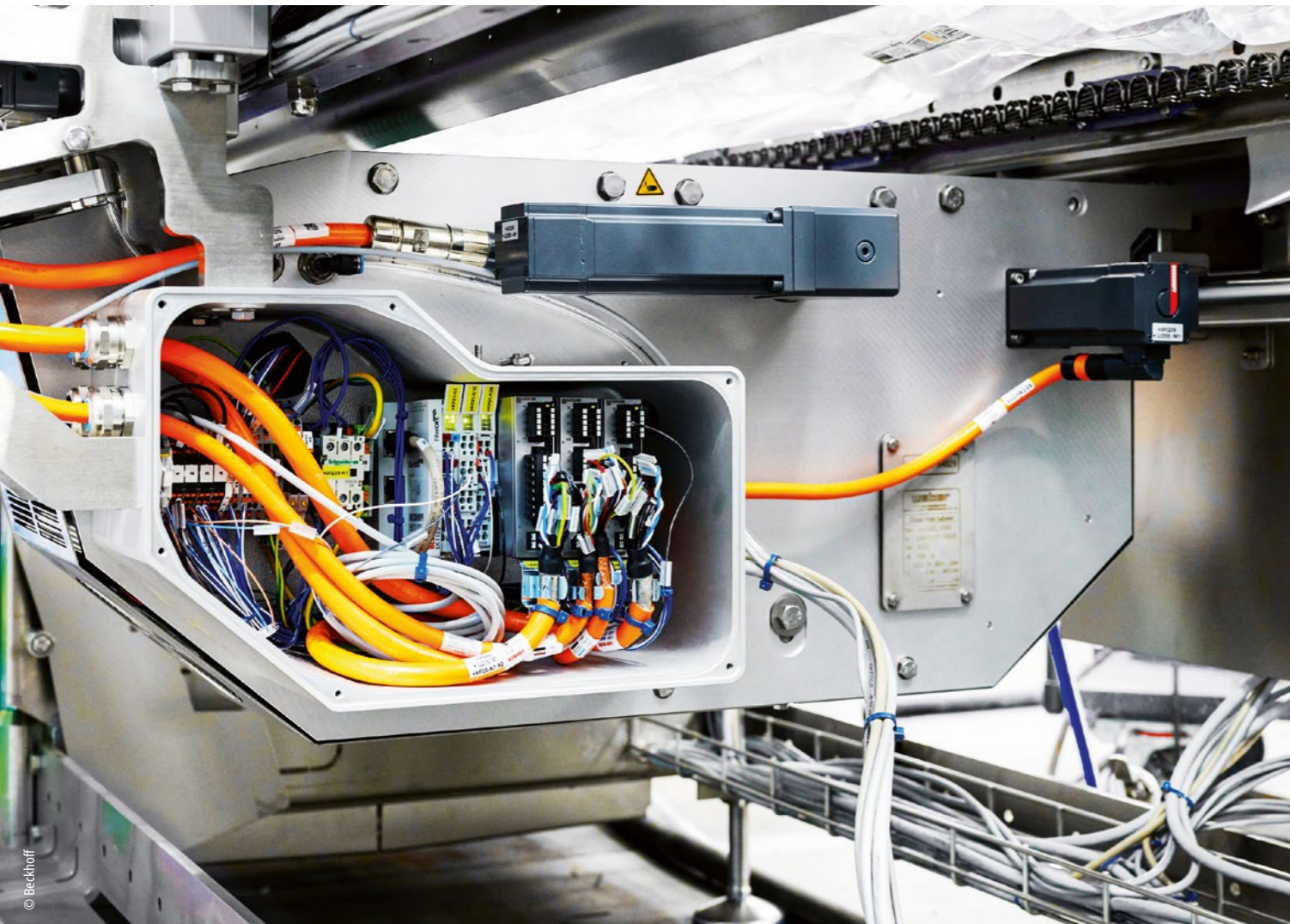
In 1981, Weber Food Technology was founded in Breidenbach, Germany, and today employs over 2,100 people worldwide. It is a leading system provider for slicing applications in the food processing industry. As Michael Brandt, Managing Director Technology at Weber, explains: "We develop complete slicing and packaging lines that cover everything from weight-accurate slicing to precisely inserting and packaging sausage, meat, cheese, and vegan substitute products. We are dedicated to ensuring our systems meet high quality standards – something that is reflected in our consistent Made in Germany philosophy, for example, and our high vertical range of manufacture, which reaches over 80%." Martin Grünkemeier, Group Manager for Labeling and Printing, adds: "A good example of the integrated, flexible nature of our solutions is the weLABEL labeler that we have added to our portfolio. It can be flexibly adapted to each customer's requirements – not only does it offer a lot of versatility through the possibility of combining four labelers with a Weber thermoforming packaging machine, but it can also be used with packaging machines from third-party suppliers."

Flexible labeling tailored to specific applications

Each labeling process is based on the specific needs of the application. This may mean that one bottom-web and one top-web labeler are enough, or two of each can be used in a fully expanded version for optimized processes. Using four labelers avoids the kinds of machine downtimes caused by replacing an empty labeler roll, for example. The same goes for high-speed

systems, as two weLABEL systems can share their labeling tasks – meaning that the roll can be changed without any downtime and at only a slightly reduced cycle rate.

A weLABEL labeler consists of a dispensing unit (with or without a printer), an applicator, and a longitudinal traversing unit. It provides four axes of movement, excellent positioning accuracy with flexible positioning, high acceleration of up to 60 m/s², and – when combined with a thermoforming packaging machine – an output rate of up to 192 labels per minute. The associated process sequence starts by feeding in the label rolls using reel discs and then, if required, running them through a printer. A dispensing edge is then used to separate the labels from their backing material, and the labels are transferred from the dispensing unit to an applicator. The backing material is wound up and conveyor belts transport the individual labels on the bottom web carrier below the packaging and on the top web carrier above the packaging. The labels are then pressed onto the packaging using a lifting unit actuated by servomotors. Martin Grünkemeier adds: "A special feature of the weLABEL is the use of spring pins in the process of pressing on the labels, something that allows the system to accommodate different packaging shapes and sizes – especially since the spring pins can extend by as much as 35 mm. This means that there are no issues with labeling uneven surfaces or sloping packaging bases, and the necessary contact pressure is applied at every point."



Compact control box of a bottom-web labeler with servomotor EtherCAT Terminals from the ELM series and, alongside these, Beckhoff AM8100 servomotors

Compact drive technology saves space and lightens the load

Michael Brandt believes that the modular, highly compact weLABEL design is crucial: "Each labeler has a small control box for the control technology it needs. The compact 48 V drive technology from Beckhoff, with ELM7222 or ELM7231 servomotor EtherCAT Terminals and AM8100 servomotors, is ideal for saving installation space and keeping the load to be moved as small as possible. This combination also has a great price-performance ratio and delivers full-scope servo performance, which is essential for the high levels of accuracy we need." In addition, he says, this highly demanding application can be controlled with four labelers and, therefore, 16 axes, using the C6015 ultra-compact Industrial PC, which measures just 82 x 82 x 40 mm and is equipped with sufficient interfaces. If demands become even greater in the future, it will be possible to benefit from the extensive, finely scalable Beckhoff IPC portfolio.

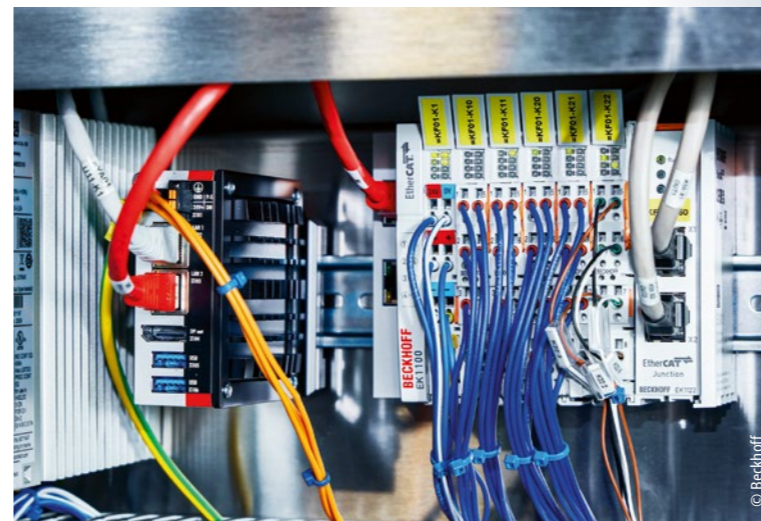
The compact design with minimal load makes it possible to move the labeler much more dynamically than a version with conventional drive technology. The maximum permissible speed is also higher as a result of the reduced kinetic energy. For Martin Grünkemeier, there are three other essential features: firstly, the small control box that moves with the vehicle, avoiding long

wiring and complex drag chains. Secondly, Beckhoff One Cable Technology (OCT) is a useful addition in that it reduces installation space, minimizes installation work, and prevents sources of error as there are fewer connectors and associated openings in the control box. Thirdly, there is the outstanding 48 V servo technology – which incorporates not only integrated TwinSAFE Safe Motion, but also the servo properties themselves, which prevent the need for reference runs after label rolls have been changed, for example.

Dirk Bauerfeind, Beckhoff Global Key Account Management, points out another advantage: "With compact drive technology, the 48 V supply also acts as a DC link via which energy can be transferred between the axes. This significantly minimizes the need for energy output through the braking resistor." Martin Grünkemeier also confirms this: "In this labeling application, many movements take place in parallel, which means that energy is simultaneously consumed during acceleration and released during braking, and can be used regeneratively. Without this function in the 48 V supply, a significantly larger DC link capacity would be required or we would end up with heat losses of the same magnitude through the braking resistors." Michael Brandt adds: "We also benefit from the special epoxy resin coating on the



The packaging machines can be flexibly equipped with up to four weLABEL labelers (one top and one bottom web carrier in this case) as required.



Little space required, even in the control cabinet: the C6015 ultra-compact Industrial PC and the EtherCAT I/O level

AM8100 servomotors and the corresponding motor/gearbox combinations, as the labelers are also used in areas with strict hygiene requirements and therefore need to be able to withstand cleaning processes."

Flexible control software and hardware

The software and hardware in Beckhoff control and drive technology feature flexibility, modularity, and universality. As a holistic software platform, TwinCAT 3 offers a wide range of functions for efficient labeling processes – from motion control and the event logger for diagnostics to communication interfaces such as the JSON Data Interface. Added to this, Martin Grünkemeier says, is the system-integrated safety technology: "Direct safety integration allows for a more flexible machine safety concept as well as separate smaller safety projects. These are implemented with TwinSAFE and the ELM terminals Safe Limited Position (SLP) and Safe Limited Speed (SLS). Used in conjunction with a safety laser, this makes it possible to implement area detection, which ensures the labeler reduces its travel speed when someone enters zone 1 and stops when someone enters zone 2. What makes this feature really special, and something unique to the market, is that the system continues to run immediately after the safety zone is exited."

Michael Brandt,
Managing Director Technology

“ The compact 48 V drive technology from Beckhoff is ideal for saving installation space and keeping the load to be moved as small as possible.”



The two Weber experts – Michael Brandt, Managing Director Technology (center), and Martin Grünkemeier, Group Manager for Labeling and Printing (right) – plus Dirk Bauerfeind (left) from Beckhoff Global Key Account Management

EtherCAT also offers the outstanding flexibility that is required, according to Martin Grünkemeier. He adds that the free approach to topologies allows for a mixture of star and ring topologies, and the wide range of EtherCAT I/Os is useful for implementing the labeling functions that are required. A good example he mentions is the EL2258 8-channel digital output terminal, which serves as a cam switch for outputting printer start signals.

More information:
www.weberweb.com
www.beckhoff.com/compact-drive-technology

XTS on a flexible packaging platform for the pharmaceutical and cosmetics industries

Compact and exceptionally gentle filling of a wide variety of product containers



Two precisely synchronized XTS movers combine to form a gripper that enables especially gentle container transport.

Rotzinger PharmaPack designed its VarioFill filling and capping platform to meet three key customer requirements: high flexibility to accommodate a broad product range, a highly compact machine design, and especially gentle, impact-free handling to ensure even the most sensitive containers can be filled. The core element – and foundation for this high-performance system concept – is the XTS linear transport system from Beckhoff.

Rotzinger PharmaPack in Waiblingen specializes in turnkey packaging systems for the pharmaceutical industry and increasingly for the cosmetics industry, too. As Product Manager Michael Gensheimer explains, "Our new VarioFill system in particular is especially well suited to filling creams and lotions, thanks to the exceptionally gentle product handling provided by XTS." As a member of the Rotzinger Group, the company also benefits from the Group's broad application expertise across a wide range of projects. If required, VarioFill can moreover be expanded with the pickFeeder container infeed and unscrambling system from Spanish sister company Packfeeder, which is likewise based on XTS.

VarioFill was designed with a highly flexible platform in mind for filling a wide variety of products and capping the corresponding containers. It is designed for non-prescription, non-aseptic pharmaceuticals such as nasal sprays and eye drops, as well as for liquid and solid products from the cosmetics, personal care, and food industries. Michael Gensheimer highlights one particularly important aspect, "VarioFill combines a very high degree of flexibility with the smallest footprint currently available in this segment of primary packaging."

Complex process sequences in an ultra-compact design

The process begins with container supply, integrated as the appropriate infeed solution for the application in question – for example, upright glass bottles or plastic bottles in bulk. This is followed by an air-rinsing module that uses filtered air and vacuum suction to ensure thorough, hygienic cleaning inside each container to be filled – usually small bottles. The containers are then filled either with liquids or with products in solid oral dosage form:

- For precise filling of liquid products with viscosities ranging from low to high and fill volumes from 1 to 160 ml, the filling station can be equipped with various dosing technologies, such as rotary piston or hose pumps, using tool-free quick-change nozzles. To ensure maximum product integrity, the containers are also purged with nitrogen before filling, reducing oxygen exposure and thereby preventing oxidation and spoilage.
- For products in solid oral dosage form, such as tablets, coated tablets, and capsules, one or more counting modules can be integrated. Fast, tool-free format changes are also possible here, and multiple capping units can be incorporated while maintaining the same compact footprint.

The filling process is fully monitored by in-process control. As Michael Gensheimer explains, the XTS linear transport system also allows a checkweighing function to be integrated in an exceptionally compact design: "XTS transfers the containers to a short conveyor belt with an integrated weighing function both before and after filling. This makes it possible to reliably verify the correct fill quantity for each individual container. It also highlights a major advantage of XTS, in that the movers remain uniquely identifiable in the control system throughout the entire product transport process. This means that each individual container and its correct filling can also be traced reliably. XTS also enables precise synchronization with the conveyor belts of the weighing unit, making it possible to implement an extremely compact scale."

Once the containers have been filled correctly, they can be fitted with the appropriate type of caps or lids at one or more freely configurable capping stations, depending on the application – including snap-on, screw, pump, and crimp closure. Here, too, flexible product transport with XTS offers clear advantages according to Michael Gensheimer, since the movements of the capping head are significantly more efficient than with conventional container infeed systems such as screw conveyors. XTS is the heart and pace-setter of the system, he adds, because it allows the individual machine modules to be operated in the optimum way for each filling order. This results in high overall efficiency and, in turn, maximized system output.

Together with the special capping process, which is based on one capping station each for placement or snap-on application and for additional crimping or screw-on closing, XTS makes it possible to achieve a machine design with a minimal footprint. As Michael Gensheimer explains, "A system in conventional design would be about twice as long as our VarioFill."

Flexible and gentle container handling with XTS

The modular transport system from Beckhoff allows VarioFill to be tailored precisely to specific customer requirements. Configured as a closed oval, the system can be extended to the required length in increments of 50 cm – with twelve movers per segment – typically ranging from 1.5 to 4 m. Beyond this flexibility, Michael Gensheimer sees another major advantage in the fact that XTS enables impact-free and therefore exceptionally gentle transport of a wide



Customer-specific configuration of the VarioFill filling and capping system with a 3.5 meter XTS system

variety of container geometries, "Conventional handling via conveyor belts or screw conveyors would pose a risk of scratches and other damage, especially with glass vials, due to the containers bumping into one another. XTS eliminates this completely, because the containers are picked up gently and with defined pressure by the gripper – implemented with two synchronized movers – and reliably separated."

Michael Gensheimer adds that changeovers for product switches are much faster than with conventional systems, since they can be implemented easily via software and, if necessary, only the gripper elements need to be replaced. He also sees a further advantage in Beckhoff's PC-based control technology, in that it simplifies the database integration used to store the comprehensive process data in a monitoring database.

PC-based control as a modular, integrated system

As Michael Gensheimer explains, PC-based control gives Rotzinger PharmaPack the advantage of being able to integrate all required functions in a modular way, "In addition to universal PLC and motion control, TwinCAT also enables real-time communication, TwinSAFE, and data acquisition and analysis in one consistent, high-performance, and highly flexible system. This modularity and system openness also extend to the broad range of control hardware."

A CX2072 Embedded PC serves as the control system for VarioFill, complemented by a C6030 ultra-compact Industrial PC and a CP3918 multi-touch Control Panel for HMI functions. If requested by the customer, a C6015 ultra-compact

Industrial PC can also be used where a separate device for remote access to the system is required. At the I/O level, Michael Gensheimer highlights the IP67 EP series I/O box modules, which can be used decentrally and, with their wide signal variety, cover all I/O requirements.

The AX8000 multi-axis servo system controls the rotary servo axes via Beckhoff AM8000 servomotors featuring One Cable Technology (OCT) designed to save space and materials. Depending on the system configuration, this makes it possible to implement around 20 to 40 axes, for example for rotating the containers during air rinsing, operating the grippers, and performing other movements within the various workstations.



Michael Gensheimer, Product Manager at Rotzinger PharmaPack, explains, "XTS is the heart and pace-setter of the VarioFill filling and capping system."

More information:

www.rotzinger-pharma.com
www.beckhoff.com/xts



Transfer of containers from XTS to one of two checkweighing systems for inline fill quantity control



One mover each from the upper and lower XTS systems of the upstream pickFeeder infeed system forms the gripper for transporting the containers to the air-rinsing station.

A C6032 ultra-compact Industrial PC controls the entire handling unit of the pouching machine.

XTS Hygienic in food packaging

Intelligent, flexible product transport for washdown applications

Syntegon has been benefiting from Beckhoff's intelligent linear product transport for more than ten years, with advantages including a reduced machine footprint, user-friendly software functionality, and greater system flexibility. With XTS Hygienic, these advantages now also extend to washdown-capable Syntegon pouching machines for packaging frozen cookie dough.

Syntegon is a leading global technology company and strategic lifecycle partner to the pharmaceutical, biotech, and food industries. Rolf Steinemann, Senior Product Manager Packaging Systems, explains, "With around 6,900 employees at 47 locations and 160 years of tradition behind us, we position ourselves as a strategic lifecycle partner to our customers. Our actions are guided by our motto 'CoCreate. CoSucceed.' We work closely with our customers to create targeted solutions that deliver measurable results. Syntegon's site in Beringen, Switzerland, specializes in automated high-performance packaging systems. The first highly flexible, high-performance XTS linear transport system from Beckhoff was integrated into a Syntegon packaging system back in 2014. This represented a real innovation with tangible customer benefits, including a smaller system footprint, high format flexibility, and fast changeovers when switching products."

XTS Hygienic as a central handling element

With XTS Hygienic – featuring an IP69K protection rating when assembled and a hygienic design with no concealed edges or undercuts – Syntegon has now also been able to bring these advantages to a customer project with particularly stringent hygiene requirements. As a central machine component, XTS picks up the frozen cookie dough portions and feeds them into the horizontal flow wrapping machine with maximum positioning accuracy. Pascal Röhlk, Senior Manager Software/Electrical Design Handling at Syntegon, explains how important precise positioning is for the packaging process when products arrive at different spacings and in different orientations: "The products must be positioned exactly in line with the film print so that the sealing tools can seal the film between the products and ensure the specified shelf life."

The XTS movers not only enable precise positioning of the frozen cookie dough portions, but also exceptionally gentle transport.





Rolf Steinemann, Senior Product Manager Packaging Systems at Syntegon, says, "Another important factor in favor of XTS is its exceptionally gentle handling."

A C6032 ultra-compact Industrial PC serves as the controller for the product handling process and also ensures the precise positioning of the frozen cookie dough portions during transfer to XTS. For this purpose, a total of three AM8800 stainless steel servomotors – featuring a hygienic design like XTS – are controlled via the AX8000 multi-axis servo system. These drive the infeed belt and two additional conveyor belts supporting the transfer process, and keep the products moving at a constant speed while they are picked up by the XTS movers, also ensuring gentle handling. The position of each individual dough portion is known based on the respective axis positions, allowing the movers to be positioned accordingly for product pickup. XTS then forms a buffer section in which the continuously arriving products are transported onward at precisely defined spacings while compensating for any variations. During transport, the dimensions of the products – specifically the length and height of the dispensed cookie dough portions – are also monitored, with defective items rejected via an air-blast unit.

Pascal Röhlk adds, "When the individual products are transferred to the sealing unit of the pouch packaging machine, a key advantage of XTS is that the mover speed can be easily matched to the speed of the sealing film. This allows us to achieve precise synchronization of the two motions at the point of contact. The movers then return to their starting point as quickly as possible so that enough movers are always available for the products that follow." Rolf Steinemann sees



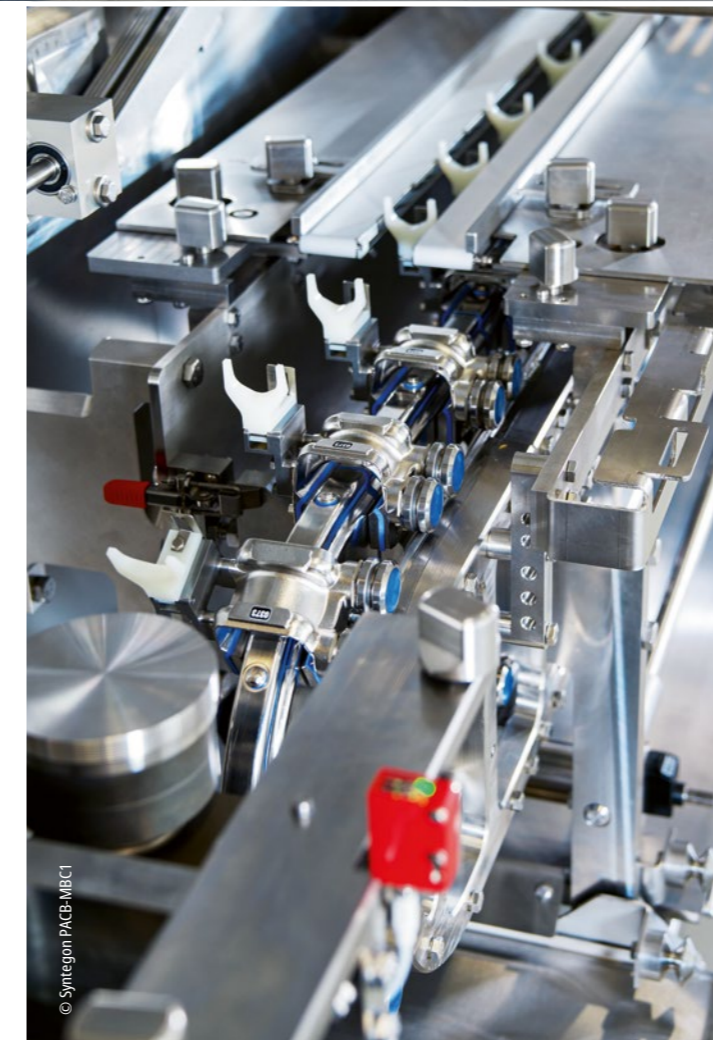
Image below: Detailed view of the XTS version featuring IP69K protection (when assembled) and a hygienic design without concealed edges or undercuts

The XTS Hygienic linear transport system is key for the handling capabilities of Syntegon's horizontal flow wrapping machine in washdown design.

another advantage in PC-based control technology from Beckhoff: "TwinCAT enables seamless synchronization of all motion functions, even across multiple control systems. In the handling unit, this synchronization extends not only to the product and film infeed and the XTS, but also to the rotary servo axes. The same applies to interaction with the machine's primary control system. This ensures independence from machine speed, allowing the central product handling functions to adapt precisely to an accelerated or decelerated main machine axis."

Compact, modular, easy-to-clean product transport

Compared with conventional infeed solutions, the XTS system used in the current flow wrapping machine for frozen cookie dough is extremely compact, featuring a closed oval design with a 4-meter track circumference, a system length of 2.5 meters, and 22 movers. According to Pascal Röhlk, XTS offers major advantages not only because of its compact dimensions, but also through its modular scalability: "Thanks to XTS, the current Syntegon system is around 30 to 40% shorter than conventional conveyor-belt solutions. XTS can also be optimally adapted to specific performance requirements. In standard applications, we use between 22 and 36 movers. But if required, we can also implement greater XTS track lengths and even more movers with minimal re-design effort. This flexibility also applies to the individual machine, since new product formats can be handled with ease through software configurations.



Pascal Röhlk, Senior Manager Software/Electrical Design Handling at Syntegon, explains, "Thanks to XTS, the current Syntegon system is around 30 to 40% shorter than conventional conveyor-belt solutions."

If no major modifications to the flow wrapper are required, the machine can often even be reconfigured remotely."

Syntegon draws on experience from 350 standard XTS applications and is also leveraging the advantages with XTS Hygienic in washdown applications, where packaging processes involving allergen-containing or sticky products place particularly high demands on the system. Rolf Steinemann explains, "In addition to the more demanding cleaning requirements, extensive documentation and therefore reliable traceability are also required in some cases. This can be handled very effectively with PC-based control technology from Beckhoff. Another beneficial feature of the XTS is exceptionally gentle handling. Products such as cookies or crackers are delicate and break easily. Transport via XTS movers has proven ideal in that regard, increasing overall machine uptime and significantly reducing waste."

A collaborative approach to application-oriented solutions

Rolf Steinemann confirms that a close, collaborative partnership contributes significantly to the implementation of solutions for Syntegon customers, "Mutual exchange and support are especially important when developing new solutions. In the case of XTS in 2014, this worked right from the start, thanks primarily to our close contact with Beckhoff Switzerland, but also with product management at the company's headquarters in Verl. We also benefit from Beckhoff's short innovation cycles, which open up further optimization potential for the future. Prime examples include the TwinCAT Automation Interface, the MX-System for control cabinet-free automation, and the economy drive system with AX1000 servo drives and AM1000 servomotors."

More information:

www.syntegon.com

www.beckhoff.com/xts-hygienic

XPlanar on a filling and capping line for cosmetic products

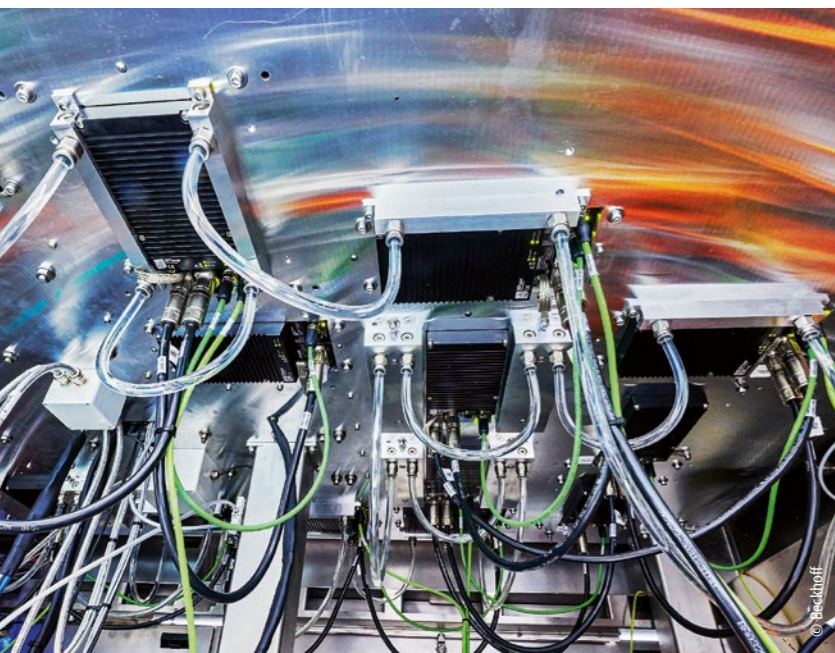
From line to compact block layout with intelligent product transport

Space constraints in production environments, leaving no room for traditional system concepts, call for creativity and PC-based control. Along these lines, Pro Pharma Automation and Glanzer cosmetic engineering have created an innovative filling system with XPlanar and TwinCAT – a solution which, according to Managing Director Sigrid Glanzer, is going to set a benchmark in filling and designing multi-component cosmetics.

Right: A C6670 industrial control cabinet server (right) coordinates all machine processes – using the AX8000 multi-axis servo system (left), among other things.



The track management and collision avoidance features in TwinCAT 3 XPlanar prevent the XPlanar movers from causing accidents within the small space and ensure they approach the process stations with high precision.



View under the machine frame: The water cooling for the aluminum baseplate adheres to the temperature specifications for the cosmetic products being dispensed.



XPlanar increases the flexibility of the filling and capping line from Glanzer cosmetic engineering and Pro Pharma Automation to a high degree.



Sigrid Glanzer (Glanzer cosmetic engineering) with a filled jar, plus Gerhard Holzer and David Kittl (both Beckhoff) with Walter Steinauer, Hellwig Mallinger (both Glanzer cosmetic engineering), and Christian Haslmair (Pro Pharma Automation) in front of the filling line (left to right)

Glanzer cosmetic engineering has been producing cosmetic products for international brands and retailers for over 90 years. Around 100 employees develop, produce, dispense, and package high-viscosity oils, emulsions, creams, and liquids on a total of ten lines. "As the leading contract manufacturer in Austria, we offer a full service in the cosmetics sector, from product development and production according to product specifications to filling and packaging," says Managing Director Sigrid Glanzer. The challenges that the company faces lie in increasingly shorter product life cycles and, in some cases, highly dynamic variations in production batches. It also has to cater to trends such as multi-phase filling and customized patterns in jars. "Things get pretty creative in cosmetics," confirms Walter Steinauer, Plant Manager and co-owner of the company, which is certified to the IFS HPC and GMP for cosmetics standards.

To meet the requirements of an increasingly dynamic market, a new filling and capping system was designed together with machine builder Pro Pharma Automation in Elsbach, Austria, which specializes in the pharmaceutical and cosmetics industries. The biggest priority in the project was achieving flexibility in jar sizes, process flows, and product ranges, which demanded a completely new approach to the production line. For Pro Pharma, things were complicated further by the limited space provided by the existing production line for high-end cosmetics, an area subject to strict hygiene requirements. "We're talking about a footprint of about 3 x 1.8 m – barely a line, really," says Christian Haslmair, Managing Director of Pro Pharma Automation, outlining the concept.

XPlanar – a compact, scalable solution

The filling system is based on the XPlanar planar motor system from Beckhoff. "Where the system really stands out is that it maximizes the space available and has a customizable layout," states Walter Steinauer. This means that it can accommodate much more stations within a smaller area than systems with conventional conveyor belts can. In addition, the XPlanar movers support

an entirely free process flow decoupled from the mechanical design. Thus, depending on product specifications, individual stations in the process can be omitted or run through several times. Systems with XPlanar can also be scaled to almost any size by parallelizing individual stations and adding more movers. "The current layout with 20 XPlanar tiles and 16 movers is designed for around 30 units per minute," says Christian Haslmair.

A total of 13 process stations and three robots were accommodated in a very confined space. The first robot takes the jars from the infeed and places them on the XPlanar mover in the transfer area using special brackets, which secure the jars in exactly the right place. The brackets are also automatically released before the robot inserts the jars. The next step is the extraction or blow-out station, which ensures that there are no particles or cardboard residue in the jars. Next is the filling process: Glanzer has the option of filling the jars with two components at the same time or just one. When it comes to product dispensing, Pro Pharma relies on servo-controlled auger fillers instead of piston fillers, traditionally a popular choice. "They allow us to dispense highly viscous liquids and water-based emulsions, and withdraw or add more if necessary," says Christian Haslmair.

Mover rotation and precision generate USP

As Glanzer cosmetic engineering intends to add small flacons to the containers it fills in the future, it relies on precision. "We need a positioning accuracy of 0.1 mm," says Walter Steinauer. "XPlanar boasts far more precision, thanks to its position resolution of 1 µm and typical repeatability of 5 µm," says David Kittl, who works in sales at Beckhoff Austria, explaining another function that the solution provides. For products with two components, the mover can rotate the jar in sync with the dispensing process. "This results in a beautiful spiral pattern in the different components, something that gives our customers an opportunity for product differentiation and catches the consumer's eye at the

point of sale," says Sigrid Glanzer of this attractive system feature. "PC-based control and XPlanar certainly don't place any restrictions in the way of creativity in the cosmetics industry," confirms David Kittl.

After filling, the next stage is a sealing and closing station involving a second robot and its special gripper mechanism. The brackets and precise positioning of the movers are crucial in this process. "If the jars are not exactly centered, the robot cannot position the lid correctly, which makes screwing it into place properly almost impossible. There isn't much room for error here," says Walter Steinauer. Finally, the movers proceed to the third robot, which places the filled jars on a conveyor belt for final inspection.

Everything under control with TwinCAT 3

TwinCAT 3 XPlanar (TF5890) coordinates all movements. "Even though there are several movers in a very confined space, the system's integrated track management and collision avoidance features stop them from bumping into each other," states David Kittl. Christian Haslmair relies on TwinCAT 3 PLC/NC PTP (TC1250), the AX8000 multi-axis servo system, and AM8000 synchronous servomotors to control process stations and drive axes, and to coordinate the robots. All these processes are carried out on a C6670 control cabinet industrial server, which also handles visualization and data acquisition during all production steps.

In the cosmetics and pharmaceuticals sector, it is important that process control and documentation comply with ISO 13485 requirements. This is why every APM4330 mover has an XPlanar ID bumper, which is used to read out the mover's individual serial number at all stations. With this information, each jar's journey through the system can be logged and documented if required – even after a power supply failure. In addition, there is no homing required at system startup if programming has been carried out accordingly.

Alongside operating smoothly, the system has to be easy to clean. This is where the XPlanar system offers clear advantages over other systems: the XPlanar tiles are mounted on an aluminum plate and covered with FDA-certified film without restricting functionality or accuracy. Pro Pharma has developed an intriguing solution for maintaining the specified processing temperatures for the cosmetics in the closed system. "We have installed a water cooling system on the underside of the work surface on the XPlanar electronics to keep the temperature in the system low," says Christian Haslmair. Cooling surfaces of different sizes are used to accommodate different tile sizes.

Small batches, short set-up times

With batches becoming increasingly smaller, set-up time is becoming a key factor in efficiency considerations. "If the next batch needs to be processed or a different jar size needs to be filled in three hours' time, we can't have a changeover process that takes half a day," summarizes Walter Steinauer. The two transfer stations make sure this is not the case – as does the largely automated product changeover process, which is initiated by the customer-specific CP3921 stainless steel multi-touch Control Panel and TwinCAT HMI. "It's still too early for exact figures, but we expect set-up time to drop by a third compared to our existing lines," states Walter Steinauer. Sigrid Glanzer is certain that the investment will pay off: "Our sales department is practically snatching the samples out of my hand so it can get them to our customers!"

More information:

www.glanzer.pink

www.pro-pharma-automation.at

www.beckhoff.com/xplanar

Seamless interaction between MX-System and control cabinet

Stunning space savings in a brownfield project

When integrating automated processes into existing production lines, machine builders often find themselves trying to reconcile steep functional requirements with a small installation space – a difficult task. This was the challenge that specialist machine builder Nordfels faced when developing a unique packaging application. It found the ideal solution in the MX-System from Beckhoff and the switch to a hybrid architecture enabled by it. The drive control system and 48 V supply are now decentralized at exactly those points where movement takes place, making it possible to reduce the volume of the control cabinet – and, therefore, the dimensions of the system.



Fitting lots of functions into a small space: the challenge faced by specialist machine builder Nordfels in the process of developing a new box sealer.

Bad Leonfelden, in Austria's northern region of Upper Austria, is renowned for its healing springs and spas – a tradition that dates back to the 17th century. However, the location is also becoming increasingly well-known for providing high-performance machine building solutions. Local company Nordfels has a role to play in this, positioning itself as a technology partner for sophisticated automation solutions and deploying advanced technologies.

Nordfels serves a wide range of industries, from aluminum and steel processing to the food and pharmaceutical industries, and all the way through to automotive and packaging applications. "Our customers come from many different sectors, but they have two things in common: they are predominantly based in the region and they rely on precise production processes with extremely high automation demands," explains Bernhard Hartl, Head of Automation at Nordfels. This background has equipped the company with an excellent ability to transfer its expertise to different requirements. "We are very good at mapping automation technologies onto whichever industrial sector we are working with," adds Matthias Mitterlehner, who is responsible for electrical design and control cabinet planning. "Technology from Beckhoff is a common thread through all the applications we handle. This allows us to focus on a single automation partner and means we're familiar with their portfolio, which usually speeds up the process of finding solutions."

With around 85 employees, Nordfels is constantly testing the limits of machine building. "We want to be at the forefront of automation," states Bernhard Hartl. This is clear, for example, from the way in which the company combines new technologies or uses artificial intelligence: it provided its first AI system in a production machine back in 2020. Now, Nordfels sees itself as more than just a machine builder – it is a business that forges software solutions for sophisticated automation.

A brownfield challenge

An ongoing project for powder coating manufacturer TIGER Coatings impressively demonstrates how new technologies can overcome the physical limitations of brownfield projects. Specifically, the project involves an automated box sealer designed to replace a previously manual process. The system takes bags filled with powder coating material in boxes from a filling station and carries out all the steps downstream of this fully automatically – from closing the inner bag and sealing the box to weighing, labeling, and palletizing. "The project has also involved various quality assurance stages," says Project Manager Hannes Stöllner. "For example, we have a device called Powder Thief that takes samples during the packaging process to verify the exact color of each powder coating batch." TIGER has set its sights high, with demands including end-to-end networking and real-time data transmission, a high level of modularity, and adaptive processes including intelligent quality assurance and cobot palletizing. The new machine also has to be integrated into an existing line, where space is extremely scarce.

To resolve this conflict of objectives, Nordfels is relying on the MX-System from Beckhoff, the scalable modular system for cabinet-free automation. "For us, it creates an ideal basis for thinking in logical function groups and implementing them in hardware enclosures," states Matthias Mitterlehner. "The automation technology is positioned exactly at the points in the machine where it takes ac-



The system carries out various process steps fully automatically – from closing the inner bag and sealing the box to weighing, labeling, and palletizing.

tion.” Nordfels has taken a hybrid approach to the system for TIGER. Although the machine still has a control cabinet, the dimensions of this have been more than halved compared to a conventional solution. The entire drive control system and the 48 V power supply have been moved from the control cabinet directly to the process. This was made possible from a technical perspective by two separate MX-System units: one in the lower structure and one in the upper part of the box sealer. The lower part of the machine transports the boxes, while the dust-protected upper part houses the sophisticated mechatronics for closing the inner bags and boxes.

Drive technology enclosed in a decentralized package

The two MX-Systems work as decentralized drive units in this application. In addition to providing control technology, they include power supply modules, power supplies, braking resistors, and I/Os. The upper baseplate supplies twelve servo axes, which drive multi-axis gantries, for example. Ten additional axes for conveyor and handling systems are controlled in the lower part of the machine. Nordfels consistently uses One Cable Automation (OCA) to integrate its motors, making it possible to transmit power, EtherCAT communication, and feedback signals via a single cable and standardized hybrid connectors. The interface on the control cabinet is also very slim, as the two MX-Systems each represent a single point for accommodating the 400 V AC supply, 24 V DC, and EtherCAT. Almost all the box sealer axes are moved by AM8000 series motors, ensuring the system behaves consistently. “We have even replaced some pneumatic axes with servo axes because energy efficiency is extremely important to the end customer, TIGER,” explains Hannes Stöllner. The safety architecture

is seamlessly integrated as well, with the safety functionality required for the axes being provided directly via the MX-System and FSoE.

A look at the remaining automation components in the control cabinet reveals a CX5330 Embedded PC being used for centralized machine control. Nordfels also integrated a C6030 ultra-compact Industrial PC as an edge server. Infrastructure packages, system visualization, and other software solutions – used for AI-based quality assurance, for example – run in a virtualized environment with a container architecture. Captured data is seamlessly integrated into the higher-level ERP system via REST API. Through TwinCAT and EtherCAT Terminals, Beckhoff supplies all the necessary interfaces for horizontal and vertical integration – from EtherCAT and PROFINET to IO-Link and OPC UA. A CP39xx Control Panel on a mounting arm is installed on the machine as an HMI.

Technology provides competitive advantage

For Nordfels, the decision to use the MX-System was strategic as well as technical. “The high standards we set for our own automation solutions mean that we’re always first in line when new technologies become available at Beckhoff,” says Bernhard Hartl. As the MX-System was still a new solution at the time of the project, Nordfels worked closely with the Beckhoff experts. Configuration was carried out using the MX-System Designer tool, which can also generate parts lists, CAD data, and EPLAN macros. “The tool gave us a quick way of implementing adjustments that we wanted to introduce later on,” confirms Thomas Oberreiter, MX-System Product Specialist at Beckhoff

in Austria. In future, the tool will also have a web-based platform that will offer users an independent way of planning their decentralized solution and system configuration for TwinCAT. “This will drastically reduce the amount of work involved in planning and project configuration,” says Thomas Oberreiter. A key benefit for Nordfels’ software developers is that project planning in TwinCAT is always the same, regardless of whether the hardware is being implemented in a control cabinet or in the form of the MX-System. This consistency underlines the fact that traditional control cabinets and the MX-System coexisting is not something atypical – instead, it is a use case that combines specific advantages of both worlds without the need for any additional engineering effort.

A blueprint for the future

The box sealer at TIGER Coatings illustrates how decentralized automation can solve many problems in machine building. The investment costs were on the same level as a conventional solution – but the added value for the end user is immense: significant space savings, robust design without having to handle air conditioning systems, excellent energy efficiency, and simplified maintenance.

“We also want to use decentralized architectures for other applications in the future, where it would be technically and economically efficient to do so,” summarizes Matthias Mitterlehner. Nordfels is already evaluating the next step for the box sealer: bringing automation fully to the MX-System, including an edge server. “The idea of an entirely cabinet-free machine is very exciting to us, so it’s only natural that we’re thinking about this route,” says Bernhard Hartl, looking ahead. “Our aim is to continue our linear growth rate so that we can keep adopting new technologies as early as possible in the future – an approach that works well with our recipe for success. With its exceptional culture of innovation, Beckhoff is the perfect partner to help us achieve this.”

All the control technology for the box sealer also comes from Beckhoff.

It includes a CX5330 Embedded PC, a C6030 ultra-compact Industrial PC, and a CP39xx operating panel in a mounting arm design.



Working together to achieve success: Thomas Oberreiter from Beckhoff and the Nordfels team: Thomas Ilk, Peter Horner, Bernhard Hartl, Matthias Mitterlehner, Hannes Stöllner, and Samuel Pflieger (left to right)



The MX-System mounted in the upper part of the machine controls twelve servo axes, eliminating the need for large control cabinets.



The tasks of the MX-System in the lower part include ensuring that the boxes filled with powder coating are transported smoothly through the system.

More information:

www.nordfels.com

www.beckhoff.com/mx-system

New level of flexibility in consumer goods labeling with XPlanar

Digitally printing products from blank to branded in seconds

The innovative Tesseract printing machine began as a sketch concept on a napkin after the engineers from Norwalt Automation had seen a demo of the XPlanar system from Beckhoff: Magnetically floating movers position printing parts with six degrees of freedom in motion. This allows a single print engine to cover a wide range of geometries, and changeovers to other formats are quick and easy via software.

For five decades, Norwalt Automation Group has engineered its success through custom machine automation. The third-generation, family-owned business with facilities in Randolph, New Jersey and Tampa, Florida serves several industries, including digital printing, packaging, pharmaceuticals, and food and beverage. The company's core strength lies in solving complex, custom automation problems for large CPG (consumer packaged goods) customers, often Fortune 50 companies. Especially the major brands are seeking faster regional product launches, seasonal releases, and reduced inventory risk.

From label to direct printing

Traditional printing methods with plastic and paper labels involve lengthy setup times, frequent manual interventions, and much larger amounts of material waste due to misprints or inefficient changeovers. Brands that wanted to experiment with limited editions, regional designs, or rapid promotional runs were typically forced to either outsource small runs to contract packaging companies or accept high sunk costs and long waits.

Norwalt saw the need to completely rethink how label-printing machines are designed – moving toward solutions that accelerate printing, minimize waste, and lower cost. The resulting approach is direct-to-object printing. “A lot of time, what happens in the CPG market is costs start shooting



A robot removes containers from the product carriers on the magnetically floating XPlanar movers when printing is complete.



Norwalt's advanced printing machines print labels directly on a variety of container dimensions and materials instead of traditional resource-intensive adhesive labels.

through the roof because you're ordering large reels of labels, you have to hold them in an air-conditioned unit, and it takes up a lot of space that could be dedicated to other manufacturing,” says Technical Sales Director Kyle Seitel. “When you move to direct-to-object printing, you're basically replacing label reels with ink. A bottle of ink goes a long way and doesn't need to be put in a special room. Lowering costs.”

Many direct-to-object systems are limited to a single geometry, however, and cannot handle tapered, irregular, or complex shapes without extensive mechanical fixturing. Norwalt's goal was to support a wide variety of geometries in one flexible machine, allow rapid software-driven changeovers, and scale throughput by adding modules as needed in the field.

Six degrees of freedom in printing

The direct-to-object printing solution that Norwalt developed is now known as the Tesseract, a modular machine built around the XPlanar intelligent transport system and PC-based control technology from Beckhoff. In geometry, a tesseract refers to a hypercube that extends a 2D square and a 3D cube into four dimensions and exhibits complex properties, especially when rotated. Norwalt's equally advanced Tesseract began as a sketch concept on a bar napkin after viewing a demo of the mechatronic motion capabilities of the

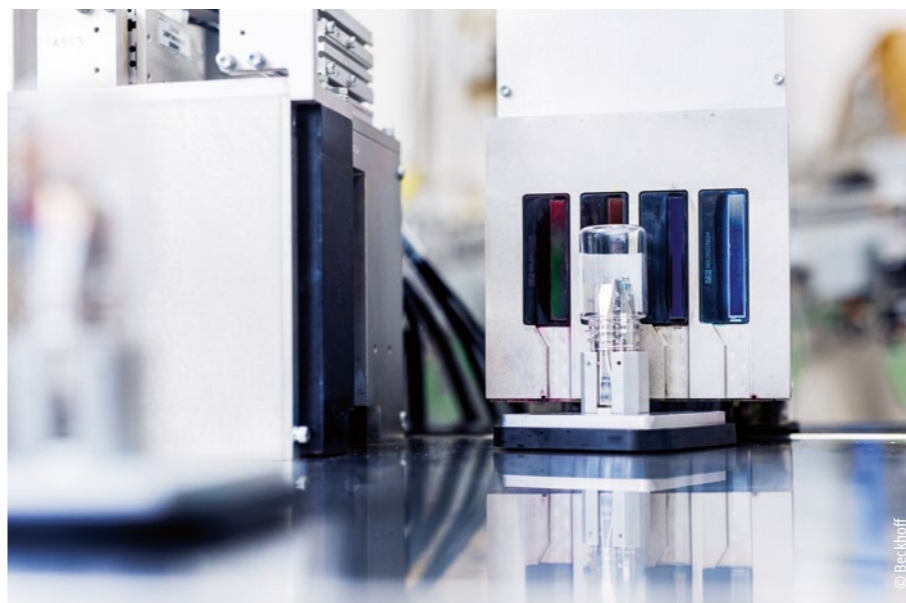
XPlanar system: Norwalt engineers imagined using the magnetic movers to dynamically position parts with six degrees of freedom so that a single print engine could cover many more geometries. They validated the idea incrementally by testing a small three-by-three array of XPlanar tiles with a single printhead and then scaling up by adding tiles and additional printheads as needed. This modular approach allowed Norwalt to quickly grow capacity in the field with minimal rework. “That's the real beauty of XPlanar - as we run out of room, we can just keep adding tiles,” says Kyle Seitel.

XPlanar flying movers and TwinCAT software running on a CX2062 Embedded PC provide the flexible, software-driven, adaptive part handling Norwalt required. Movers can rotate parts 360°, translate them in X and Y coordinates, and even adjust Z height up to 5 mm, so even complex geometries are moved optimally around the printheads for high-quality labeling. With six degrees of freedom in motion, XPlanar ensures consistent printing results down to the sub-millimeter. The containers are loaded and unloaded onto the levitating XPlanar movers by a robot arm.

Motion profiles are software controlled, so changing the path from circular to linear or adjusting dwell points is a button-press operation via the HMI rather than an exhaustive mechanical changeover.



Project participants at Norwalt Automation Group (from left): Trevor Seitel, Digital Print Manager; Keith Harman, Executive Director of Business Development; Michael Forte, Controls Engineer; Mike Seitel, Chairman/President; Darshan Nayee, Controls Engineer; Kyle Seitel, Technical Sales Director.



XPlanar movers can float and fly with 6 degrees of freedom, so containers are moved optimally around the printheads for high-quality labeling.



ELM7212 servomotor terminals and connected AM8100 servomotors control printhead positioning to ensure smooth overlay of multiple ink colors.

For additional motion control, ELM7212 servomotor terminals and AM8100 series servomotors control printhead positioning and any linear axes that required high precision; these ultra-compact drives are networked via EtherCAT to ensure low-latency triggering and smooth overlay of multiple ink colors. EtherCAT provides deterministic, high-speed communication across the Tesseract's range of distributed I/O modules, enabling extremely tight system-wide synchronization. Instead of spending hours assigning IP addresses and tracing wiring errors, with EtherCAT's diagnostic capabilities, engineers can scan the EtherCAT network and quickly identify all connected devices and find the exact location of cabling problems, reducing commissioning and debugging time from days to minutes in many cases. Machine safety is also integrated via TwinSAFE I/O terminals and Safety over EtherCAT (FSoE).

The TwinCAT HMI software, which includes a PackML state machine, is displayed on CP22xx multi-touch Control Panels and CP3xxx series Panel PCs. TwinCAT automation software became the unified development environment for XPlanar, PLC, all motion control, HMI, machine safety, and higher-level PC tasks. Norwalt's engineers leveraged TwinCAT's structured text and object-oriented programming (OOP) capabilities to build modular, reusable function blocks, properties, and methods, and standardized motion profiles they could apply across machines. The text-based workflow also allowed Norwalt to adopt standard software version control practices – branching, commits, and merges – which speeds up development and makes rollbacks and audits straightforward.

This cut programming times substantially; what once required hours of careful manual work is now achievable in minutes through standard software workflows. That productivity translates into faster machine iterations, quicker fixes in the field, and more predictable delivery schedules.

By working closely with Beckhoff USA's Special Projects Team (SPT) and technical support, Norwalt's controls engineers climbed the learning curve

quickly and received practical help for complex integrations. "I couldn't have asked for better people to get me to a point where I can take projects and run them on my own," says Michael Forte, Controls Engineer at Norwalt.

The proof is in the print

The Tesseract program delivered multiple successful outcomes. The most visible impact is operational flexibility: direct-to-object printing removes the need for large reels of labels and their associated waste, slashes holding costs, and lets companies run customized articles on demand.

Norwalt also achieved large reductions in mechanical complexity and improved maintainability since XPlanar replaced many traditional mechanical components and gearboxes. "Mechanically, it reduces the cost of a machine by 30% to 40%, saving hundreds of thousands of dollars," says Norwalt's Executive Business Director, Keith Harman. The smaller mechanical footprint also reduced machine size, saving floor space, and fewer mechanical parts also mean fewer failures. "And for any errors we do get, 95% of all fixes can be handled remotely because there's no mechanical failure to correct," says Keith Harman.

Product quality and print performance improved as well. Precise control and tightly synchronized EtherCAT communications allowed multiple color passes with the registration accuracy required for high-quality results. The result is a machine and process that fit the company's long-term goal of delivering the factory of the future to CPG and pharmaceutical companies through adaptable, future-ready automation and mechatronics.

More information:

www.norwalt.com

www.beckhoff.com/xplanar

The Tesseract from Norwalt is an advanced direct-to-object printing machine, enabling 6D product positioning based on the XPlanar intelligent transport system.





Bartelt chose the XTS intelligent transport system to equip the MAG Series with rapid, push-button changeovers and highly flexible, hygienic packaging solutions for evolving customer demands.

Redefining flexible, hygienic HFFS packaging with XTS and XTS Hygienic

Mechatronic transport systems put pouch packaging on the fast track

A growing requirement in the packaging industry is the ability to run a broad range of package sizes and products on a single machine. Traditional chain-driven systems with fixed speeds and formats can't keep up. When Bartelt Packaging sought a technology partner to close the gap, they found a match in Beckhoff and the mechatronic XTS system that enables changeovers at the touch of a button.

From powders and snacks to cheeses and consumer goods, today's pouching operations demand equipment that can shift quickly, maintain consistent seal quality, and meet increasingly strict hygienic standards, often within a shrinking footprint. Headquartered in Sarasota, Florida, Bartelt Packaging started in 1941 as a machine shop in Rockford, Illinois. Seven years later, the company would make their mark on the packaging industry by producing what the company says is the world's first horizontal form, fill, and seal (HFFS) pouching machine. Today, as part of the renowned ProMach family of processing and packaging brands, Bartelt continues to deliver best-in-class pouching and cartoning solutions across a wide range of industries. Nearly every grocery store aisle in the U.S. displays packaging produced on their equipment.

Stress test for packaging's best

However, increasing hygiene and performance demands in food packaging, where a customer application requiring high-level sanitation exposed the limitations of previously used track and control systems in washdown environments prompted Bartelt to explore alternative technologies and ultimately partner with Beckhoff.

Bartelt conducted extensive in-house testing of the stainless steel, IP69K-rated XTS Hygienic. "We beat up that demo system with days of continuous testing, including the addition of weights to each mover as a carrier to simulate maximum product weight," says Tom Tomac, Vice

President and General Manager, at Bartelt. “We put everything on it that we possibly could and put the XTS through its paces. We provided Beckhoff our detailed feedback and their dedicated engineers reworked and refined the solution for Bartelt and shipped another XTS Hygienic that took all the team’s testing feedback into account. More testing ensued, which we upped to another level with sticky, sugary gummy bears and more, but the new and improved system could not be beat.”

Mechatronic transport system changes the rules

The Bartelt MAG-B compact, MAG-L linear, and MAG-R rotary HFFS packaging machines are designed for a wide range of flexible packaging applications that demand high throughput, adaptability, and efficient use of space – capabilities made possible by the XTS or XTS Hygienic technology at the core of each system. With pitchless and wireless movers, which are controlled independently of each other by magnetic fields, the XTS enables seamless transitions between bag sizes and filling processes while maintaining maximum throughput. Linear motion based on electromagnetic propulsion provides smooth, accurate transport along a predefined path, ensuring precise and consistent motion control and product handling.

The MAG Series platforms can be configured in straight-line, rotary, or dual-lane layouts. The machines are designed for maximum packaging flexibility, handling a wide range of pouch sizes all on one platform with minimal changeovers. Each configuration supports both rollstock and/or pre-made pouches. By accommodating numerous pouch sizes and filling configurations within a single machine, the series offers a distinct advantage as product variety increases and batch sizes grow smaller in high-mix production.

The first iteration to reach the market was the MAG-L (Linear), which provides an in-line process flow layout, filling pouches along the machine’s length at speeds up to 150 pouches per minute. The XTS Hygienic-equipped MAG-B (Back) fills pouches on both the front and back of the machine to maintain the same output as the MAG-L but in a more compact design. The IP69K-rated machine offers full washdown capability as required in certain food applications. Meanwhile, the smallest iteration, the MAG-R (Rotary), utilizes the XTS in a rotary process to optimize floor space while delivering high production speeds. Many of Bartelt’s machine types are optionally available in the cleaning-friendly XTS Hygienic.

Built to run. Built to adapt.

In an industry characterized by high production volumes and tight margins, uptime is critical. Rapid changeovers and minimal cleaning time are essential as CPG manufacturers cannot afford extended downtime between products or formats. This is where the XTS-based series shines by providing digitally-controlled machine adjustments for fast and repeatable format changes. It supports higher speeds, variable timing between stations, and advanced pouch handling, including on-the-fly clamping, controlled shaking for product settling, optimized nitrogen filling, and scalable operation from simplex to triplex pouch indexing.

Unlike traditional mechanically indexed machines with fixed pitch and limited adaptability, the MAG Series machines’ use of XTS allows pouch indexing to be adjusted dynamically based on the product being run.

This higher level of automation further reduces reliance on increasingly scarce skilled labor. Automated repositioning of axes and tooling

streamlines setup, while an integrated, in-house-designed auto-splicer, semi-automatic zipper splicer, and unwinder enable continuous operation during film roll changes. This design maximizes the effective use of film roll down to the core and reduces floor space by eliminating the need for third-party equipment.

Automation, motion control, and networking in one package

Beckhoff PC-based control hardware and software form the backbone of the new packaging machines, managing all aspects of automation and motion control. This tightly integrated control platform delivers impressive gains in performance, usability, and reliability.

From a development standpoint, Bartelt engineers point to Beckhoff’s TwinCAT software as a key differentiator. Chris Conley, Electrical Engineering Manager at Bartelt, affirms, “I really like their programming software – it is intuitive to use, simplifies programming and saves me engineering time.” TwinCAT provides a straightforward programming environment with built-in XTS track simulation and ‘Open from Source’ functionality, allowing code to be verified, updated, and debugged directly on the machine with confidence. The ability to run applications through a remote Windows connection to the controller further streamlines commissioning and support.

Control and computing tasks for the machines are handled by the ultra-compact C6032 Industrial PC, which provides significant processing power while occupying minimal cabinet space. The whole system is tied together by high-speed EtherCAT communication, enabling real-time motion control and I/O performance, automatic device recognition, along with rapid configuration and commissioning.

Built for tomorrow

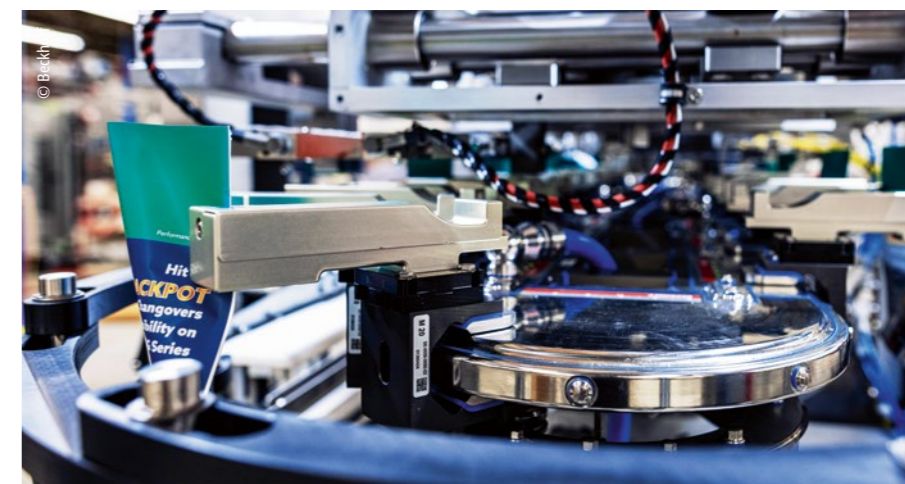
Looking ahead, Bartelt sees packaging industry pressures on machine builders only accelerating: higher throughput, greater product variety, tighter quality expectations, and added features. Meeting these demands will require automation platforms that are inherently flexible. By incorporating XTS and PC-based control technology, the MAG Series was designed with exactly that future in mind, with adaptability and long-term scalability built into the platform from day one.



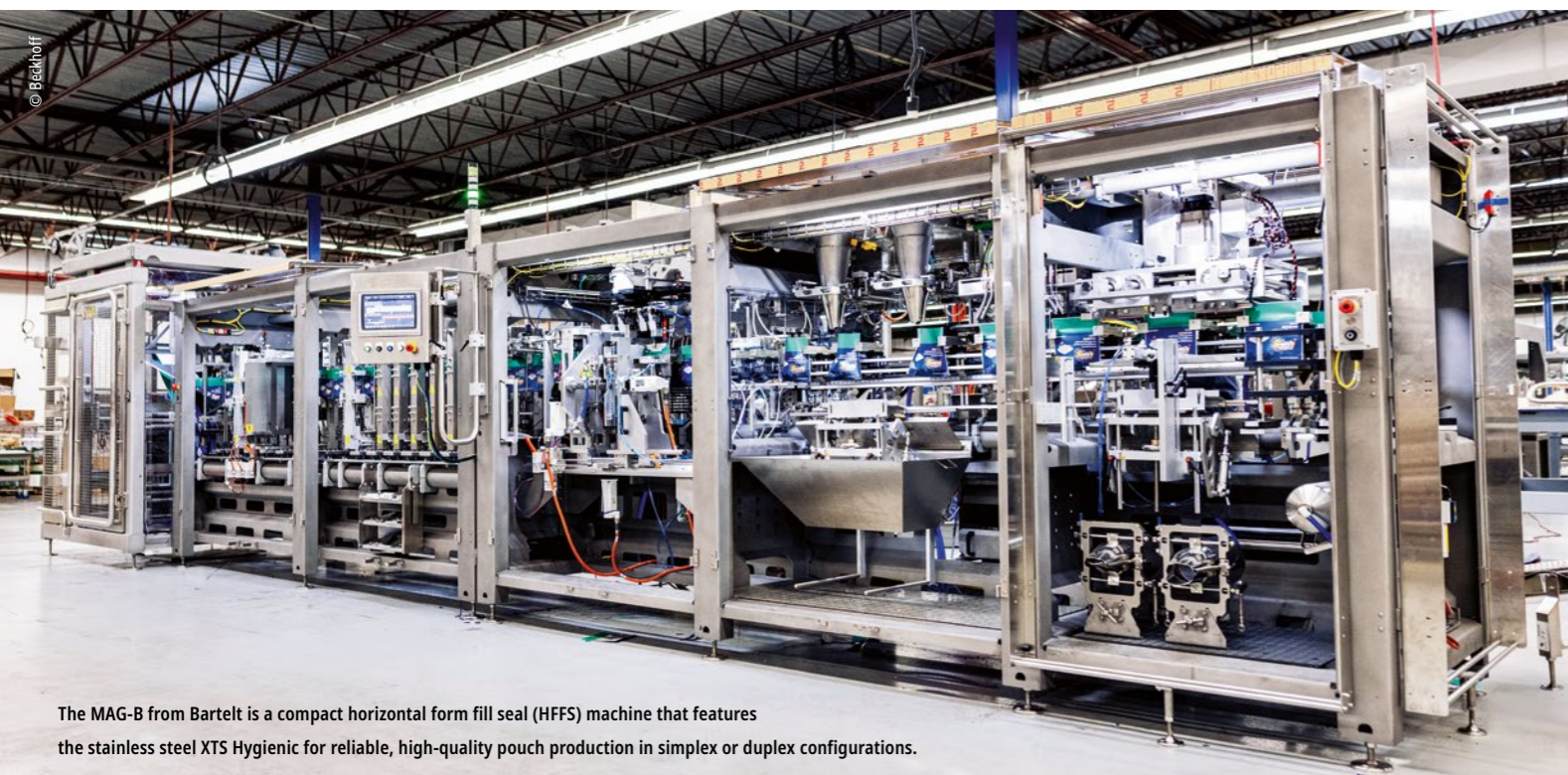
An ultra-compact C6032 Industrial PC provides significant processing power while occupying minimal cabinet space.



The project team (from left): Daniela Ciro (Beckhoff), Chris Conley (Bartelt), Tom Tomac (Bartelt), Tom Brooker (Bartelt), Rafael Majano (Bartelt) and Greg Marsh (Beckhoff)



Closeup of the IP69K-protected XTS Hygienic used as a foundation for product transport and handling, which permits washdown in environments with rigorous sanitary requirements.



The MAG-B from Bartelt is a compact horizontal form fill seal (HFFS) machine that features the stainless steel XTS Hygienic for reliable, high-quality pouch production in simplex or duplex configurations.

More information:

www.barteltpackaging.com

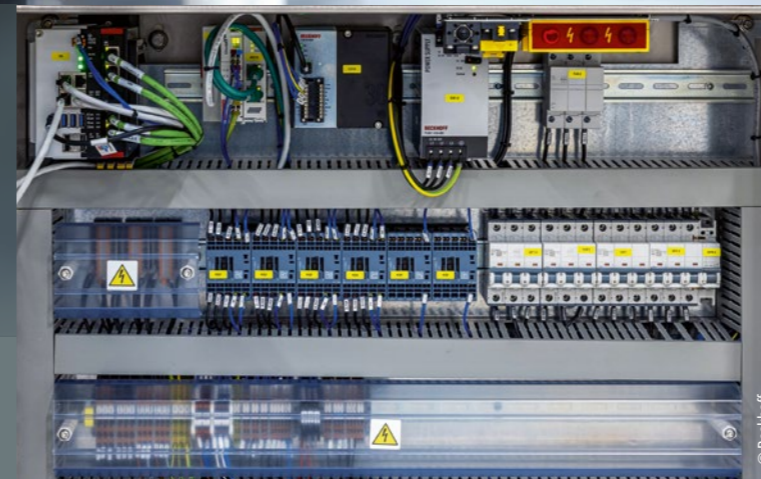
www.beckhoff.com/xts



With the IVB Flex packaging machine, the intelligent XPlanar product transport system combines operational flexibility, process reliability, and traceability.

Using XPlanar in leak detection for pharmaceutical packaging

Floating, fast, and safe handling of medical bags



Left: View of the control cabinet with the C6030 ultra-compact Industrial PC, EK1100 EtherCAT Coupler, EL6631 2-port communication interface, CU8130 UPS, and PS3031 power supply (above, from left to right).

To make its medical bag handling processes faster and safer, Bonfiglioli Engineering has deployed the magnetic floating technology found in the intelligent XPlanar transport system from Beckhoff as a leak detection solution in its latest IVB Flex packaging machine. The partnership between the two companies played a significant role in achieving the project goals.

In automatic packaging machines, quality control and product integrity do more than just ensure that production stays efficient: most importantly of all, they reliably meet legal requirements and assure traceability. This is particularly true for the pharmaceutical industry. Bonfiglioli Engineering, part of the TASI Test and Automation Group, has built up extensive expertise in this field over more than 50 years. Specializing in areas including leak detection, it has gradually expanded its technology portfolio in quality control and assuring the integrity of pharmaceutical packaging.

Challenges posed by flexible bags

Davide Luisari, director of engineering at Bonfiglioli Engineering, explains that three complementary inspection technologies cover the quality control requirements that are typical of the industry: “The first technology, CCIT (container closure integrity testing), is used to check the integrity of the closure and that the containers are sealed. The second one, AVI (automatic visual inspection), identifies visual defects and discrepancies in appearance or function. The third technology is HGA (headspace gas analysis), which

measures the gases in the container headspace – a very important parameter in some packaging processes.”

One or more of these technologies may be brought into play depending on the type of inspection involved. The key difficulty, however, lies in container handling. With medical bags, for example, there is a real risk of damage every time one of them is picked up and fed into the machine. This is precisely where Bonfiglioli Engineering’s solution excels, as Davide Luisari explains:



Davide Luisari (second from left), director of engineering at Bonfiglioli Engineering, and the representatives of Beckhoff Italy: Massimo Veronesi (third from left), sales team leader; Marco Portuese (right), sales engineer; and Giovanni Paladini (left), XTS/XPlanar product expert, in front of the IVB Flex for leak detection in medical containers.

“We don’t just sell machines – we support the customer by providing them with a comprehensive consulting service. In a highly regulated sector such as the medical field, what makes you stand out is not only ensuring product quality, but also designing a reliable, repeatable, and truly productive process.” To meet this need, the IVB Flex packaging machine with XPlanar uses magnetic floating technology, which eliminates mechanical contact and therefore wear during product transport, as well as drastically reducing the risk of bag damage. What’s more, it ensures end-to-end traceability.

Intelligent, floating product transport

The solution aims to minimize transportation and handling of the product with the help of XPlanar movers. Inside the machine, the leak tests are carried out simultaneously using special bell systems developed by Bonfiglioli Engineering. To achieve this, the bags are placed on the XPlanar movers, each equipped with a suitable bag holder, and moved under the bell jars. Once the correct position is reached, the system grips the tool – the bag holder – and lifts it until it rests against the base of the bell jar, creating ideal conditions for the test.

A test takes around seven seconds; the bag is pressurized, which allows leaks to be detected based on the pressure difference. Depending on the inspection result, the bag is either forwarded to the station’s outgoing line or transported to the reject area. The entire process takes place without the need to handle the product directly. Once the bag is loaded onto the mover, it is gently transport-

ed between the various test stations, ensuring its integrity and guaranteeing highly reliable and repeatable tests. The machine has six bell jars as well as a loading station and an automatic unloading station, all of which are extremely compact: together, they have a footprint of just over 5 m².

The system uses eight 155 x 155 mm APM4330 XPlanar movers, which float over a surface of 13 XPlanar tiles: seven measuring 320 x 320 mm (APS4244) and six measuring 320 x 160 mm (APS4242). This results in a high functional density in a relatively small space. The XPlanar movers are equipped with interchangeable bag holders that the operator can change manually to suit the product type. The format-changing process is quick and intuitive: all the operator has to do is remove the tool and replace it with one that is suitable for the new format. The replacement tool can easily be attached using centering pins, which ensure correct alignment and stability during movement. As Davide Luisari explains: “XPlanar provides a handling solution that allows unparalleled flexibility during format changeovers. This allows us to quickly switch from small containers with a capacity of 50 or 100 ml, for example, to bags with a larger capacity.” In addition to process flexibility, IVB Flex also guarantees excellent standards in terms of precision and quality thanks to the XPlanar movers’ high load capacity of up to 1.8 kg. This opens up more scope for reliable operation and extensive possibilities for developing the system in the future.

Davide Luisari,
director of engineering at Bonfiglioli Engineering

“XPlanar provides a handling solution that allows unparalleled flexibility during format changeovers.”



A complex challenge with a simple solution

According to Davide Luisari, the XPlanar system made it possible to combine operational flexibility, process reliability, and traceability. However, Beckhoff’s technology went even further than this. Deploying automation based on a C6030 ultra-compact Industrial PC, Luisari explains, helped to simplify the IVB Flex architecture – notably due to implementing TwinCAT as the software platform: “As we were using these technologies for the first time, we took full advantage of the training offered by Beckhoff. We started with a basic course, then moved on to an advanced course that dealt specifically with the XPlanar system. We always had the option of contacting the product specialist if we came across any obstacles or doubts. The TwinCAT programming environment proved to be consistently user-friendly, however, and the prototype was created in just ten months or so – from design and software development all the way through to factory acceptance at the customer’s premises. That’s a record for us!”

There were also no problems with integration. “Despite a specification restriction imposed by the customer, which required the use of third-party PLCs, our technicians experienced no compatibility or interface problems,” explains Davide Luisari. What’s more, there are considerable advantages to be gained in the area of remote maintenance. The ultra-compact industrial PC from Beckhoff is designed for connection via VPN and allows secure access to the machine, regardless of the installation location. This supports advanced diagnostic activities, identification of any critical points in good time, and early and efficient intervention efficiently to resolve any problems.

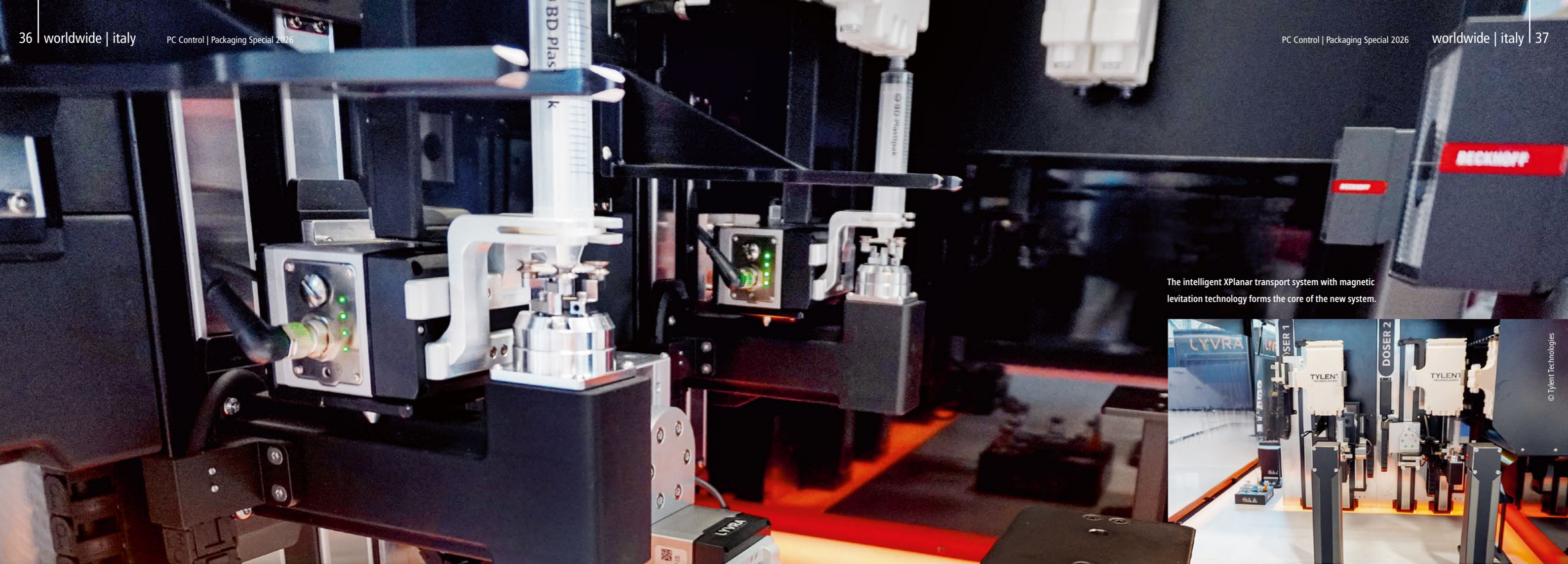
Potential for the future

According to Davide Luisari, the productivity of the machine has exceeded the expectations of the customer, a medical manufacturer that operates plants abroad: “The contactless magnetic floating technology plays a significant role in this by minimizing mechanical wear, requiring less maintenance, and – crucially – ensuring aseptic operating conditions. However, here at Bonfiglioli Engineering, we’re already thinking outside the box. The development we are working on involves integrating optical inspection into the machine itself. Similar solutions already exist on the market, but their cost and space requirements make them impractical and economically unviable.” Another challenge lies in artificial intelligence: “We are looking into the use of neural networks to make leak detection and visual inspection even better and reduce the number of false rejects, especially with flexible products such as bags.” These are developments that require considerable computing power. Luisari adds that, in view of the CPU power that Beckhoff Industrial PCs offer, the aim is to integrate everything – both real-time control and AI – in a single piece of hardware.

More information:

www.bonfiglioliengineering.com

www.beckhoff.com/xplanar



The intelligent XPlanar transport system with magnetic levitation technology forms the core of the new system.



Intravenous compounding automation with the XPlanar system

A paradigm shift enabled by magnetic levitation

Tylent Technologies has developed an innovative system for the automated preparation of injectable drugs in patient-specific doses. At the core of the project lies the XPlanar system from Beckhoff, which has opened up new application horizons for system designers.

The XPlanar movers are used as mobile workstations.

The preparation of infusion drugs in personalized doses is one of the most complex and critical processes in the clinical environment. Dosing accuracy, microbiological safety, end-to-end traceability and operational continuity are essential requirements, particularly for high-criticality therapies such as oncology, biologics and patient-specific treatments.

Over the past twenty years, intravenous compounding automation solutions have largely relied on architectures derived from traditional industrial automation: monolithic systems, highly serialized processes and extensive use of anthropomorphic robotic arms. In many cases, pneumatic solutions have also been adopted to simplify actuator complexity and motion control. While well established, these design choices introduce structural limitations in terms of scalability, process parallelism, fine motion control and operation in environments where airborne particulate control is critical and regulated, resulting in bottlenecks that are difficult to eliminate. It is from this legacy industry design approach that the Lyra™ project was born. Developed by Tylent Technologies, a company of the GPI S.p.A. Group, Lyra™ aims to rethink the architecture of automated compounding systems from the ground up.

End-to-end automation, safety and traceability

The entire system is designed as a fully automated, end-to-end process, from initial material loading to the final packaged product



The team of experts at Tylent Technologies

© Tylent Technologies

ready for administration, without missing steps or manual interventions to complete the workflow.

Each preparation is seamlessly and uniquely identifiable tracked throughout the entire process. Information relating to the drug, dosage, patient and ward is automatically marked on the final product, while waste handling is managed through self-sealing containers, reducing operator exposure and contamination risks.

This approach delivers concrete and well-established benefits: reduced drug waste, increased safety for both patients and operators, and a significant reduction in pressure on highly qualified human resources, which are still often engaged in manual activities or supported by partial or outdated automation technologies.

Modularity and parallelism as architectural principles

Tylent's approach is based on a key principle: moving beyond serial automation towards a natively modular architecture, composed of replicable and reconfigurable workstations capable of operating in parallel and dynamically adapting to different workloads, priorities and preparation types.

The enabling element of this paradigm is XPlanar, Beckhoff's intelligent transport system with magnetic levitation. The contactless and independent movement of movers on a two-dimensional plane makes it possible to decouple the process flow from fixed paths and rigid sequences, allowing dynamic routing of individual carriers and the simultaneous execution of multiple operations.

"XPlanar allowed us to design a truly parallel system, in which each process unit can be managed and routed independently, without the constraints typical of linear architectures," explains Alessandro Jurman, R&D Manager at Tylent Technologies.

Fully electric system design with broad wireless communication

In intravenous compounding automation, the use of pneumatics has often represented a design shortcut to reduce the complexity and number of required actuators. However, this approach introduces significant challenges in terms of calibration, stability and contamination management, especially in applications requiring high precision and repeatability.

Tylent Technologies has instead adopted a fully electric architecture, in which all movements are handled by integrated electromechanical solutions and deterministically controlled via EtherCAT. In particular, the use of two Beckhoff motor families with integrated drives and absolute multiturn encoders has made it possible to significantly reduce the number of sensors, optimizing system components with both design and economic benefits. These include the ASI8100 compact integrated stepper motor drive for low-speed, space-constrained applications, and the AMI8100 compact integrated servo drive with integrated brake for vertical movements. Thanks to these design choices, the Lyvra™ system implements sophisticated motion functionalities while maintaining compactness, reliability and ease of integration.

This approach is complemented by a broader concept of wireless system design. Not only does the surface formed by planar motor modules eliminate mechanical connections and friction, but the electronic equipment itself is also distributed in an innovative way.

Tylent Technologies has developed original electronic solutions, currently patent-pending, integrated directly on board the Beckhoff movers. As a result, the movers evolve from simple transport elements into intelligent mobile workstations, capable of executing process functions, acquiring data, interacting with vision systems and actively contributing to overall process orchestration.

This design significantly increases system efficiency, scalability and reconfigurability, while reducing cabling, critical connection points and overall integration complexity.

PC-based control architecture and functional integration

Managing a high variability of formats, volumes and dynamic behaviors – ranging from small-volume syringes to flexible bags exceeding one liter – requires tightly integrated control of motion, vision and process logic. Tylent Technologies has selected a Beckhoff PC-based architecture, in which motion control, vision, safety and HMI are integrated within the single development and runtime environment TwinCAT. In particular, the CX2062 Embedded PC and C6032 ultra-compact Industrial PC, running TwinCAT, control the entire machine, while EtherCAT ensures deterministic real-time communication between the XPlanar system, the integrated drives, vision systems and field devices.

This level of integration enables adaptive motion profiles, safe handling of partially filled loads and variable geometries, while maintaining precision and safety even under complex dynamic conditions. Variability, which is intrinsic to clinical compounding, is therefore addressed not through dedicated solutions or process exceptions, but as an integral part of the control architecture. To fully exploit the flexibility offered by the mechatronic system, Tylent Technolo-

gies is complementing the conventional control software with an orchestration platform based on machine learning and artificial intelligence algorithms, designed to coordinate and optimize every process step. The goal is to maximize overall system performance by dynamically adapting operational flows to different clinical and production scenarios, while maintaining rigorous control over safety, traceability and process quality.

A new generation of intravenous compounding automation

The project developed by Tylent Technologies represents a substantial evolution in intravenous compounding automation. "The capabilities of XPlanar and the TwinCAT automation system, together with collaboration with a partner like Beckhoff – strongly focused on research and development – were decisive in our choice of solution," concludes Alessandro Jurman.

The combination of native modularity, process parallelism, intelligent mobile workstations and deep integration with the Beckhoff ecosystem makes it possible to overcome the limitations of traditional architectures and to address the complexity of modern clinical compounding in a structured and scalable way.

More information:

www.gpigroup.com

www.beckhoff.com/xplanar

The Lyvra™ system for automated intravenous compounding



The Lyvra™ system also utilizes Beckhoff's Vision Units Illuminated (VUI, shown on the right) – compact units comprising a camera, illumination, and focusable optics with liquid lens technology.

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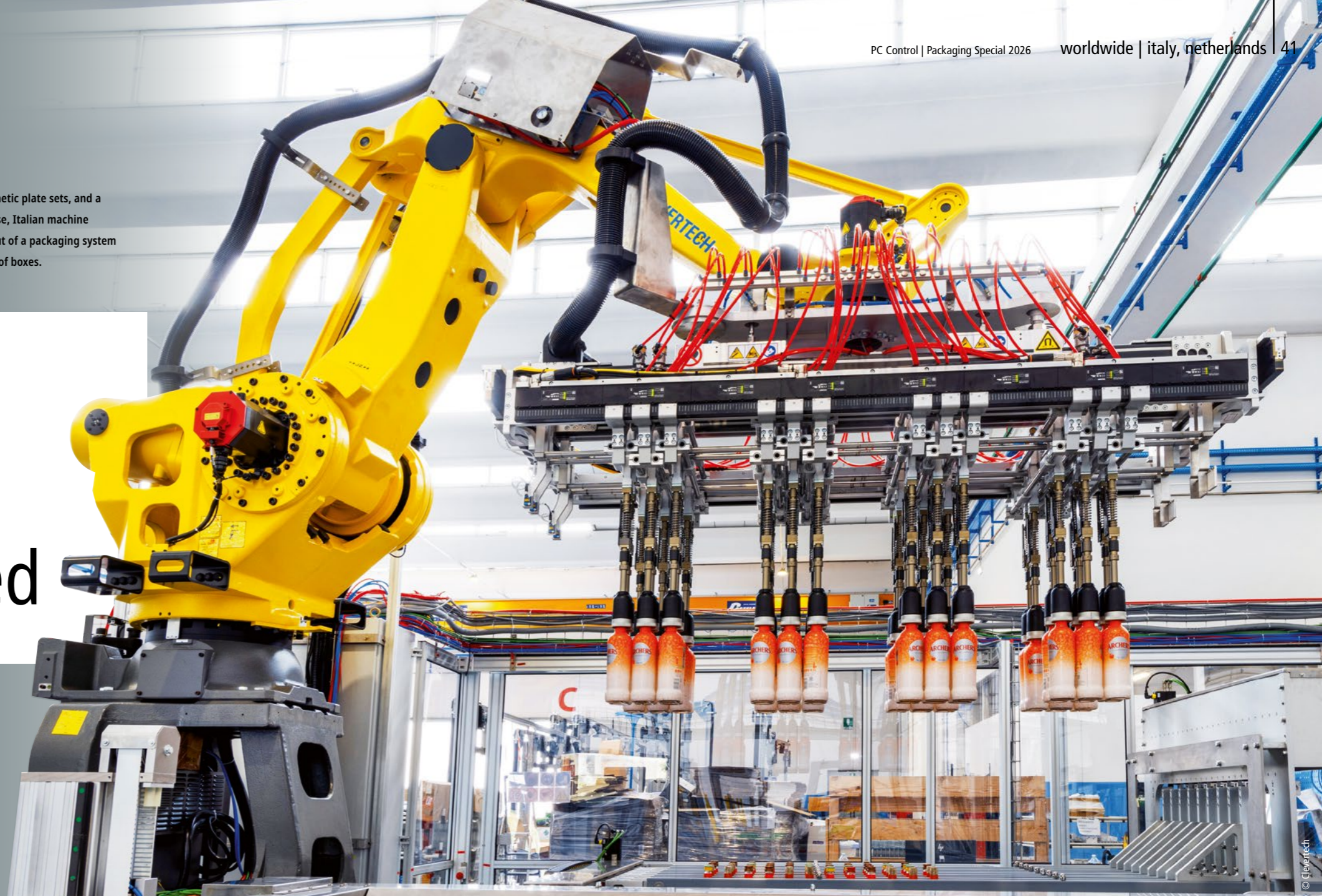
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With 24 XTS motor modules, 32 magnetic plate sets, and a mover mechanism developed in-house, Italian machine builder Cleverttech doubled the output of a packaging system for various bottles and a wide range of boxes.

XTS for highly efficient end-of-line packaging of beverage bottles

Throughput doubled, flexibility increased, set-up times minimized

With a variable gripper solution based on XTS, Italian machine builder Cleverttech is increasing the flexibility and productivity of end-of-line packaging systems. A traditional distillery in the Netherlands has been able to double throughput with the innovative solution and reduce set-up times from 30 to just 7 minutes with PC-based control from Beckhoff – despite the fact that the company works with many different bottle and packaging variants.



Being one of the oldest distilleries in the Netherlands and also an official supplier to the Dutch royal family is a distinction that testifies to tradition and prestige. However, even with such an important history, production efficiency remains a key issue for the company – for example, when it comes to the final packaging.

The variety of bottles and frequent changes in format pose a challenge here and demand maximum flexibility from the packaging line: up to ten changeovers a day are not uncommon. With 24 bottle variants and 42 different packaging boxes, effective automation of the process is anything but simple. Despite this, Cleverttech – a fast-growing family business that achieved sales of €250 million in 2024 and is based in the Italian province of Reggio Emilia – has managed to develop a solution that is as flexible as it is powerful. The XTS linear transport system from Beckhoff plays a central role in it.

Cleverttech, which specializes in the design and construction of end-of-line systems for primary and secondary packaging, does not simply offer machines from a range in a catalog. Instead, it analyzes the customer's needs in each case and develops an individual solution that meets their specific requirements on this basis.

Increased flexibility with XTS

"We have been working with this Dutch distillery for more than 20 years, and I have to admit that the request we received put our Development department to the test," explains Luca Carollo, business development manager at Cleverttech. The challenge was to drastically reduce the set-up times of the end-of-line packaging system and increase productivity at the same time. These requirements forced Cleverttech to completely rethink the automation of the entire line, including the design of the bottle gripper installed on a robot. The specialists at Beckhoff were contacted early on, right at the concept phase. "Al-

though we were familiar with Beckhoff's technologies, we had not yet carried out a project with them," says Carollo.

The task was to develop a robot case packer that could handle a format changeover in just 7 minutes instead of the 30 minutes previously required, and that would also more than double the processing capacity from 110 to 225 bottles per minute. "Due to the limited space available, the floor space could not be increased," states Carollo. In addition to different bottle sizes, the machine has to adapt to the box formats, position the centering devices, and configure the grippers so that the bottles are placed in the correct sequence.

Mover mechanism developed in-house

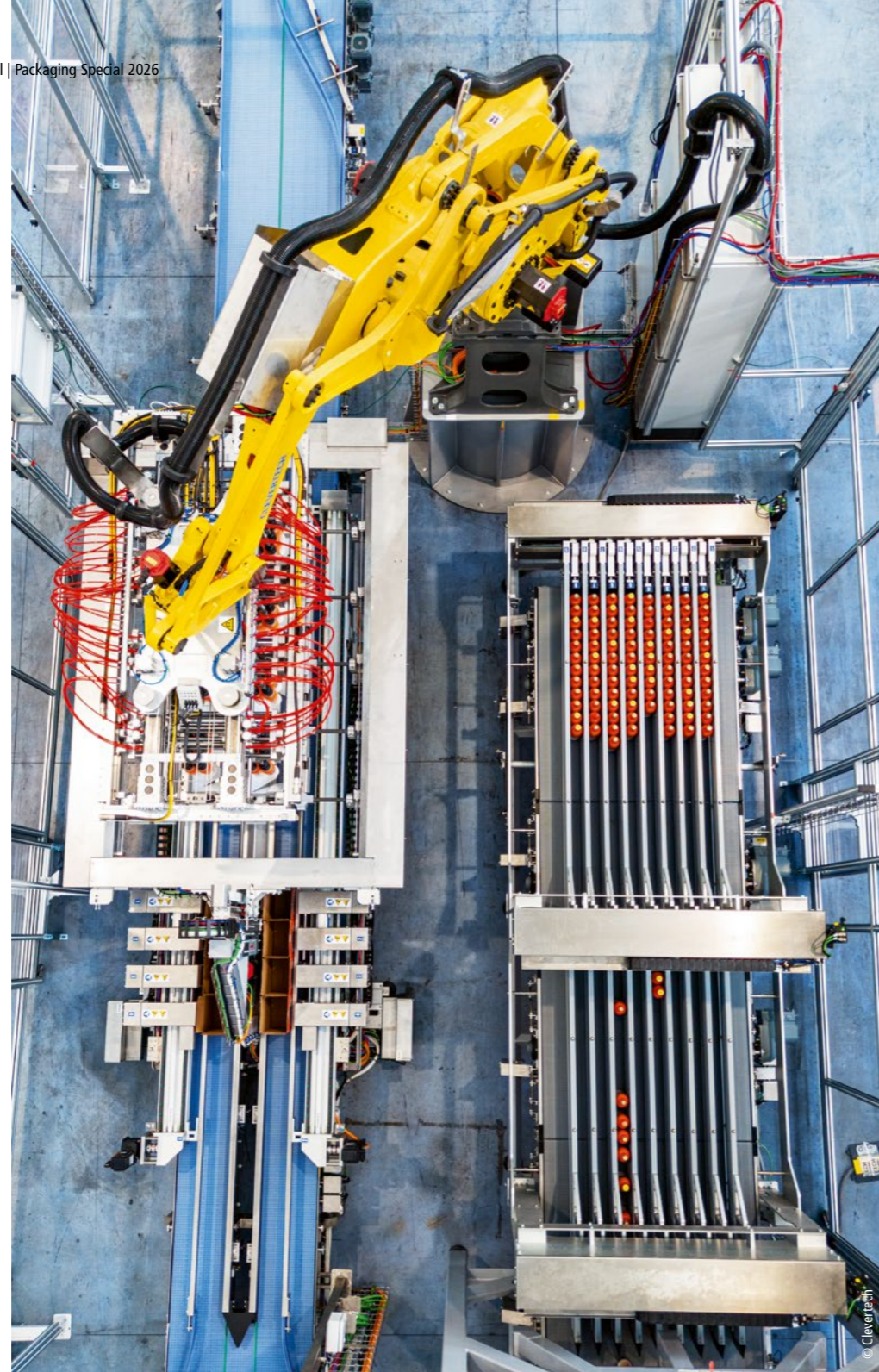
This is exactly where the flexibility of the XTS makes the difference: With 24 XTS motor modules (AT2002-0250) and 32 magnetic plate sets (AT9001-0550 and AT9001-0AA0), Cleverttech's designers developed a special gripper head in

Luca Carollo, business development manager at Cleverttech

“With XTS, it was possible to implement a solution that can process a wide range of bottles without having to change the mechanics of the grippers.”

a 12x4 matrix configuration. Thanks to the precise and synchronized control of the 32 movers, this structure makes it possible to grip bottles with different diameters, allowing the matrix dimensions to be adapted to the different box sizes on an ad-hoc basis – with options of 3x2, 4x3, or 6x4 bottles available, for

Right: As the width of the eight infeed lines (right) is also set fully automatically via TwinCAT 3, the changeover time of the system is reduced from 30 minutes to just 7 minutes.

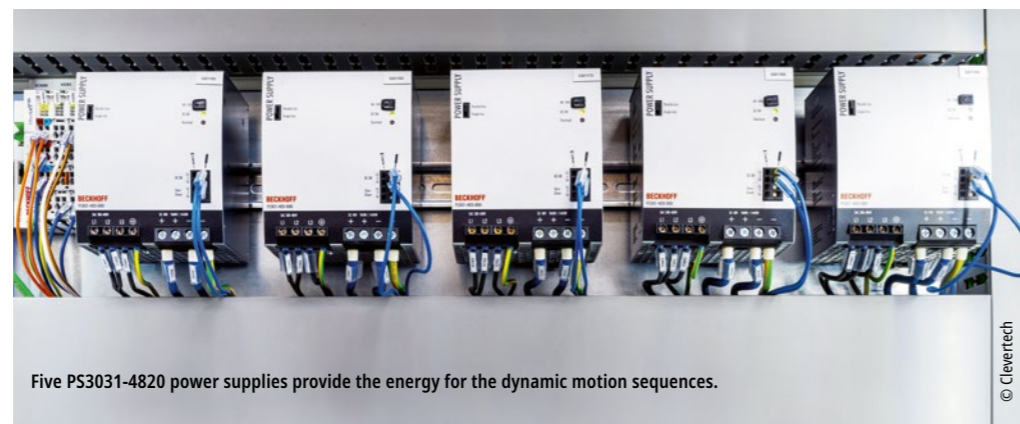


Special customer benefits

Clevertch's gripper solution benefits from the properties of the XTS, although it is not built in the frequently chosen closed travel-path variant:

- Clevertch uses XTS instead of classic linear motors, replacing heavy drag chains.
- The entire set-up is significantly leaner because the XTS motor modules have the sensors already integrated.
- As a central component of the XTS, the software ensures precise synchronization of the opposing movers (axes). This is only possible thanks to TwinCAT, EtherCAT, and central data processing in the industrial PC.
- A particular advantage is that every point on the "action area" spanned by the XTS systems can be reached due to the interaction of the opposing axes.
- The low dead weight of the XTS suspended from a robot arm extends the degrees of freedom of the packaging system.

Thomas Beckhoff,
Product Manager XTS,
Beckhoff Automation



Five PS3031-4820 power supplies provide the energy for the dynamic motion sequences.



Clevertch fulfills the high requirements for synchronous and dynamic control of the 32 movers with TwinCAT 3 on a C6032 ultra-compact Industrial PC.

example. "With XTS, it was possible to implement a solution that can process a wide range of bottles without having to change the mechanics of the grippers. This enabled us to simplify the machine's design, something that brings even more advantages when it comes to construction, assembly, and maintenance," emphasizes Carollo.

This case packer from Clevertch also features additional technical solutions which, together with the XTS, ensure a significant increase in productivity. One example is the positioning of the adjustable guides, which form the infeed lines for the bottles of different thicknesses. These track widths are set automatically depending on the bottle type.

Conventional systems that pack six bottles in 3x2 boxes, for example, typically have two infeed lines, with three bottles gripped from each. In contrast, the Clevertch gripper's 12x4 matrix enables bottles to be gripped from up to four separate tracks simultaneously, doubling productivity.

23,000 more bottles per shift and increased safety

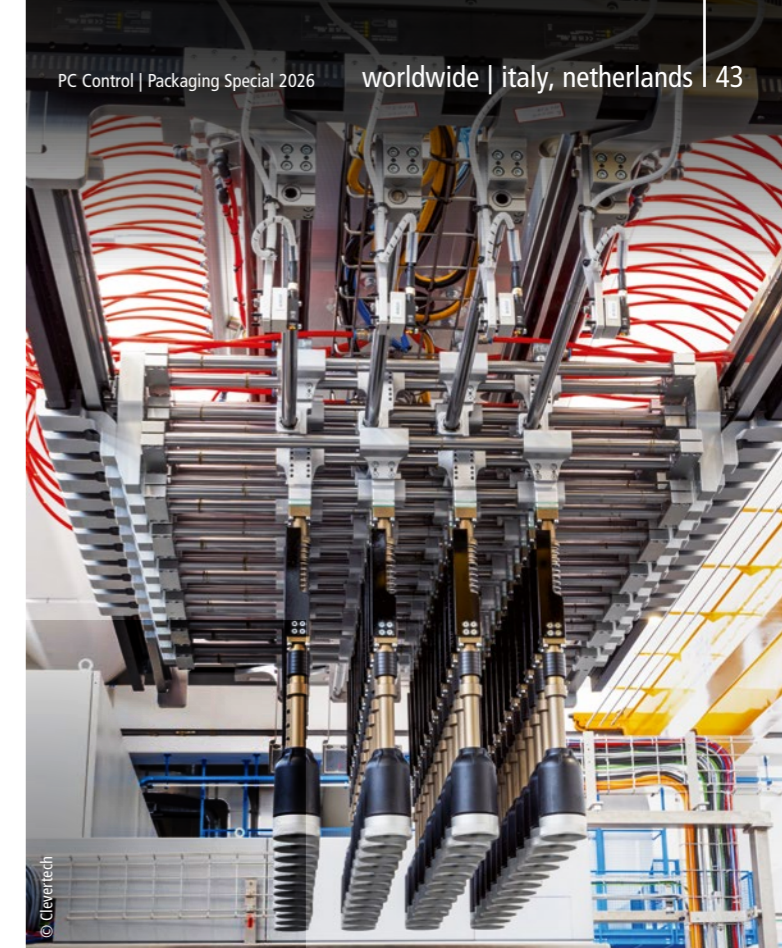
But that's not all. In the previous system design, the bottles were moved on the conveyor belts at up to 14 m/min in order to achieve sufficient processing speed. This sometimes led to broken bottles and glass splinters and thus to unwanted machine downtimes. By doubling the infeed lines, Clevertch has been able to almost halve the belt speed of the new depositing system to a safe 7.8 m/min. This not only guarantees the integrity of the bottles, but also taps into opportunities for additional savings and sustainability projects, such as the use of thinner and therefore more cost-effective glass.

The reduction in machine downtime by 23 minutes per format changeover, together with the doubled packaging capacity, means that the customer can pack up to 23,000 additional bottles during one shift.

TwinCAT and XTS – a winning combination

The TwinCAT runtime controls and synchronizes the motion profiles and positioning of all 32 movers and thus forms the heart of the automation solution. A C6032 ultra-compact Industrial PC with an Intel® Core™ i processor and Windows operating system was selected as the controller. "The programming approach is very simple, almost instinctive," states Roberto Sarzola, software developer at Clevertch, "and the TwinCAT libraries provided all the functions we needed for the application."

The precise synchronization via EtherCAT and the real-time kernel of TwinCAT enabled highly dynamic application with very short cycle times and complete control of all speed and acceleration profiles. In addition, integrating logic,



The individual positioning of the 48 grippers in total (12x4), each via two parallel XTS travel paths, enables the bottles to be gripped from up to four parallel infeed lines and then grouped (3x2, 4x3, or 6x4) according to the boxes provided.

motion, and safety functions in the same engineering environment simplified development, reduced configuration errors, and sped up commissioning. "TwinCAT was the key for us to fully exploit the potential of XTS," confirms Sarzola.

Customer satisfaction is the best reward

"The end customer is extremely satisfied with the work we have done and as soon as all the tests have been completed, we are planning another line," says Luca Carollo. He states that automatic format changeover not only guarantees increased machine availability – it also eliminates the need for skilled workers to make mechanical adjustments. In a market where it is difficult to find qualified personnel, this is yet another advantage. According to Luca Carollo, the improvements achieved are down to the engineering flair and technical skills of Clevertch's designers. However, he adds that the experts at Beckhoff also played a key role by providing targeted support and training.

More information:

www.clevertch-group.com
www.beckhoff.com/xts

PC-based control in machines for secondary packaging

Fast, precise and flexible control, even for difficult-to-handle packaging



Individual products in flexible packaging must be placed precisely into a carton at high speed; therefore, speed and accuracy in pick-and-place operations are great challenges for machine control at Blueprint Automation.

Blueprint Automation (BPA) develops machines for placing products in primary packaging – often flexible ones such as pouches – in cartons. This requires a fast, precise, and flexible control process. Three years ago, BPA decided to standardize on PC-based control from Beckhoff: “We wanted to be able to develop innovations more efficiently so we could build on them more quickly.”

Blueprint Automation based in Woerden develops and manufactures machines for secondary packaging. These machines place packaged products into outer packaging such as cartons, boxes, and trays. The products are typically contained in flexible or other difficult-to-handle packaging. Examples include packaged ice cream, bags of chicken nuggets, packages of cheese slices, packaged pancakes, and sacks of pet food. The machines use robotics controlled via image processing and perform various tasks, such as erecting cartons, picking up and placing products, wrapping with film, and sealing closing cartons.

Increasing product diversity and packaging speed

According to Sjoerd Goorden, Business Development Manager at Blueprint, BPA has grown significantly in recent years: “We have always had a strong emphasis on innovation. So, at the leading packaging trade fair, Interpack 2026, we will be showing a total of five new product launches.” In doing so, BPA is responding to customer requirements and market trends. In addition to the common goals of increasing productivity and reducing costs, adaptation to the ever-growing product variety is at the top of the agenda. “Where production runs used to take six to seven hours previously, they often last only one and a half to two hours today. Therefore, packaging machines have to be converted more frequently – and quickly and efficiently at that,” Sjoerd Goorden continues.

In addition, according to the Business Development Manager, combination packaging is trending. “For example, packing three ice cream flavors in one box – that requires more computational effort to control the robot than if you were packing just one product into a box. In a production line, there are often several robots, sometimes even five or six, lined up one after another. These, you must make sure to work very well together. Otherwise, if the first robot tries to optimize its operations without taking into account the next one’s tasks, every subsequent robot becomes slightly less efficient. In that case, you will not be able to get as much performance out of the machine as a whole. Therefore, the control system must be able to plan ahead and operate proactively; that is a challenge when it comes to robots. For this purpose, we developed the specialized software Bluelogic.”

For controlling its packaging machines, where the robots represent bottlenecks for the machine’s performance, BPA originally used components from various suppliers. Three years ago, however, a decision was made to standardize, says Sjoerd Goorden. “We were flexible in our options for the controls, but our aim was to standardize in order to develop innovations more efficiently and be able to build on them more quickly.” The choice fell on Beckhoff, both for the hardware (industrial PCs, motion, and I/Os) and for the software (TwinCAT). In addition to programming flexibility, the high speed of the control system was a key criterion. This is a necessity due to the ever-increasing pace at which

packaging lines must operate and the extensive computing power required for coordinated motion control of all robots.

Vision for the setup phase of new products

An important component of the control technology is to support image processing for precise product handling. Since this is a unique selling point of its machines, BPA develops the image processing software in-house. The company uses TwinCAT Vision to read data from the generic cameras used. The image processing functions are crucial, among other things, when switching to new products, explains Sjoerd Goorden: “Then we have to reconfigure the machine. We use image processing and AI to determine exactly what this product looks like – for example, which side is the top and which is the bottom. The operator no longer has to enter this manually.”

BPA also uses the control system to support end customers, provided they give their consent, as Sjoerd Goorden explains: “If necessary, we can remotely access the control system to troubleshoot any issues. When we visit a customer, we only see a snapshot of how the customer operates the machine on a given day. Now, for instance, we can analyze all downtime events from the past month: What’s going wrong, is it perhaps due to the software, and how can we fix it? We can also view videos of the downtime; which, of course, the customer can do as well. We call this ‘product’ – the infrastructure with cameras and other hardware, as well as the software platform – Blueperformance.”

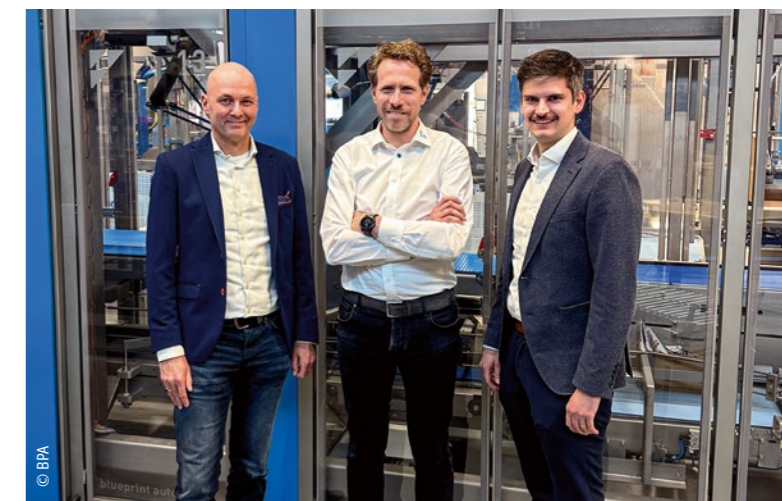
Future-proof control technology

Based on current portfolio of control technology from Beckhoff, Sjoerd Goorden looks to the future with confidence: “Beckhoff has the necessary developments and innovations that will enable us to grow in the coming years. We’ve implemented new features based on image processing and see more potential there. We’ve developed a great many things on the Beckhoff platform; now it’s a matter of introducing them and ensuring that everything runs smoothly in the field.”

Sjoerd Goorden has one wish, however: “No more parts that become obsolete.” This aligns perfectly with the Beckhoff philosophy of long-term availability. And should components ever become unavailable, Beckhoff ensures suitable

successor products are available. For example, industrial PCs retain the same form factor whenever possible, so that there is always physical space in the control cabinet to accommodate replacements. Moreover, the company relies as much as possible on standard components – from connectors to CPUs – that are readily available and will continue to be developed. The company maintains a large inventory. “We learned that from the supply chain crisis a few years ago,” they say. “In addition, Beckhoff uses two designs for critical products, so that if there are availability issues with one design, the other is still available. This gives BPA the certainty that they can continue to deliver their machines worldwide.”

Elbert Griffioen (center), Managing Director of Blueprint Automation, along with John Stut (left), Managing Director of Beckhoff Netherlands, and Daniel Rostan (right), Global Business Management Packaging at Beckhoff Automation



More information:

www.blueprintautomation.com

www.beckhoff.com/vision

A shared focus on packaging technology

The packaging industry is an important market for Beckhoff, says Daniel Rostan, Global Business Management Packaging at Beckhoff Automation: “We provide various transport systems for this purpose with contactless power supply, and offer control cabinet-free automation solutions. This allows for rapid machine installation and flexible control system. We also respond to growing sustainability requirements by reducing material and energy consumption and, where necessary, supply products in hygienic stainless steel designs.”

In the packaging market, Blueprint Automation is a key customer, according to John Stut, Managing Director of Beckhoff Netherlands. “We’ve been working well with them for quite some time. We supply hardware and software, conduct training for their engineers, and offer on-site support. Every month, our specialists spend about a day at BPA to support machine development and troubleshoot issues if necessary.”

Internally, Blueprint Automation also places great emphasis on collaboration. For example, the company recently adopted a two-person

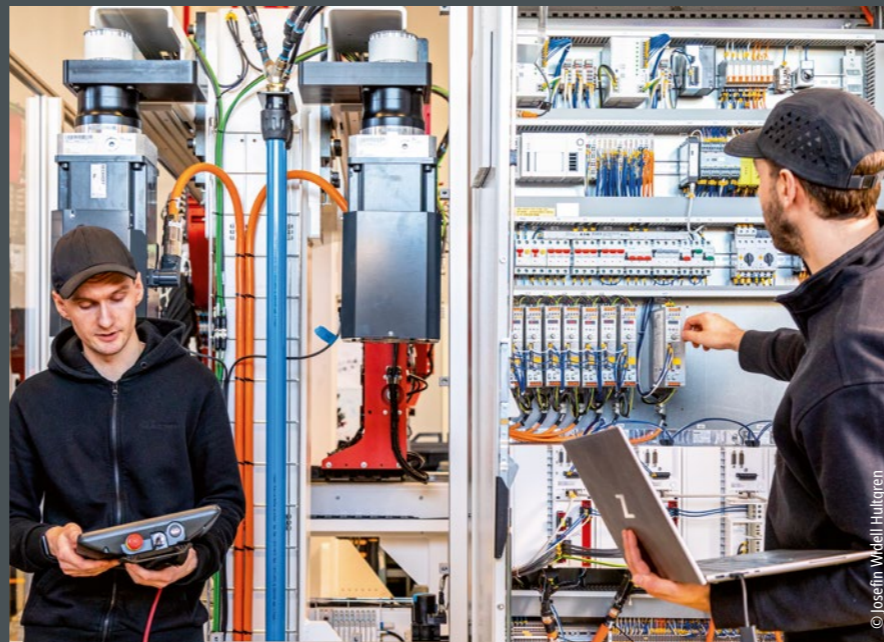
management structure. As Managing Director, Kees Nijenhuis is responsible for project management, operations, service, and human resources, while his colleague Elbert Griffioen manages the areas of sales, marketing, product management, innovation, and engineering. Previously, Elbert Griffioen served as Technical Director, overseeing innovation and standardization – for example, for control products. “We made a conscious decision to adopt a dual leadership structure,” he explains. “We’ve grown significantly. Together, we can devote additional attention to our customers and employees.”



Space-saving: combining PC-based control and the XTS shrinks the system's footprint significantly in comparison to conventional conveyor belts.

More OEE, less space: High-speed packaging with XTS

Software-based product manipulation on the fly



In highly dynamic packaging solutions, fractions of a second determine profitability. That is why the Swedish 3Button Group is replacing rigid mechanics with software-defined motion control – based on the XTS from Beckhoff. This has turned a new stacking and packaging system into a compact high-speed system that inspects sensitive in-mold labeling products at high throughput, handles them precisely, and keeps them available around the clock.

The hardest currency for fast-moving consumer goods, which are produced in runs of millions, is high overall equipment effectiveness (OEE). The 3Button Group, which has established itself as a system integrator in the plastics, food, and pharmaceutical sectors, meets the high demands of end users: Not only do machines need to run quickly and reliably, they also need to be so intuitive to operate that it takes no time at all to put them into operation. "Our customers run their packaging lines non-stop," explains Johan Enander, head of R&D and Sustainability at the 3Button Group. "As soon as a machine stops, the cost clock starts ticking." This is why the Swedish system integrator relies on an operating concept that only requires 3 buttons: start, stop, and reset. Behind this, however, lies sophisticated technology – because keeping operation as simple as possible requires all the more machine intelligence in the background. This is impressively demonstrated by a solution for inspecting, stacking, and packaging coffee cup lids.

Drive technology from a single source: the 3Button group also implements AM8000 servomotors and AX5000 servo drives from Beckhoff, along with the XTS.

Speed and geometry

The real challenge in handling plastic lids of this kind lies in the combination of high speed and sensitive material. This applies in particular to in-mold labeling (IML), where a pre-printed label is inserted directly into the mold before the liquid plastic is injected. An IML lid is light and sensitive, and must not be damaged on the visible surfaces. In conventional systems, these requirements tend to clash: mechanical conveyor belts are often used to achieve throughput of around 100 million units per year, but they offer little flexibility and can lead to product damage, jams, and breakdowns in high-speed operation.

"Speed and precision come together in the packaging phase," says Johan Enander, analyzing the situation. "If the throughput is very high and products have an unusual shape, using conventional conveyor technology is a costly, laborious process." A conventional system would require a large number of servo drives, pneumatic cylinders, sensors, and complex mechanics to separate, align, and stack the lids. This would not only have massively increased the space required by the system, but would also have resulted in it needing more maintenance – a risk that was unacceptable given the required level of availability of over 99%. "A conventional conveyor system would have been too

C6032 acts as the central control unit, combining not only the logic (PLC), but also motion control and image processing in one runtime environment. The positions of the movers are updated via EtherCAT communication with a cycle time in the microsecond range. "This enables synchronization between the movers and the external process stations, something that would be unattainable with purely mechanical solutions," emphasizes Enander. "With XTS, we control each product individually and position it at high speed exactly where we need it." In practice, this means that the lids are taken from the injection molding machine, gripped individually by the movers, and dynamically guided past the various stations. As the movers move independently of each other, it is possible to compensate for process fluctuations to an excellent standard. If a lid needs to be inspected for longer, only this one mover slows down, while subsequent units catch up – the buffer is already integrated in the transport system.

Integrated inline image processing

Quality control is a critical aspect of IML products. The label must fit perfectly and must not have any bubbles or scratches. At this point, the 3Button Group benefits from the seamless integration of vision systems into the Beckhoff automation platform. As TwinCAT 3 controls both the movement of the XTS mov-

was manufactured, the 3Button Group was able to simulate the behavior of the XTS movers and their interaction with the robots in the system. This is because TwinCAT 3 enables the control code to be tested in a virtual environment. As a result, collision tests, cycle time calculations, and motion sequences optimizations were carried out as early on as the engineering phase. For the end customer, this meant that commissioning time on site was dramatically reduced. Any bottlenecks in the material flow had already been identified and eliminated in the simulation. The software architecture also enables fast format changes. If a different lid is to be produced in the future, the mechanics do not need to be modified. All that is needed is a parameter update in the software to adapt the movers' motion profiles to the new product geometry.

Increased OEE, increased economic efficiency

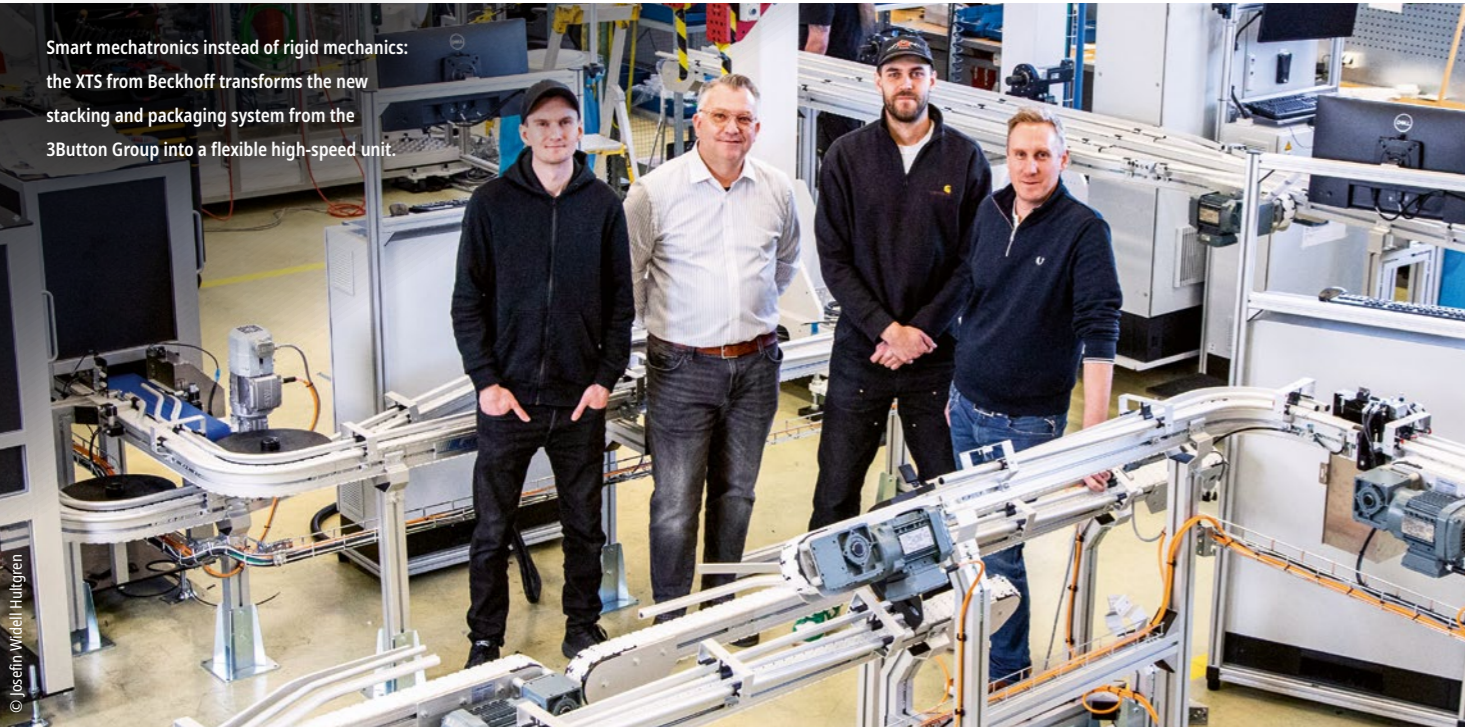
Technological finesse is meaningless if it is not profitable. But this is precisely where the Swedish integrator's solution demonstrates its strengths. The absence of complex mechanics significantly reduces maintenance costs. The XTS works almost wear-free, as the movers are held magnetically and do not require any sliding contacts or cable chains. At the same time, the compact de-

sured quality. For the customer, the focus of the investment shifts away from initial machine costs toward the total cost of ownership (TCO) instead. For the 3Button Group, the decision in favor of Beckhoff was also a strategic choice against proprietary black box systems. Ultimately, the openness of PC-based control makes it possible to integrate different technologies and standards – whether that means a connection to higher-level MES/ERP systems via OPC UA or integrating third-party components. "We really appreciate the openness and integration," confirms Enander. "It allows us to focus on offering our customers added value, instead of having to deal with technological limitations."

A partnership for the future

The successful implementation of the IML packaging system is another step forward in the collaboration with Beckhoff, which started in 2019. With around ten XTS applications delivered, the integrator already has a lot of experience in this area and is planning to deliver more machines this year. "In future, we also want to combine XTS and XTS Ecoline motor modules in order to adapt machines precisely to customers' needs," explains Enander. This will make it possible to implement cost-optimized hybrid solutions that use high-performance segments in cases where process speed is critical, and deploy Ecoline modules

Smart mechatronics instead of rigid mechanics: the XTS from Beckhoff transforms the new stacking and packaging system from the 3Button Group into a flexible high-speed unit.



A wealth of expertise: the 3Button Group is already an experienced XTS user and is planning to use it in further applications this year.



PLC, motion, and vision united in one runtime environment: a look inside the control cabinet

complex and costly," summarizes Enander. "That's why the solution for us was to abandon rigid mechanics in favor of a software-based approach."

A paradigm shift in material flow

The heart of the newly developed system, the XTS from Beckhoff, is a track on which 14 independent movers move. In contrast to chain conveyors, where the product is transported passively and is tied to the cycle of the chain, the movers act as active, servo-electrically controlled units. Each mover can be individually accelerated, braked, and positioned. A powerful Ultra-compact Industrial PC

ers and image processing, no complex synchronization is required. The system knows the mover's position in the sub-millimeter range at all times. The camera is triggered exactly when the lid is in optimum focus – during movement. This eliminates dead times that would occur with stop-and-go operation. Defective products are immediately identified and ejected as rejects without interrupting the continuous material flow.

Another advantage of the PC-based control architecture is the option to perform simulations. Even before the first mechanical part of the system

sign of the XTS reduces the footprint of the system. The movers run on a closed track, meaning that outward and return paths can be used for transportation. This is a compelling argument in production halls where space is at a premium. However, throughput remains the decisive factor. "If you save just a few tenths of a second per cycle in 24/7 operation, the increase in production is significant in the long term," confirms Johan Enander.

The 100 percent inspection and gentle handling minimize rejects and prevent complaints. Accordingly, the system not only delivers quantity, but also as-

on the transport routes in between. As a result, the 3Button Group will have a foundation that not only meets the increasing demands for speed and precision, but also offers the flexibility to respond quickly to future market trends.

More information:

www.3bg.se/en

www.beckhoff.com/packaging

www.beckhoff.com/xts



Left: Xoaquin Frabeiro, control engineer with Beckhoff Spain (left), and Débora Fraga, General Manager of Herfraga (right), in front of the SM-200 packing machine

cycle times in the millisecond range and enables straightforward integration into different production environments, in line with Herfraga's focus on adaptability and long-term serviceability.

Precise pneumatic control

Herfraga manages all relevant dynamic parameters for the pneumatic actuators on this control platform, including speed, torque, acceleration and deceleration, as well as synchronization and sequence control. Precise control is essential for two key functions:

- Automatic weight adjustment: a pneumatic drive regulates the fill quantity in each can and adapts to different formats and customer requirements.
- Hygiene and maintenance: controlled air supply to the compaction piston prevents product adhesion during filling, improving cleanliness and reducing maintenance time.

Data as a basis for process optimization

Beyond real-time control, the industrial PC also enables structured data acquisition. Operating data such as alarm history, production records, downtime and performance statistics are made available to the end user. This transparency supports preventive maintenance and contributes to continuous optimization of overall line efficiency.

Herfraga chose Beckhoff technology for this project due to its open PC-based architecture, fast communication and engineering flexibility. Integrated into Herfraga's overall machine concept, it supports the company's long-standing commitment to reliability, precision and customer-oriented solutions.

More information:
www.herfraga.com/en
www.beckhoff.com/cp6606

EtherCAT and PC-based control in a tuna packing machine for the fishing industry

Tradition meets high tech: tuna as if packed by hand

With more than 70 years of experience in fish processing machinery, Herfraga, a Spanish manufacturer, combines mechanical robustness and process expertise with continuous technological evolution. The company integrates PC-based control technology from Beckhoff in selected projects to further enhance flexibility and data availability, while preserving the quality standards that define the "Herfraga cut".

Founded in 1930 and based in Galicia in Northern Spain, Herfraga has grown from a small specialized machine builder into an international reference in automatic fish packing solutions, exporting to more than 50 countries worldwide. Its machines are designed for demanding, continuous production environments and are known for their robustness, reliability and for being low maintenance. The presentation quality achieved in the can is their hallmark: the "Herfraga cut" ensures that the tuna appears as if it has been hand packed.

Craftsmanship on an industrial scale

Herfraga patented its first tuna packing machine in 1962. Since then, this form of machinery has become one of the key elements in tuna and fish canning lines and remains one of the company's flagship products. Filling and compacting fish inside the can is a highly sensitive process. Any deviation in weight or

compaction directly affects productivity and final product quality. Herfraga's machine design ensures precise control of these parameters, supported by pneumatic actuators on the main axis.

Over the years, Herfraga has successfully implemented different automation architectures depending on application requirements. Beckhoff PC-based control technology was integrated into selected machinery as part of its continuous improvement strategy and in order to expand flexibility in parameter management, format adaptation and data handling. Débora Fraga, General Manager of Herfraga, explains: "One of the most valued features in our systems is the quality of the Herfraga cut. Preserving this hallmark while continuously improving operational flexibility is a key priority for us."

A CP6606 Economy Panel PC handles logic and motion control tasks and with its integrated touchscreen also provides an operator interface directly on the machine.



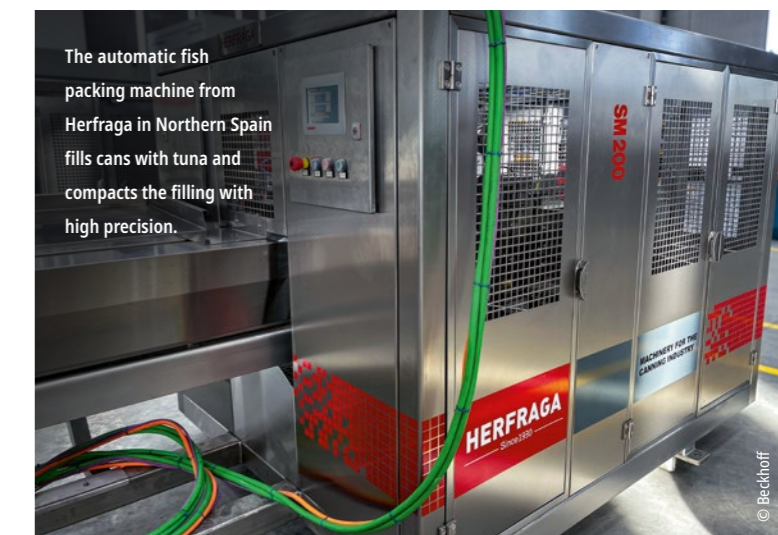
An integrated control platform

In this project, Herfraga implemented a CP6606 Economy Panel PC from Beckhoff as the central control platform for selected functions within the overall machine architecture. This compact industrial PC with a 7-inch touchscreen combines PLC and motion control tasks with operator interface functions, thus simplifying the control structure and reducing the cabinet space required.

This integration enables operators to monitor the machine directly and adjust operating parameters in real time while maintaining the robust mechanical design and process consistency that characterize Herfraga equipment.

Fast EtherCAT communication

Communication between the control platform, the frequency inverter and the I/O modules is carried out via EtherCAT. The modular architecture supports fast



The automatic fish packing machine from Herfraga in Northern Spain fills cans with tuna and compacts the filling with high precision.

PC-based control for integrated robotics solutions in medical technology

Precise, careful handling

There's no room for error when handling plastic packaging in the medical and pharmaceutical industry: sterility and a flawless surface are mandatory. In order to meet these requirements as throughput continues to rise, Saxe Group, a Danish company develops integrated robotics solutions that unite precision, complete traceability, and ease of use. This machine builder uses PC-based control from Beckhoff as its central control platform to seamlessly combine PLC, motion, safety, and robotics on one piece of hardware.

NETSTAL

To save valuable floor space in end users' cleanrooms, Saxe integrates the automation cell directly into the injection molding machine of its Swiss partner Netstal.

Digital partner:
bfa solutions ltd

The Saxe Group develops and manufactures modern automation systems with six-axis robots for the plastics, food, and pharmaceutical industries. With its roots in plastics manufacturing and a deep understanding of the strict documentation requirements of the medical sector, the company occupies a niche in the market. In order to meet high demand – the company delivers a robot cell approximately every two weeks – Saxe recently built a new production hall for automation at their Randers site. From there, the company supplies the whole of Scandinavia and is also breaking into other markets in Europe and the USA.

Quality assurance in the machine

In the pharmaceutical industry, even the smallest cracks or scratches on components can have severe consequences. They jeopardize sterility and, in the worst case, impair the function of the end product. Sensitive plastic parts that come directly from injection molding therefore need to be handled with particularly high precision. At the same time, manufacturers must fully document every step. The Saxe Group is a specialist for these requirements: the company's customized take-out solutions ensure safe, traceable handling of the plastic packaging and are positioned in the injection molding machine.



AX5203 2-channel servo drives in combination with AM8022 servomotors assure dynamic and synchronized movement for the take-out system.

Morten Møller, R&D manager at the Saxe Group, appreciates the long-standing partnership and the direct line to Beckhoff.

The technical foundation is provided by four- and six-axis robots from Stäubli. "Our solutions monitor the process with very high accuracy: if parameters deviate or if parts are not 100% perfect, the robots automatically remove them as scrap during the take-out process," explains Ulrik Gert Nielsen, owner of the Saxe Group. Only flawless parts are gently transferred to downstream processes such as filling or packaging.

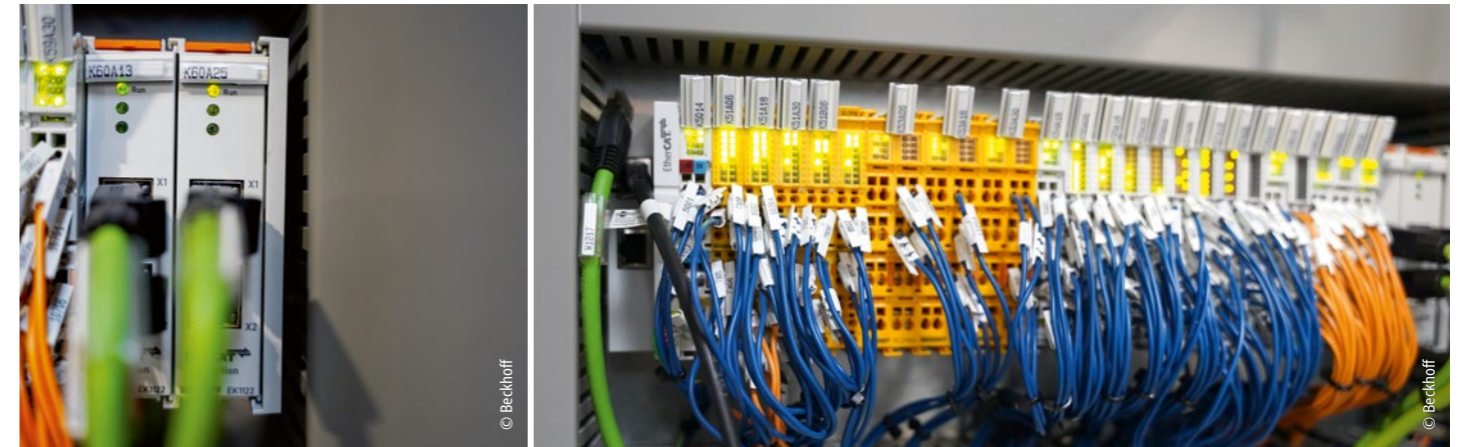
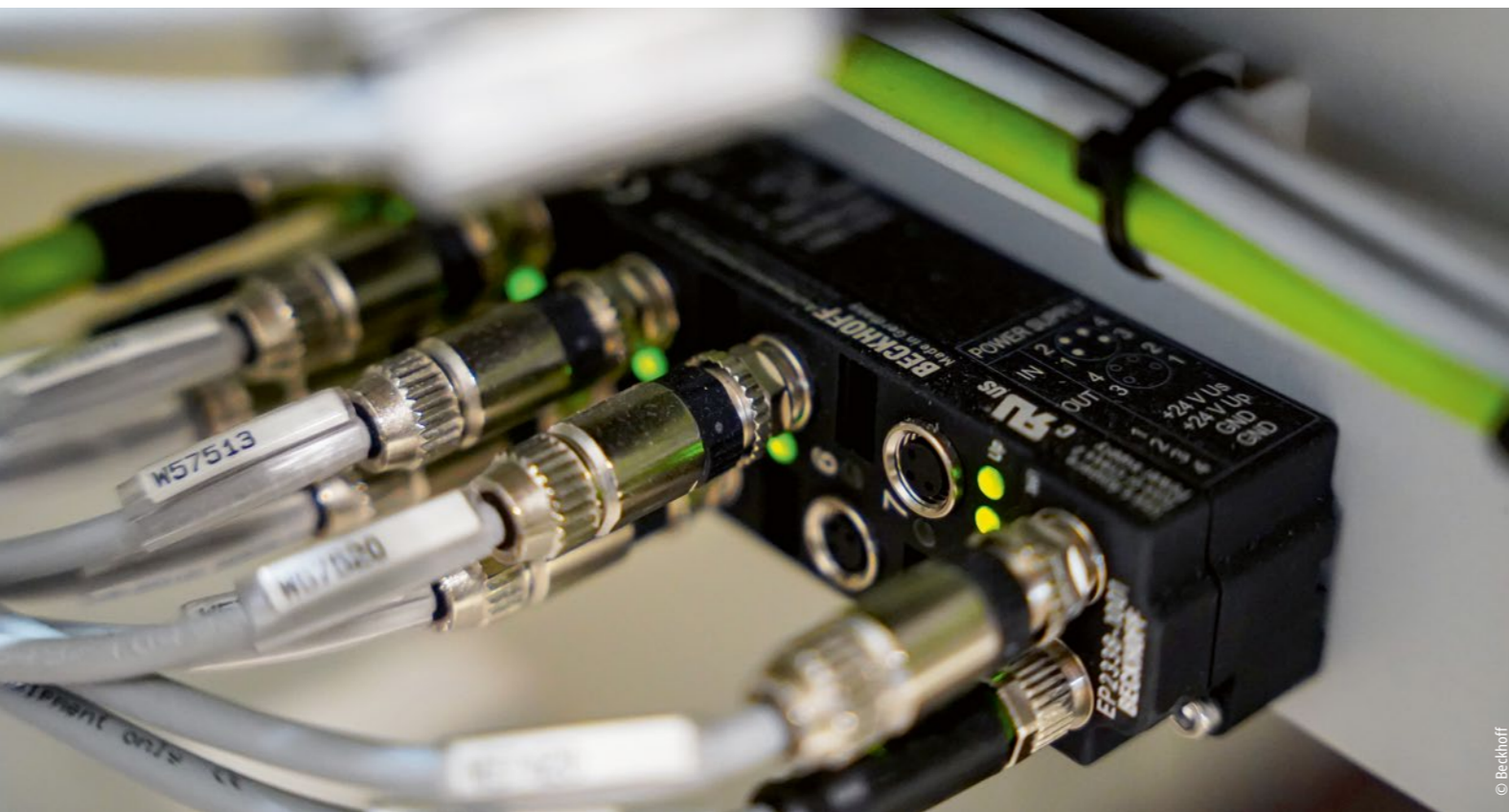
From adjacent unit to fully integrated cell

Netstal is an important partner for the Saxe Group; this Switzerland-based injection molding machine manufacturer is represented by the Saxe Group in the Nordic region. Previously, the robot used to stand next to the injection

molding machine as a separate enclosed unit, but as time went on, the market demand for compact turnkey solutions grew. Saxe therefore developed a new design in which the automation cell is integrated directly into the machine frame, saving valuable floor space in end users' cleanrooms.

"In our cycle-optimized solutions, the open and flexible automation technology from Beckhoff allows us to combine high precision with high speed," emphasizes Morten Møller, R&D manager at the Saxe Group. The machine builder relies on a CX5240 Embedded PC as the central controller for the new robot cells. This PC combines all the necessary automation functions on a single platform: PLC, motion, safety, and HMI. "As TwinCAT 3 has a modular

Saxe uses IP67-protected EP2338 EtherCAT Box modules to integrate sensors and vacuum valves directly in the field.



The EK1122 2-port EtherCAT Junction enables a star topology to be set up and ensures seamless data flow between the controller, robot, and peripherals.

According to users, the fact that safety and PLC work on the same platform is a significant advantage in validation and documentation.

structure, we only activate the functions that we really need," adds Møller with regard to the software. Specifically, Saxe uses TwinCAT 3 PLC/NC PTP 10 for the application code and axis management and TwinCAT 3 HMI for visualization. Communication with third-party providers is standardized via OPC UA.

Morten Møller, R&D Manager at Saxe Group

“The open and flexible automation technology from Beckhoff allows to combine high precision with high speed.”

End-to-end communication without latency

As this embedded PC provides the entire automation functionality, all interface problems are eliminated. The controller communicates with all decentralized units in real time via EtherCAT. This architecture reduces latency times, simplifies project planning, and accelerates both development and commissioning. An EK1122 EtherCAT Junction acts as a star connection for the robot and ensures seamless data flow between the controller, robot, and peripherals.

AX5203 2-channel servo drives are used for servo control. In combination with AM8022 servomotors, they assure dynamic and synchronized movements in the take-out system. The I/O modules used – e.g., EL series EtherCAT Terminals and IP67-protected EP2338 EtherCAT Box modules – integrate the sensors and vacuum valves. Safety technology is also integrated: TwinSAFE Terminals such as EL1918 and EL2904 monitor emergency stops and safety gates directly in the EtherCAT network. "Safety functions and machine control operate on the same platform, which is a significant advantage when it comes to validation and documentation," states Morten Møller.

The one-button machine

Through the combination of PC-based control and EtherCAT, the system achieves cycle times of just a few milliseconds. All process data is logged automatically, ensuring that the high requirements for traceability are met. The developers have paid particular attention to usability. In light of the current shortage of skilled workers, Saxe developed the concept of the one-button machine, which can be operated by those without specialist expertise in robotics. As the robots are deeply integrated into the injection molding control system, the operator controls the entire process via a standardized interface and starts the system by pressing a single button. "In the manufacturing industry, there is a shortage of operators who can monitor several complex processes at the same time," says Ulrik Gert Nielsen, explaining this strategy. "Our aim is therefore to provide solutions that require as little operation and maintenance work as possible. This, too, is only possible thanks to the end-to-end automation platform from Beckhoff."

Partners as drivers of innovation

Beckhoff and Saxe established their partnership in 2012, and it became the foundation for the technological implementation of the automation cells. This partnership originally came about through robot manufacturer Stäubli. For the machine builder, the standardized platform also offers advantages when it comes to service as updates can be managed centrally. "Beckhoff provides high-performance products and solutions that are also compact. They enable us to remain strong in a segment where quality and regulatory compliance are uncompromising," says Morten Møller. He also values the fact that communication with Beckhoff is quick and straightforward: "We have direct access to all new information, calculations, and software updates via our contacts. This guarantees that we are always at the cutting edge of automation technology."

More information:

www.saxe-group.com

www.beckhoff.com/packaging

Decentralized MX-System

Control cabinet-free automation has entered series production

Beckhoff has started regular delivery of the MX-System. The first machines to be fully equipped with this modular solution are already being used successfully. This marks the start of a new generation of automation systems – without traditional control cabinets, but with maximum efficiency, flexibility, and future-safety instead.

In this 14-meter-long machine from Schirmer Maschinen GmbH for fully automatic processing of PVC window profiles, all previously required control cabinets were replaced with the MX-System.

The MX-System combines all automation functions in a pluggable, robust system design and offers machine builders and end users in the packaging environment, for example, comprehensive benefits over the entire life cycle of the machine.

Technical concept: a modular system

The standardized function modules can be easily connected and screwed into place on the robust baseplate – the heart of the MX-System. This baseplate completely replaces the internal wiring of a traditional control cabinet. Mechanical and electrical interfaces are standardized and directly integrated – enabling maximum compatibility, safety, and easy expandability.

The baseplates are available in different sizes and can be scaled according to performance requirements – from compact individual machines to extensive, widely branched production lines. The largest version can even supply powerful drives up to 15 kW. The MX-System supports a total power supply of up to 125 A, making it suitable for power-intensive applications. The high mechanical stability of the aluminum construction and the IP67 protection rating also enable direct use in harsh industrial environments – without additional protective housings or the need for control cabinet air conditioning.

The modular system currently comprises around 150 different function modules, including industrial PCs, network interfaces for Ethernet and EtherCAT communication, I/O modules for digital and analog signals, power modules for motor control (servo, asynchronous, 48 V, or stepper motors), and system modules for power supply, voltage supply, fuse protection, or data logging. Many of these modules combine several functions in a single housing, reducing complexity, wiring work, and space requirements.

Flexible application options from individual units to distributed packaging lines

Even with “just” 150 function modules, it is possible to automate a wide range of different applications. For compact special machines, such as, for instance, a mobile asparagus peeling machine in a supermarket environment, a small baseplate is often sufficient to provide all necessary control, sensor, and actuator functions.

The system also offers a scalable solution for large machines with several hundred motors, such as window profile production systems and interconnected production lines for the packaging industry: Several baseplates can be connected to each other via pre-assembled cables so that each station has its own locally installed automation unit. This enables decentralized machine concepts with a high degree of prefabrication and facilitates both assembly and commissioning.

Seamless integration into new and existing machine architectures

The MX-System can be flexibly integrated into almost any machine design. Actuators such as motors, sensors, heaters, or safety devices can be connected directly. At the same time, distributed EtherCAT Box modules, IO-Link devices, or external variable frequency drives can be integrated with ease. The modules provided for this purpose supply the appropriate supply voltage, take care of fuse protection, and – where necessary – even provide safety-related shutdown capabilities in accordance with functional safety requirements.

In larger systems, the MX-System can also be used as a powerful substation – fed from a central control cabinet that provides main power supply and communication interfaces. This hybrid architecture combines the advantages of modular, decentralized intelligence with established control cabinet infrastructure and is ideal for system modernization or heterogeneous transitional solutions.



Only one workstation is required to assemble the MX-System, where the entire system can be set up with just one tool.

Advantages throughout the machine life cycle

Planning and project planning: The effort required for planning and documentation is drastically reduced. Instead of hundreds of individual parts, the MX-System solution comprises only approximately 10% of the typical number of components. This reduces the complexity of CAD design, shortens construction time, and facilitates the reuse of modular function groups. UL, IEC, and CSA certifications have already been obtained, which simplifies international use.

Set-up and installation: Installation requires only one tool. Pluggable modules, clear interfaces, and predefined installation positions enable safe, fast, and standardized installation. Installation times are reduced by up to 95% compared to conventional solutions. Control cabinet design is also benefiting: Many systems can now be implemented entirely without a traditional cabinet.

Installation directly on the machine: Direct installation on the machine eliminates the need for long cable runs and complex cable routing. This saves

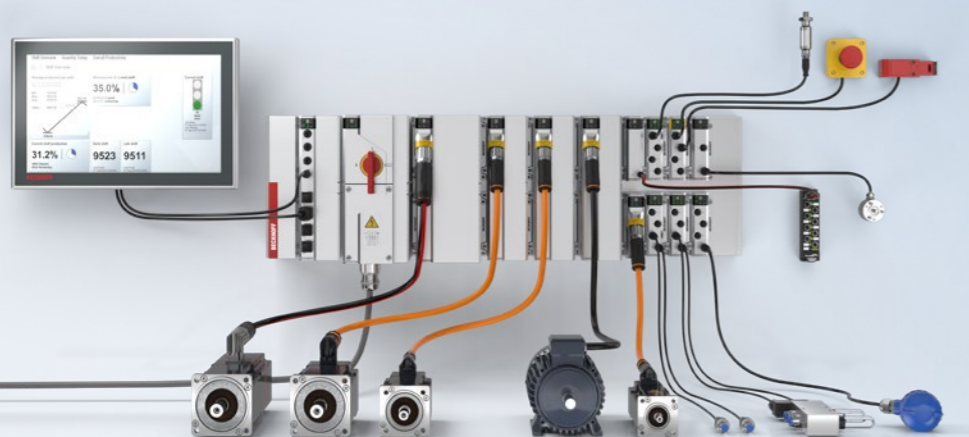
material and time and reduces sources of electromagnetic interference. At the same time, the system requires only about 30% of the space compared to a conventional control cabinet – an advantage that pays off especially in compact systems and mobile machines.

Operation, diagnostics, and maintenance: During operation, all function modules provide diagnostic data in real time – from current values and temperatures to fuse status indicators. This data can be accessed via EtherCAT or viewed directly on a smartphone using the Beckhoff Device Diagnostics app. Hot-swappable modules can be replaced during operation, minimizing downtime and simplifying maintenance. As no active cooling is required, ongoing energy costs are also reduced.

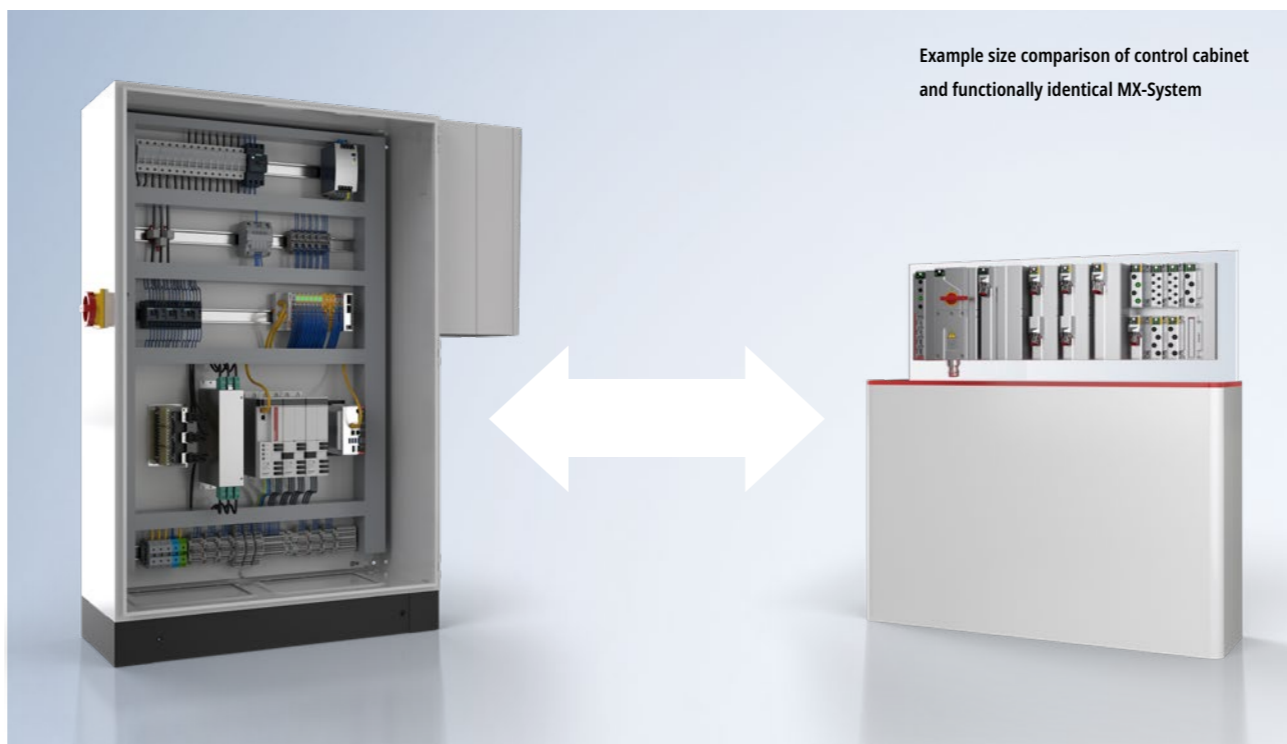
Conclusion

The MX-System from Beckhoff represents a paradigm shift in automation technology. It not only replaces the control cabinet, it redefines it. The combination of modular hardware, standardized interfaces, and integrated intelligence creates the basis for future-proof, flexible machine concepts. The technology has already been field-proven in numerous applications – from packaging technology and building production through to the food industry. Beckhoff provides its customers with comprehensive support offers ranging from project planning and training to series integration. If required, the Beckhoff specialists can also demonstrate for individual customer applications how the MX-System can become the optimum solution for the automation task in question.

With the MX-System, the individual modules simply need to be plugged onto the baseplate and screwed in place so that the entire automation system can be positioned directly on the machine without a control cabinet.



Example size comparison of control cabinet and functionally identical MX-System



Daniel Siegenbrink,
Product Manager
MX-System,
Beckhoff Automation



CoAgent



With TwinCAT CoAgent and TwinCAT Machine Learning Creator, process and automation experts can use AI technologies directly for their applications.

TwinCAT CoAgent and TwinCAT Machine Learning Creator for AI-assisted automation

Unlock optimization potential even more easily with advanced AI functions

Artificial intelligence has long since found its way out of laboratories and research facilities and into everyday life – and is also proving to be a key driver of innovation in industrial automation. Beckhoff recognized this trend early on and integrated AI directly into the control environment. With TwinCAT Machine Learning, AI models can be executed in real time directly on the machine controller and are literally woven into the PLC code. Furthermore, TwinCAT CoAgent and TwinCAT Machine Learning Creator allow process and automation experts to use AI technologies directly for their applications. Recent functional enhancements to these products show how consistently Beckhoff is driving forward the democratization of AI in automation.

Two approaches to the use of artificial intelligence have emerged in industrial practice: task-specific AI and agentic AI. Task-specific AI handles clearly defined tasks such as visual quality control, predicting machine failures, or locating objects. It is based on domain-specific data and is closely integrated into the control environment – for example with TwinCAT Machine Learning Creator and TwinCAT Machine Learning. On the other hand, there is agentic AI, i.e., AI-based assistance systems built on generative models. These systems support engineers and machine operators through dialog-based interaction, automated code generation, or error analysis during operation – implemented with TwinCAT CoAgent. Both approaches complement each other by addressing different levels: task-specific AI increases efficiency and quality directly in the machine process, whereas agentic AI makes everyday engineering and servicing easier – from development to commissioning and ongoing optimization.

More efficiency in development, service, and machine operation

TwinCAT CoAgent for Engineering supports control programmers in a variety of tasks – from precise code suggestions and smart optimizations through to automatic documentation. Through integration into existing projects, verified content can be adopted directly. In addition, the CoAgent enables quick access to the Beckhoff documentation system, the development of user-friendly HMI controls, and the simple configuration of complete I/O topologies via chat or natural language. For developers, this means less time spent on routine work and search tasks, a significant acceleration in day-to-day project work, and more freedom to focus on demanding automation tasks. Thus, TwinCAT CoAgent is establishing itself as a personal assistant that makes the entire engineering workflow more efficient in the long term.

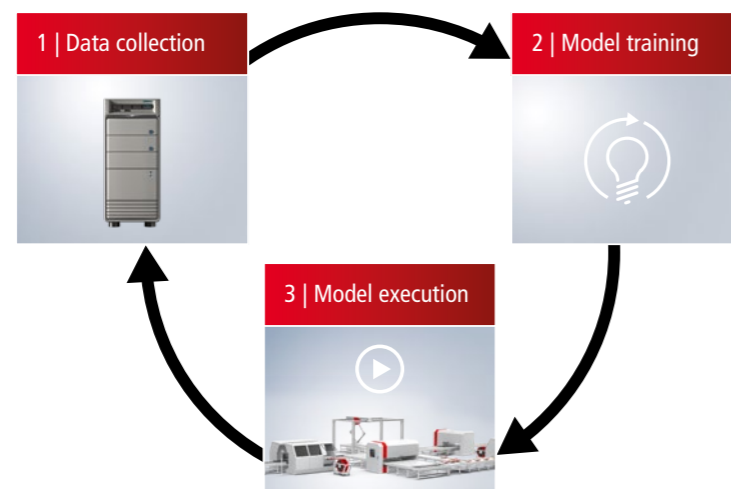
With TwinCAT CoAgent for Operations, Beckhoff brings agentic technology directly into machine operation. The CoAgent continuously monitors process values, log files, and KPIs, detects deviations, and initiates a structured problem-solving process together with service personnel:

1. Form a hypothesis.
2. Perform evidence-based diagnosis.
3. Provide concrete suggestions for action, including step-by-step instructions.

Agent-supported error diagnostics make it possible to evaluate alarm messages in context – e.g., by correlating increased power consumption, falling

throughput, and log warnings. This allows false alarms to be reduced and critical faults to be prioritized. Typical potential benefits include a significantly shorter time to resolution (TTR), a higher first-fix rate for the most common error patterns, and a noticeable workload reduction for service personnel. Another advantage lies in the documentation: TwinCAT CoAgent creates detailed, target group-oriented service reports for any period of time as desired. These reports include root cause analyses, impact, duration, recommended corrective actions, and follow-up of outstanding issues. Shift reports can also be generated automatically – including KPIs, trend charts, and unresolved maintenance tasks scheduled for the next shift. Thus, TwinCAT CoAgent for Operations is being established as an interactive service agent that makes ongoing operations more intelligent, from faster troubleshooting and improved transparency to a consistently higher quality standard in reporting.

With PC-based control from Beckhoff, the entire workflow of AI-assisted automation can be seamlessly implemented in the TwinCAT control environment.



In summary, Beckhoff TwinCAT CoAgent proves to be a powerful AI assistant over the entire automation lifecycle – from code generation in engineering to error diagnostics during operation. The open architecture of TwinCAT CoAgent enables the integration of different language models and flexible combination with customer-specific extensions – supported by interface standards such as the Model Context Protocol (MCP). For example, a company can provide its own knowledge database as an MCP server and integrate it seamlessly with the CoAgent. By extending the product to cover the entire lifecycle, all development and service processes can be accelerated, complexities reduced, and downtimes significantly shortened. Developers

benefit from more efficiency and freedom in their day-to-day project work, while service teams can respond more quickly and receive targeted support. The increased flexibility and openness of the system also ensures investment security and future viability.

Automatic AI model creation for signal and time series analyses

The TwinCAT Machine Learning Creator (MLC) from Beckhoff is aimed at automation and process experts and adds automated AI model creation to the TwinCAT 3 workflow. This opens up the potential of artificial intelligence for smaller companies too – with benefits in terms of competitiveness and in dealing with the increasing shortage of skilled workers. At the same time, the tool also makes work easier for AI developers: as a “version zero generator”, it automatically creates initial model variants, reduces sources of error, and accelerates the development process. In addition, extensive methods are avail-

able to represent the behavior of the models transparently, compare variants, and support auditing processes through automated report generation. With the provision of the right tools, those directly affected – the automation engineers – can solve their challenges themselves. This way, the expertise becomes more deeply embedded in the company and is built up over the long term.

The model that has been automatically trained with TwinCAT MLC can be exported in the ONNX open standard format and is optimally adapted to the real-time requirements in the control environment in terms of latency and accuracy. The focus to date has been on AI-supported image processing. With TwinCAT MLC Signals and Time Series, Beckhoff is expanding the functional scope of the Machine Learning Creator: In addition to image processing (TwinCAT MLC Computer Vision), signals and time series can now also be analyzed efficiently. Typical applications include:

- classification (e.g., for quality inspection)
- forecasting (e.g., to predict energy consumption or wind speed)
- anomaly detection (e.g., in condition monitoring)

Signals and time series include both the progression of a single signal over time or over other variables (such as frequency, wavelength, distance, or angle) as well as the development of several signals in parallel over different dimensions, e.g., the progression of pressure, temperature, and electrical power over time.



Dr. Fabian Bause
Product Manager TwinCAT, Beckhoff Automation

“With TwinCAT MLC Signals and Time Series, historical, time-ordered data can be analyzed to detect patterns and trends as well as to predict future values or identify anomalies.”

TwinCAT® CoAgent

As an AI-based assistant, TwinCAT CoAgent significantly optimizes engineering and now optimizes the control runtime, too.

Create a function block with Quicksort

```
VAR
  Pivot: REAL;
  i: INT;
  j: INT;
END_VAR
```

```
IF Low < High THEN
  Pivo
```

CoAgent





Jannis Doppmeier
Product Manager TwinCAT, Beckhoff Automation

“TwinCAT CoAgent optimizes both engineering and runtime applications and serves as a team member that helps with diagnostics, interactively guides service personnel through checklists, and is actively involved in problem solving.”

Signal and time series analysis opens up a wide range of possibilities in industrial applications, especially as comprehensive machine data is already available with PC-based control from Beckhoff. Numerous TwinCAT tools can be used for convenient data collection directly from the control process, such as TwinCAT Scope View, Analytics Logger, Database Server, or Data Agent.

Anomaly detection and condition monitoring

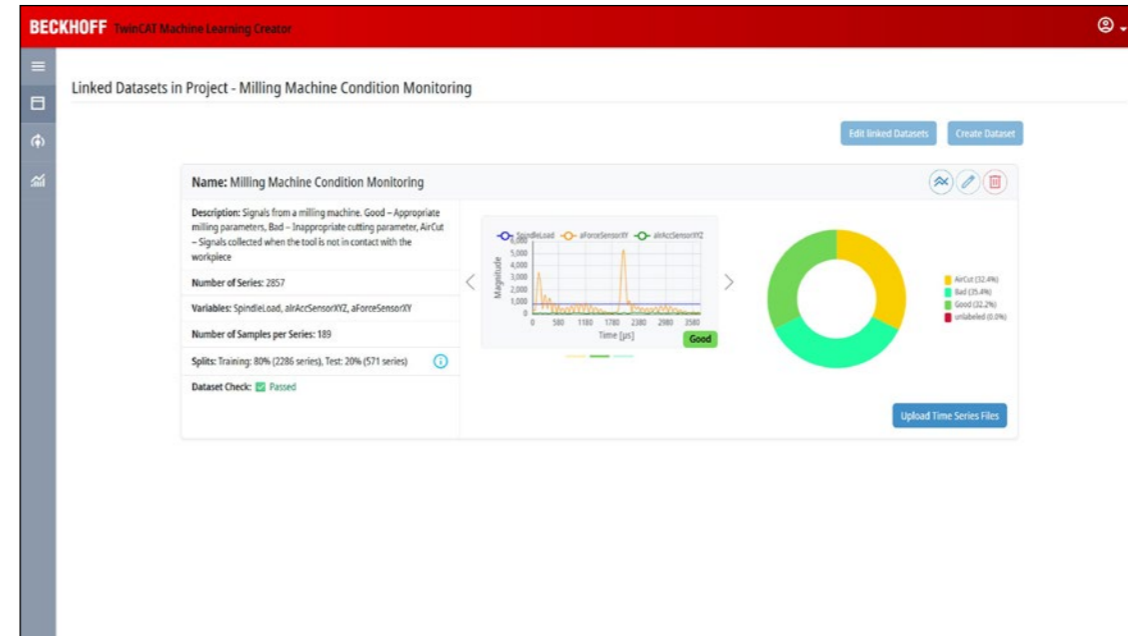
A central area of application for signal and time series analysis is anomaly detection: the temporal correlation of disruptive events – such as faulty signal transmissions, power supply fluctuations, operating errors, or environmental conditions – allows causes to be reliably identified. Typical applications include:

- detection of motor malfunctions (bearing damage, imbalance, mechanical problems) based on current, vibration, or acoustic signals
- diagnosis of pump and compressor faults via current and temperature data
- detection of leaks in hydraulic or pneumatic systems via pressure monitoring
- wear detection on milling and drilling tools based on spindle currents

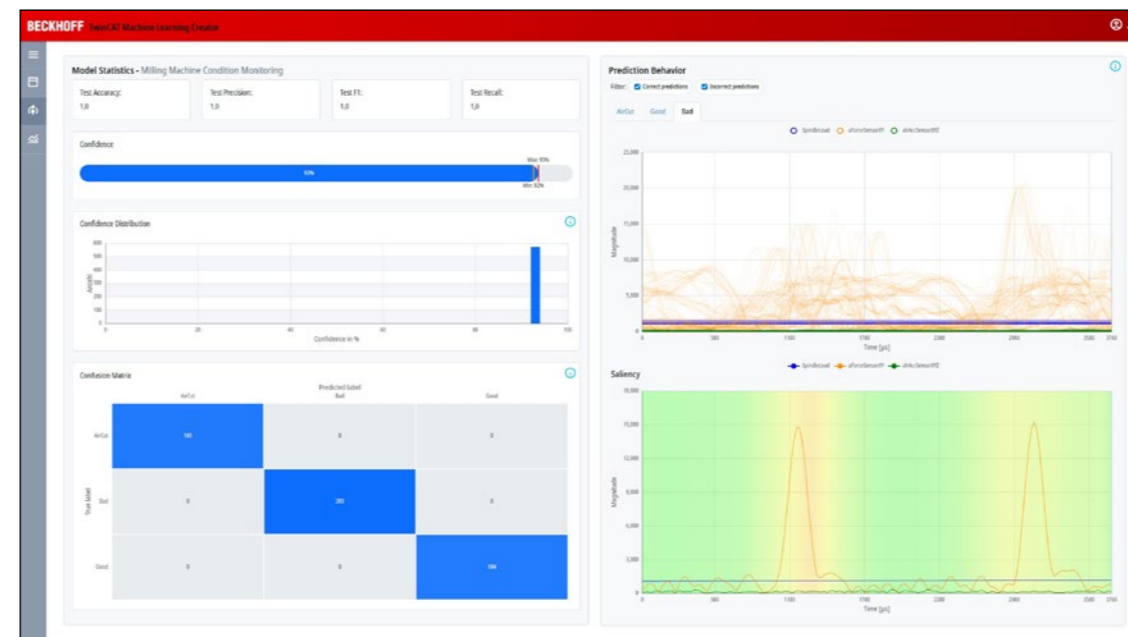
Quality assurance and process monitoring

There is also new potential in the field of quality assurance. Sensor-based, non-optical end-of-line tests can evaluate electrical properties (e.g., impedance curves) or geometric variables. Inline analyses enable process-integrated quality monitoring for applications such as:

- welding processes via current and voltage curves
- cutting and packaging processes based on servo motor currents
- sealing, grinding, or forming processes based on motor currents

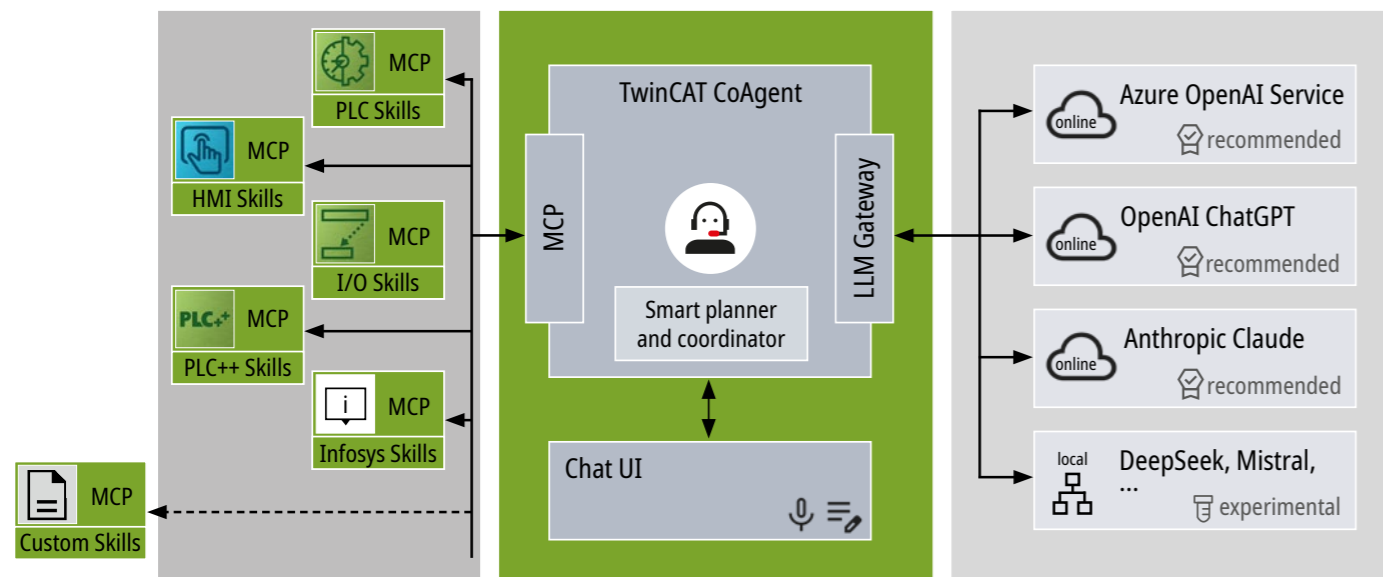


Example of a time series analysis with TwinCAT Machine Learning Creator



Verifying the quality of an AI model with TwinCAT Machine Learning Creator

The open architecture of TwinCAT CoAgent implemented via the Model Context Protocol (MCP) enables the use of different language models and flexible combination with customer-specific extensions.



Beckhoff MCP servers: extendable

Beckhoff MCP clients: interchangeable

Large Language Models: selectable

- kneading and fermentation processes in food production using temperature-time profiles
- complex processes such as crystal growth in semiconductor production

Process optimization and energy efficiency

In addition, time series analysis contributes to process optimization and energy efficiency. Examples include the dynamic adjustment of adaptive process parameters (e.g., feed rate, pressing force), the optimization of energy consumption based on load profiles and forecasts, or the predictive control of complex systems. In the context of wind power, for example, the nacelle and rotor blades can be optimally aligned based on the predicted wind direction and speed.

More information:
www.beckhoff.com/twincat-coagent
www.beckhoff.com/te3850

Economy drive system closes the gap in the entry-level drive segment

Affordable without compromise on key features

Global cost pressure in machine building is forcing many designers to readjust the balance between performance and affordability. This applies in particular to standard applications in series machines and exports to price-sensitive markets. Solutions are called for that reduce investment costs but do not require significant compromises to be made in terms of functionality and quality. Beckhoff is responding to these circumstances with the economy drive system: the coordinated platform of servomotors, servo drives, and variable frequency drives enables compact, cost-efficient machine concepts offering full integration into the world of PC-based control.

Diversity in industrial production is constantly increasing. While high-end applications still require the highest possible cycle times and extremely accurate synchronization, the need for solid automation solutions that are particularly attractive from a cost perspective is growing at the same time. Until now, designers have often been faced with a dilemma here: Either they use oversized drives in order to remain within the familiar system environment. Or they switch to cheaper alternatives, but this increases system complexity and engineering costs. It is for these reasons that Beckhoff has launched its economy drive system. It offers an answer to the question of how functionality, reliability, and a universal system can be combined with an optimized price to performance ratio.

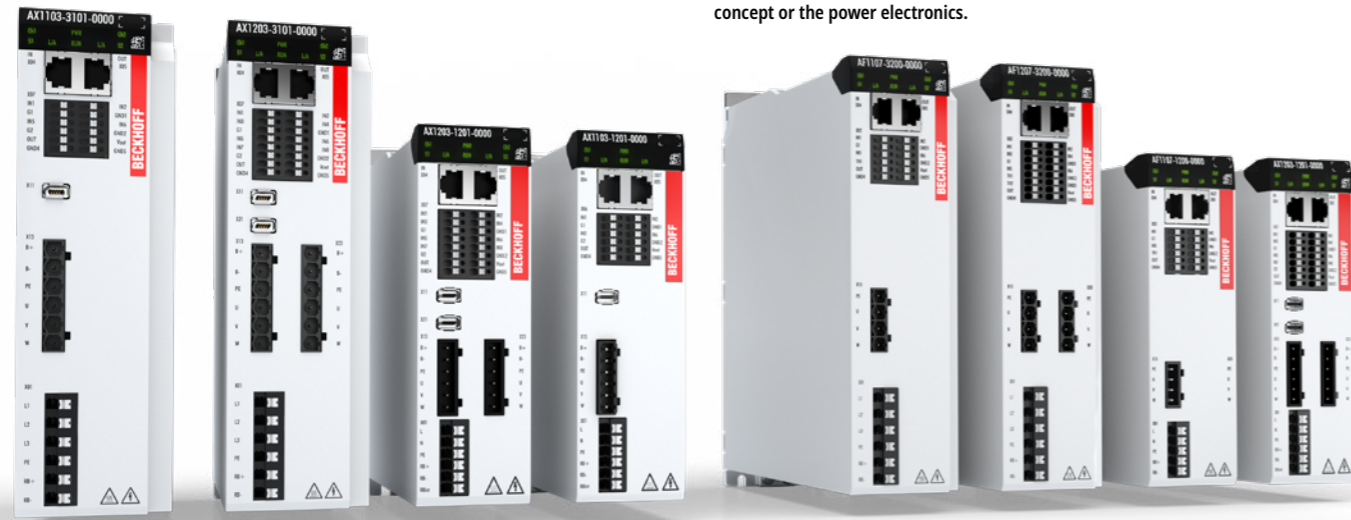
A technological balancing act

The challenge when developing the economy drive system was to retain the key features of advanced servo technology while significantly reducing complexity and hardware costs. The result follows a platform strategy in which servo drives and variable frequency drives are closely related in terms of technology and share housing concepts and power electronics.

The central element of the new topology is the AX1000 servo drive. It covers the rated current range from 1.65 A to 12 A and is available for both single-phase (1 x 230 V AC) and three-phase networks (3 x 400 V AC). One notable aspect is the high packing density: The power supply, DC link capacitors, and braking

With the economy drive system, Beckhoff is providing the answer to the question of how functionality, reliability, and a universal system can be reconciled with an optimized price to performance ratio.





In line with a platform strategy, the AX1000 servo drives and AF1000 variable frequency drives are closely related in terms of technology – for example, with regard to the housing concept or the power electronics.

circuit are fully integrated, despite their extremely compact dimensions. The housing is made of robust plastic, which reduces weight and material costs. The devices can be installed next to each other in the control cabinet without minimum distances having to be maintained between the drives.

Servo technology for the global market

The AX1000 is a perfect match for the newly developed AM1000 synchronous servomotor. Featuring an extremely compact design and available in the common international flange dimensions of 40, 60, and 80 mm (I1, I2, I3), the motor covers a power range up to 1,000 W (at 230 V) or 1,700 W (at 400 V).

For machine builders it is essential that – even if the drives are positioned in the economy segment – established features are still available. The AM1000 supports One Cable Technology (OCT), where power and feedback signals are transmitted via one motor cable. This dramatically reduces cabling effort and risk of errors during installation. The motor is characterized by low to medium inertia, which makes it ideal for dynamic positioning tasks in packaging machines or handling systems. With battery-free encoders (single or multi-turn), the system also eliminates the need for maintenance-intensive battery changes in the field.

Variable frequency drive with dual-axis topology

The AF1000 variable frequency drive that forms part of the economy drive system is an exceptional innovation. While dual-axis modules are already established in servo technology, their availability with variable frequency drives is entirely new. As the AF1000 uses the same hardware platform as the AX1000, Beckhoff also offers it in a dual-axis version. The benefits of this architecture are obvious:

- Essential components such as the EtherCAT interface, the housing, the microcontroller, and the power supply are shared by both axes, significantly reducing the costs per axis.
- Both axes operate on a common DC link. Generative energy from a braking axis can be reused directly, improving the energy efficiency of the overall system.
- The integration of two variable frequency drives in a housing just 50 mm wide (or 60 mm for 3-phase) enables control cabinet designs with extremely high power density to be achieved.

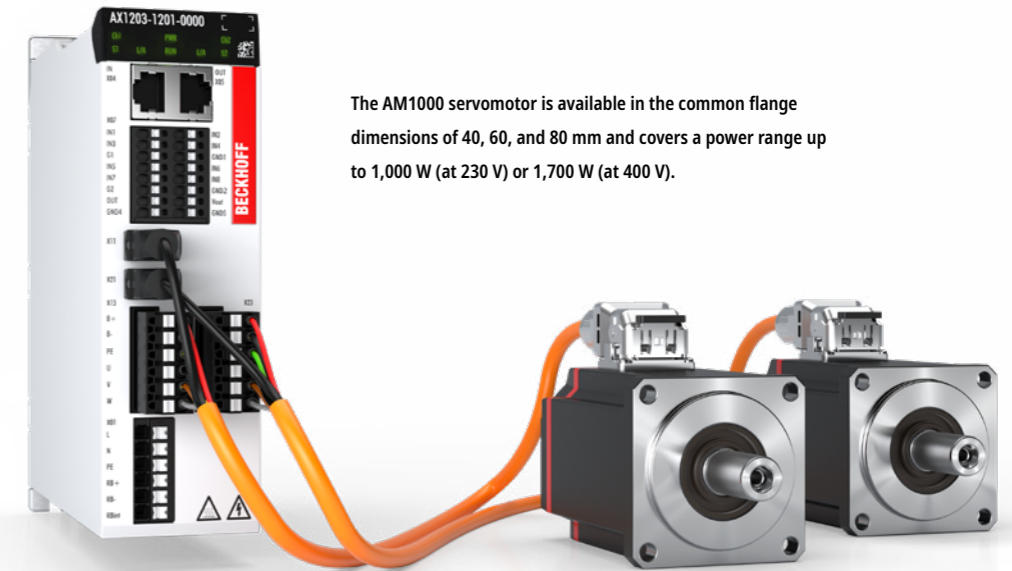
The AF1000 covers a power range from 370 W to 5.5 kW and is suitable for synchronous, asynchronous, and reluctance motors in sensorless operation (V/f or vector control). This makes it a suitable drive for conveyor belts, pumps, or fans within a more complex machine.

A reduction in hidden costs

The economic leverage of the economy drive system lies not only in the component price, but also in the reduction of peripheral costs and installation times. One special feature is the internal generation of the 24 V control voltage directly from the DC link. This means that no separate 24 V power supply is required to supply the drive electronics and the motor brake. The 24 V generation permanently draws energy from the DC link, which increases the voltage reserves for dynamic braking processes and delays the activation of the internal braking resistor. This lowers the heat generation in the control cabinet, and cabling requirements are also reduced.

In addition, all connections (except optional safety inputs) are accessible from the front, improving ergonomics during installation. In combination with the

The economic leverage of the economy drive system lies not only in the component price, but also in the reduction of peripheral costs and installation times.



The AM1000 servomotor is available in the common flange dimensions of 40, 60, and 80 mm and covers a power range up to 1,000 W (at 230 V) or 1,700 W (at 400 V).

OCT of the AM1000 and the partially shielded motor cable of the AX1000, which enables smaller bending radii and thinner cable diameters, significant amounts of space can be saved with respect to cable channels and drag chains.

One platform, one tool

The key difference to cost-optimized solutions from other suppliers is that this system is integrated completely into the Beckhoff motion platform. Both AX1000 and AF1000 are fully fledged EtherCAT devices. There is no break in communication and no need for gateways. Commissioning can be carried out via Drive Manager 2 in TwinCAT, which already supports all existing Beckhoff drives. This means that users do not need to gain additional knowledge of specific third-party tools. Proven features such as the electronic nameplate on the AM1000 enable plug-and-play commissioning. Diagnostic and tuning features such as Autotuning or Bode Plot are also available without restriction for the economy drive system.

No compromises are made in relation to functional safety either. The AX1000 economy servo drive supports TwinSAFE by default for the implementation of the drive-integrated safety functions STO/SS1 in accordance with IEC 61800-5-2. It is optionally available with many other TwinSAFE safety functions.

Conclusion and outlook

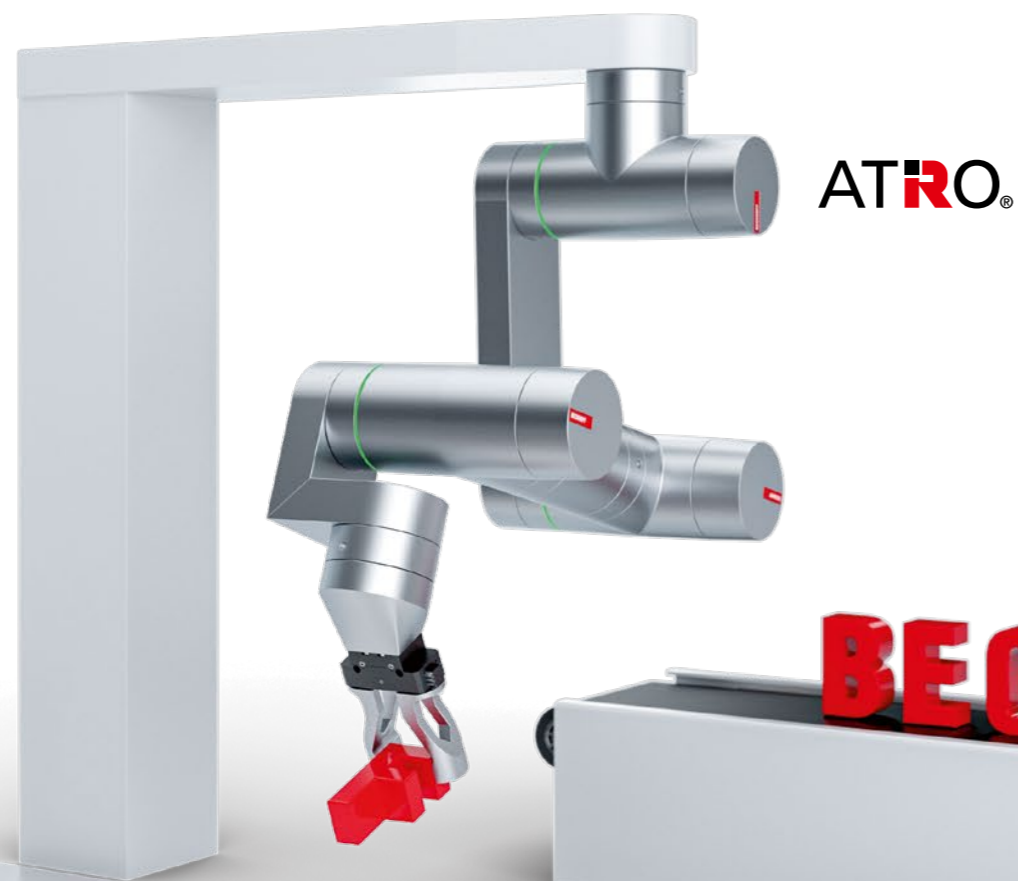
With the economy drive system, Beckhoff is underlining the fact that “Made in Germany” and cost efficiency are not contradictions in terms. The expansion of the drive portfolio enables modular scaling of applications without having to sacrifice the customary control quality: From high-performance axes with the AX8000 multi-axis system or the AX1000 stand-alone device to cost-efficient conveyor drives with AF1000 – all are based on one automation platform. This strengthens the competitiveness of users in the machine building sector who need to serve global markets with reliable yet economical technology.



The product management team behind the economy drive system: Andreas Golf, Dirk Hansen, Michael Pfister and Simon Rubel (from left to right)

More information: www.beckhoff.com/economy-drive-system

The modular ATRO industrial robot system makes it possible to implement application-specific robot solutions that are seamlessly integrated into TwinCAT.



ATRO®

ATRO: Automation Technology for Robotics

The future of robotics is modular

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Can you imagine having the right robot ready on the shelf for every handling task around your machine? A small machine type might require a robot with a short reach to insert new, relatively heavy parts. In another type of machine, you might want to stack the finished products on a pallet – this time requiring a large reach. Yet another machine involves a simple, fast pick-and-place application from a fixed infeed to a moving conveyor belt. You are unlikely to always have the right robot to hand for all of these variants. But if a customized robot can be freely assembled from existing standard modules for each task – as with the modular ATRO system from Beckhoff – you can achieve the necessary flexibility without a great deal of effort.

The modularity of the ATRO system from Beckhoff therefore results in concrete advantages for the user. After all, a 6-axis articulated robot is not always the right tool for the job. In many pick-and-place scenarios, just three or four degrees of freedom are enough, which means fewer axes, lower costs, and reduced weight – and these weight savings can then be used to offset a higher payload. The same ATRO motor and link modules can be used to create a wide variety of kinematic designs, which reduces variance in the inventory and increases flexibility.

High flexibility through modularity

The ATRO system is a modular industrial robot system that can be used to put together optimized robot structures for different applications in the field of assembly and handling technology on an individual and flexible basis. Standardized motor modules with integrated drive functionality, together with link modules in various designs and lengths, allow for virtually limitless mechanical combinations. Furthermore, complete integration into the holistic TwinCAT control platform offers direct access to a wide range of proven automation functions. An integrated PC-based platform for machine control, robot control, safety, vision, condition monitoring, or connection to an edge device or cloud system integrates all functions.

Wouldn't it also be helpful if the external supply lines to the end effector could be omitted? This would mean that they would not be constantly in the way and would also eliminate the need to replace them regularly due to the torsional stress. And without these cables, endless rotation of all the robot's axes would

be a possibility. All ATRO modules offer an internal media feed for data and electrical supply plus two fluid channels for this very purpose. The desired media can be fed in at the base of the robot and are conveyed through the motor and link modules to the end effector. The active motor modules were designed in such a way that endless rotation of all axes remains possible.

ATRO combines modularity and flexibility in an industrial robot system with an internal media feed and endless rotation in all axes, and is integrated into the PC-based machine control system. The ability to (re)use identical module types across various configurations helps cut storage costs and reduces the need for spare parts.

General requirements and properties

A robot is regarded as partly completed machinery as it cannot usually fulfill a specific function without additional components such as tools, sensors, or safety devices. Only when a robot is installed in a machine and equipped with the necessary components does it become a complete machine. In compliance with the European Machinery Regulation EU 2023/1230, which also applies to partly completed machinery, the health and safety requirements must be guaranteed by the manufacturer. The European harmonized standards DIN EN ISO 10218-1 and DIN EN ISO 10218-2 apply to the safety of industrial robots. New versions of these standards were published in early 2025 and will soon take effect once harmonization is complete. As of the end of the transition period (expected in 2027), they will apply to all industrial robots that are new on the market.

If a machine builder puts together their desired robot configuration using ATRO modules and integrates this system into their machine, they must meet the requirements of ISO 10218-2 for the robotic portion of the application. In addition to the hardware modules for the kinematics, the ATRO system also offers software modules that – in combination with pre-tested safety templates – meet precisely these requirements.

Versatile and easy-to-install mechanical system

Each ATRO motor module represents a complete drive system for one axis or joint of the robot. The system comprises a decentralized 48 V EtherCAT drive with brake, gearbox, and Safe Motion functions. This means that the only external components required are a power supply and a control system, which significantly reduces the space required in the control cabinet.

In addition to the active motor modules, there are mechanically passive modules which can be used to create the design of the robot configuration. The modules are assembled by simply screwing them together, whereby the ATRO interface provides a robust mechanical connection and also connects the internal media feed. This means that assembly can be carried out by a single person and individual modules can be exchanged effortlessly, e.g., for maintenance purposes.

The base modules allow the robot to be mounted on a base plate, a wall, or the ceiling. The connection to the internal media feed can be implemented at the side or at the bottom. The tried-and-tested hybrid connectors, which provide both electrical power and EtherCAT or Ethernet communication, allow simple plug-in connection. The robot's 48 V supply is stabilized in the base by a brake chopper with resistor.

The link modules are offered in different shapes and lengths to form the "arms" of the robot. Since they, like all ATRO modules, are EtherCAT devices and come with their mechanical properties as an electronic type plate, the chosen configuration can be scanned by the controller in order to select the correct calculation rule for motion control.

The ATRO interface also serves as an interface to the tool on the end effector. For adaptation to grippers with an ISO interface, a flange module is offered that routes the internal media to pluggable contacts. A flange set with ATRO interface is available for manufacturers who wish to fully integrate their tools.

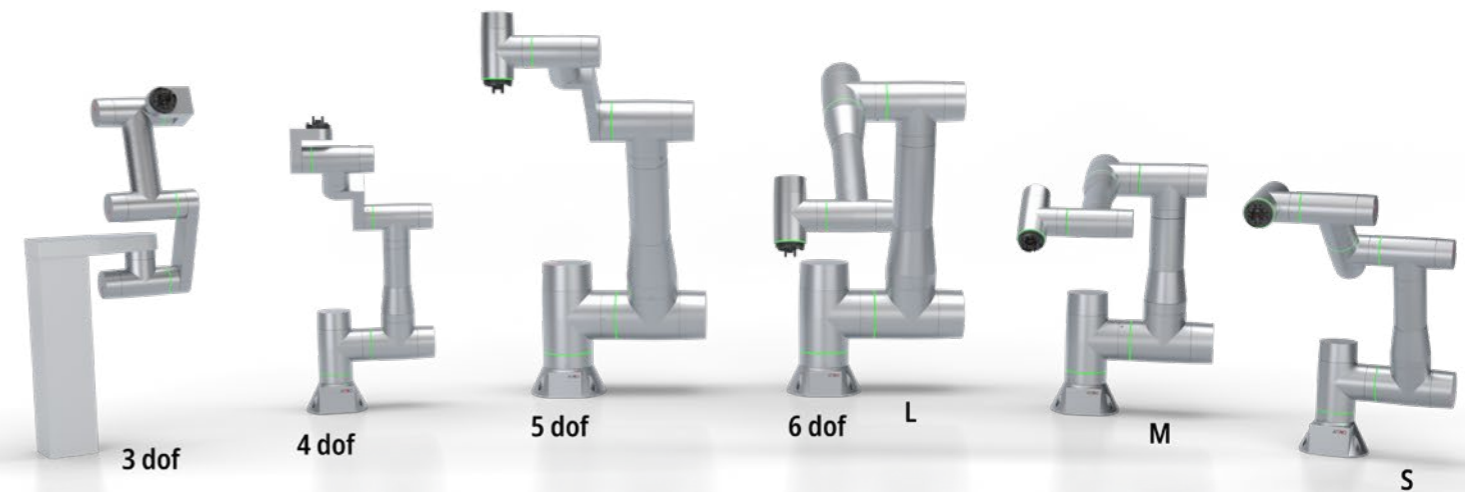
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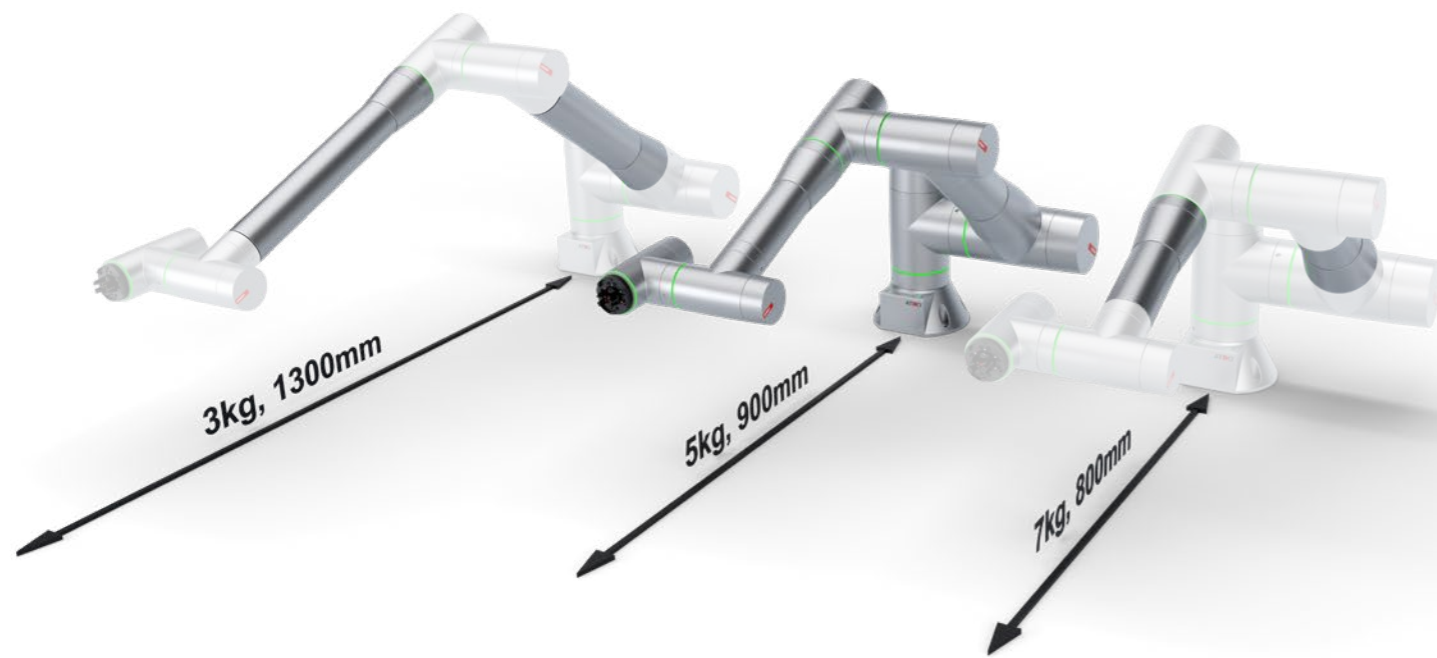
Machine and robot control become one

One of the main tasks in integrating robots into a machine or system has so far been to successfully manage the interfaces between the systems: The robot controller must be connected to the machine control system, and both require further automation functions such as vision or coordinated motion functions. For highly dynamic applications, the integration of these systems must be based on real-time-capable interfaces. The movement of the machine axes can

Various motor and link modules are available in the ATRO system, which can be used to create application-specific kinematics.



Just a small selection of possible ATRO kinematics



The possible payload of a robot configuration is directly related to the selected arm length, i.e., the possible reach.

then be coordinated with the tool at the robot end effector and synchronized with the detection of the product from the camera.

The TwinCAT automation platform combines all these functions in a PC-based control system. This means that up-to-date information from all functions is available to every device at the same time for processing. This also incorporates information and states regarding the functional safety of the system



Thomas Rettig,
Product Management
ATRO and EtherCAT,
Beckhoff Automation

and the robot, which until now has often been coupled to the system via safe I/O signals.

The robotics integration in TwinCAT includes the configuration of the modular kinematics on the one hand and the motion control programming functions on the other. A 3D visualization tool supports the configuration of the modular kinematics. Here, all types of ATRO modules can be selected to form the desired combination. By importing STEP files, the embedding of the robot in the machine environment can also be visualized. The configuration can then be loaded into the TwinCAT development environment. At the same time, all necessary preparations and links are automatically created in the TwinCAT system so the user can start programming motion control directly.

If there is an online connection to the real controller, the 3D representation can also be used as a live view of the current robot pose and movement or as a simulation view.

An extensive robotics library is available to facilitate programming. The library abstracts the individual modules into a robot instance on which the necessary parameters – such as length, mass inertia, dynamic model, and also the transformation equations – can be parameterized. This robot instance can be operated using simple movement commands.

An intuitive user interface has been developed for commissioning and operating the robot. This interface provides visualization elements based on TwinCAT HMI that enable standard-compliant operation of the robot, e.g., for jogging the individual axes or in Cartesian coordinates.



ATRO is fully integrated into the TwinCAT platform.

The 3D visualization, which has already been used for configuration, can be found here as an online view. Vision controls or, for example, scope controls for displaying continuous signal curves can also be embedded.

Task-specific functions can be individually displayed using an app concept. There are functions for moving the robot and for saving or editing waypoints. In another application, movement and gripper commands can be combined with wait states to create simple sequence programming. Complex motion programming can also be carried out in a similar way on the programming computer or, of course, in the familiar PLC environment, i.e., integrated into the machine programming.

As web-based display based on HTML5 is used, the interface can be displayed using a browser, e.g., on a machine panel, a tablet, or a teach pendant.

The necessary safety functions from ISO 10218-1:2025 include various safe stop functions as well as safe monitoring of the Cartesian speed of the tool center point (TCP) and exposed areas of the robot, e.g., the elbows. Beckhoff uses the TwinCAT Safety PLC for this purpose, which provides SIL3 safety logic on standard Beckhoff Industrial PCs. On this basis, function blocks are offered which monitor a safe Cartesian speed of the TCP and other exposed axes based on the safe individual axis positions of the ATRO motor modules. Application examples of these function blocks, which have been approved by a notified body, also help the user to achieve the necessary safety level for their application.

Conclusion

The end-to-end modularity of the ATRO system – both in its hardware modules and software modules for configuration, programming, operation, and safety

monitoring – opens up a whole new level of flexibility for user applications. In addition to classic serial robot kinematics, exciting new configurations can be put together from the modular system by simply adding passive link modules: Due to the option of endless rotation in axis 1, workstations can be reached in the most effective way and always via the shortest route.

An additional T-module after the first axis enables a 2-arm robot and thus doubles productivity; an X-module at this location results in a 4-arm robot. In many cases, however, the five or six degrees of freedom are not needed at all. A 3-axis handling arm or a 4-axis pick-and-place configuration can be assembled much more cost-effectively from the same modules. The individual applications and concepts therefore determine the solution.

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