BECKHOFF New Automation Technology

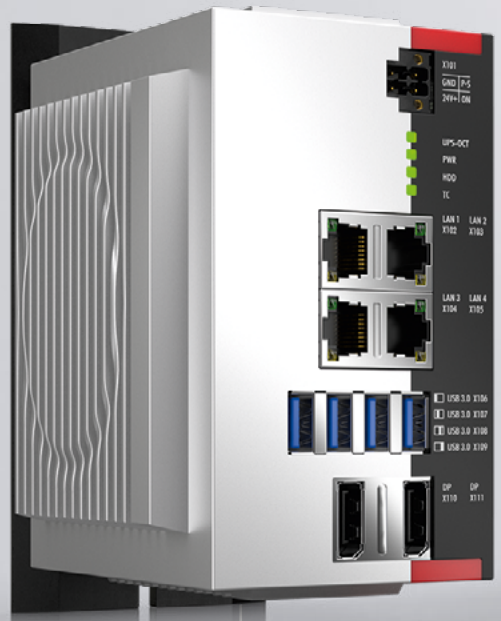
Precise and highly efficient: PC-based control for the print industry

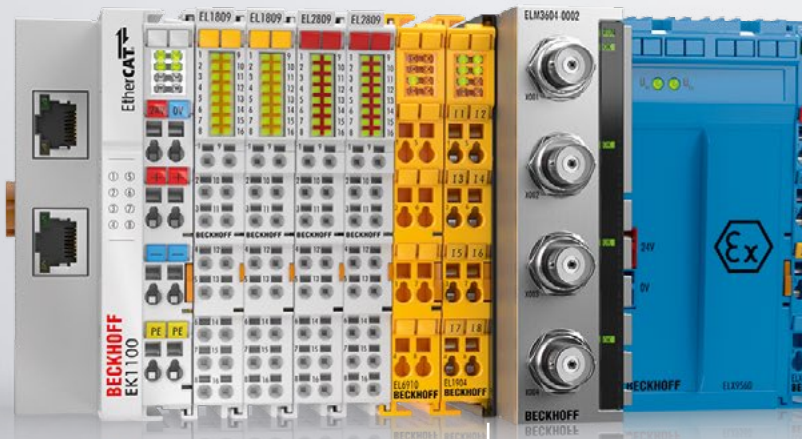
Rely on technological expertise: with PC-based control from Beckhoff

As a pioneer for PC-based control and the inventor of EtherCAT, Beckhoff has achieved numerous milestones in the world of automation over the past 40 years. Continuous technological innovations laid the foundation for the development of our New Automation Technology, which is now used successfully worldwide. Abstracting the control functions from the device hardware replicates all machine functions within the software. This enables PLC, motion control, HMI and safety applications to be run on a universal PC platform.

The principle of PC-based control technology is built around a powerful Industrial PC and a high-performance fieldbus interface with connected sensor and actuator peripherals combined with software for engineering and real-time control. The Beckhoff control platform is complemented by a comprehensive portfolio of drive technology components. Our customers can choose between individual components or a complete solution along with the configuration of a specific control system precisely tailored to their requirements.

By implementing Microsoft Windows as the operating system for our Industrial PCs, we focused on the convergence between the worlds of IT and automation from the outset. In the process, we





IPC

I/O

created the foundation to implement intelligent production concepts in line with Industrie 4.0. The powerful state-of-the-art processors, which we utilize in all of our Industrial PC solutions, enable the easy integration of computationally intensive applications such as image processing, measurement technology or simulation into the control platform. This offers extensive functional benefits for the control system and facilitates implementing cutting-edge technology at a comparatively low overall cost.

As a medium-sized, family-run company with decades of experience in automation, we consider long-term availability, reliably high quality and a strong focus on customers and services to be our core values and an integral part of our business philosophy. To make sure that customers all over the world enjoy consistently high standards, our research, development and production activities are subject to sophisticated quality assurance guidelines. In addition, the Beckhoff name stands for unequaled production reliability and investment protection. The Beckhoff corporate group, which includes PCB assembler Smyczek, drive technology specialist Fertig Motors and embedded specialist ADL Embedded Solutions, is distinguished by its extensive vertical integration. This enables us to maintain consistent, high-quality standards while also allowing us to rapidly bring new technologies and products to market.

From digital printing to 3D printing: PC-based control as a universal control solution

The print industry has undergone a profound transformation in recent decades. As in other industries, aspects such as Industrie 4.0 and lot size 1 in mass production have begun to play an increasingly important role. At the same time, this demands innovative automation solutions. With PC- and EtherCAT-based control technology, we offer machine manufacturers a control platform that optimally meets all current requirements regarding digitalized, connected production processes. Combining efficiency and modular design with precisely scalable performance, the solutions are ideal for digital printing, packaging and also 3D printing.

With TwinCAT automation software, Beckhoff offers you an integrated software platform for engineering, runtime and diagnostics. It combines all functions, such as PLC, motion control, robotics, HMI, image processing, safety and measurement technology, cloud communication and analysis functions, in a single package. This ensures efficient interaction between all system components and therefore maximum productivity. As a print machine manufacturer, you benefit from simplified engineering, increased availability, optimized output and improved production efficiency! The modular hardware and software components enable quick and easy format changes along with the

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Digital printing, page 6-9

economical manufacturing of individualized print products – down to lot size 1.

In addition, open hardware and software interfaces to all common fieldbus systems such as Ethernet, EtherCAT, PROFINET and IO-Link offer exceptional freedom when it comes to system design. Based on industry and IT standards such as OPC UA, the Beckhoff control platform supports the implementation of Industrie 4.0 concepts for machine-to-machine communication along with data processing and analytics in the cloud.

Your benefits with PC-based control:

- integration of all machine functions into a single control platform including motion control, image processing, IoT connection and data analysis
- modular, scalable components for optimal customization of the machine control system
- seamless integration into existing production environments
- retrofit implementations
- effortless engineering via TwinCAT, also cloud-based
- increased availability through predictive maintenance

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Packaging printing, page 10-11

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3D printing, page 12-13

PC-based control fully utilizes the potential of your digital printing machine

While digital printing is a relatively new printing process, it is becoming increasingly important because of its flexibility. In contrast to traditional technologies, digital printing is a non-impact printing (NIP) process that does not require static printing plates. This makes it ideal for economically producing printed products with the greatest possible degree of customization. The application spectrum ranges from commercial, sheet-fed and web printing to label and packaging printing. A wide variety of materials and surface shapes can be printed.

The technical challenges facing digital printing processes can only be overcome through the use of open, digitally networked control technology. Its scalability and modularity as well as its high degree of integration make PC-based control from Beckhoff the ideal solution for universal control encompassing the entire process chain: from digital image creation to the finished print product. As it supports standardized interfaces such as OPC UA, the machine controller can be easily integrated into any production environment, minimizing the integration workload. PC-based control provides the optimal solution, particularly

Improved process efficiency

Reducing the number of interfaces between prepress and machine control increases the print speed. Standardized interfaces, such as OPC UA, MQTT, AMQP and HTTPS, enable integration into diverse processes.

Optimized print quality

Ensure consistently high print quality standards through maximum synchronization of all printing processes.

with regard to short processing times and small production volumes, even with personalized print products in lot size 1. Since all control functions are replicated in the software, production changes do not require lengthy retooling of the machine. As a fast communication system, EtherCAT ensures the highest process speed together with excellent print quality, which serves to safeguard your market position and reputation.

Increased availability

Reduce downtime with reliable machine diagnostics utilizing state-of-the-art technologies such as predictive maintenance and machine learning.

Maximized output

Implement your next machine innovation with PC-based control cycle times in the µs range, enabled by the combination of EtherCAT and synchronization times in the ns range.

Optimize your digital printing process with universal PC-based control technology

Digital printing involves a wide variety of processing modules between the prepress and the finished print product. Regardless of whether classic sheet and web printing or printing for various packaging types, the media has to be prepared for the respective printing process. To meet all requirements for connecting all machine modules, we offer a comprehensive control platform with PC-based control: from detecting the web tension during the winding process to the evaluation and quality assurance of the print product.

TwinCAT automation software and comprehensive drive technology solutions from Beckhoff enable the highest level of automation for unwinding and winding processes. Inline coating units for modifying the surface properties of the print medium can be seamlessly integrated into the printing process via EtherCAT and implemented in real-time using TwinCAT automation software. Final coating supplements the actual printing process, whether inkjet, electrochemical or another process. For this purpose, we also have the corresponding automation, drive and analytics technologies in our product portfolio: TwinCAT Vision, for example, provides an image processing tool for the fastest possible synchronous image analysis and optimization of the finishing process. Fast and synchronous winding or handling pro-

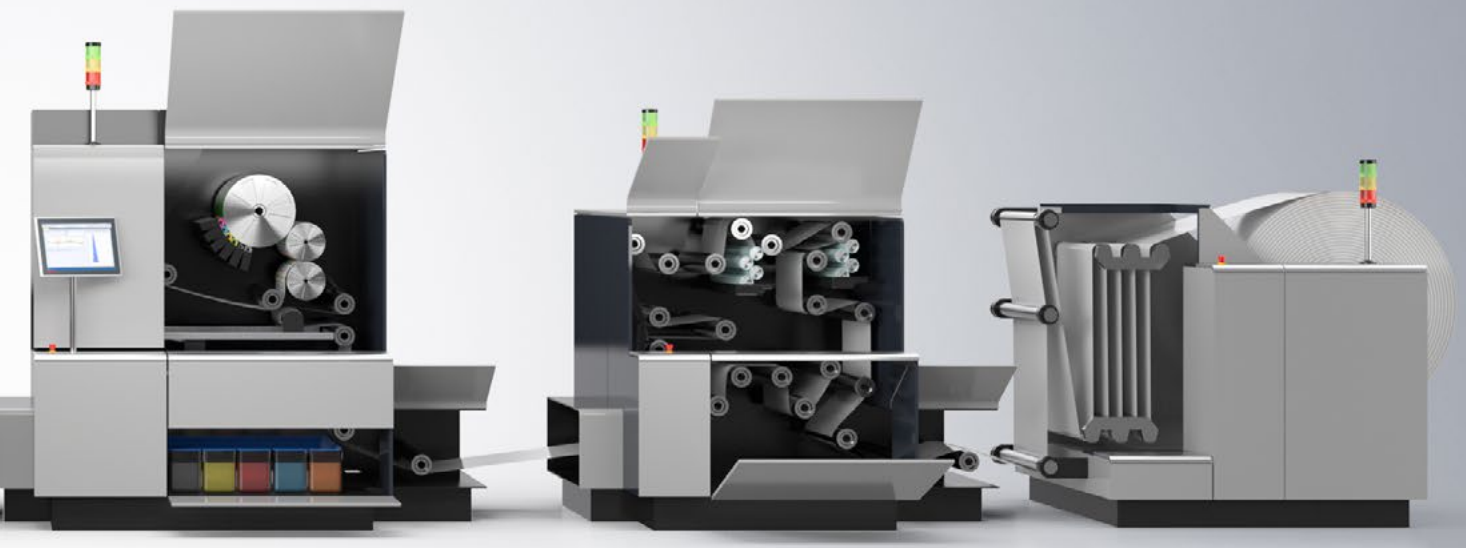
TwinCAT software platform

TwinCAT automation software transforms every Beckhoff Industrial PC into a real-time controller with multiple PLC, NC and/ or robotic runtime systems, thus providing a universal platform for all requirements.

Industrial PCs in every performance category

Whether centralized or decentralized control architecture – the scalable Industrial PC portfolio covers the entire range of performance profiles and designs: from ultra-compact Industrial PCs to control cabinet industrial servers with 40 cores.

cesses for sheet-fed printing can be implemented easily and cost-effectively utilizing our dynamic drive technology components. Standardized synchronization and communication via EtherCAT offer the additional benefit of enabling a wide variety of machine modules to be combined and connected with each other without any loss of efficiency.



I/Os for all signal types

The extensive Beckhoff I/O spectrum places no restrictions on the control of temperature, web tension or exhaust air pressure.
The most suitable fieldbus for the specific application can be selected from more than 20 fieldbus systems.

Scalable drive technology

The scalability of our drive components in terms of power and design allows the drive solution to be tailored to your specific performance requirements: from compact drive technology for positioning tasks to highly dynamic drives for large winding and rolling applications.

System-integrated image processing

TwinCAT Vision integrates precisely synchronized image capture capabilities into the automation platform. From web edge control to print control, all functions are executed within one system.

Customized packaging printing: economically implemented with PC-based control

The general trend in packaging printing is towards high-quality packaging and print products, while simultaneously balancing sustainability and costs. However, the specific requirements for packaging printing differ depending on the industry or end product such as packaged consumer goods, food or pharmaceuticals. While consistent traceability plays a key role for pharmaceutical products, in other areas the economic implementation of rapidly changing production cycles and small lot sizes is more important.

As the external appearance of goods has a decisive influence on the buying behavior of consumers, manufacturers try to improve their customer reach by customizing product series or personalizing individual products through corresponding packaging printing. This is compounded by the rapid development of new products and formats, resulting in faster and more efficient production – while maintaining the highest quality. To economically produce small quantities – down to lot size 1 – the printing machine needs to be highly flexible. As an experienced and reliable partner to the packaging industry and the plastics industry, we have the necessary expertise to implement the correspondingly high process and

Full integration

The PC- and EtherCAT-based control platform enables the direct integration of vision and measurement tasks. Eliminating the need for separate systems improves synchronization and increases the efficiency and quality of the printing process.

Efficient implementation of lot size 1

PC-based control technology enables fast format changes to implement low order volumes using largely software-based solutions. Changeover times on the machine are reduced to a minimum.

processing speed along with the ability to respond flexibly and with minimum effort to changing requirements.

High speed and perfect synchronization

EtherCAT is the foundation of the XFC technology developed by Beckhoff, which synchronizes all processes in the µs range. The rapid and precise detection of the print area ensures a high-quality print image.

Openness and transparency

Open hardware and software interfaces together with support for defined industry standards such as PackML enable continuous communication from the sensor to the cloud, to ERP systems or other IT structures and form the foundation for transparent data traceability.

OPC UA®

Hygienic design

Selected components in every product area, made of stainless steel, are ideally suited for use in the food, chemical or pharmaceutical industries.

3D printing with in-depth CNC expertise from Beckhoff

Additive manufacturing processes are the ideal solution for flexible production in low quantities. With our extensive portfolio of software and hardware components, we support printing press manufacturers in implementing innovative printing machine concepts that optimally fulfill demanding market requirements with regard to product quality, speed and flexibility.

You can rely on our extensive experience in CNC when implementing precise and efficient 3D-printing applications. It has been incorporated into the development of a complete, software-based CNC solution featuring modular components with scalable performance: The TwinCAT all-in-one CNC integrates all CNC functions into one software platform. TwinCAT CNC and NC I cover the entire range of traditional CNC path control systems – through to high-end systems for complex motion and kinematic requirements. These systems are able to support the control of up to 128 interpolating axes with up to 20 channels as well as extensive coordinate and kinematic transformations. State-of-the-art control algorithms enable precise and highly synchronous processing. TwinCAT TcCOM provides an open interface, which you can utilize to safely integrate your own process expertise into the standard controller by means of special, self-developed functionalities.

All-in-one software solution

TwinCAT CNC integrates seamlessly into the Beckhoff software environment.
Its high-speed control algorithms enable highly synchronous and precise 3D manufacturing.

In combination with the motion control solutions provided by TwinCAT automation software, our drive technology offers a performance-oriented solution for every area of application: from the ultra-compact servo terminal to the AMP8000 series motors with integrated servo drive and the AX5000 and AX8000 EtherCAT Servo Drive series for medium and high performance requirements with the corresponding servomotors.

Using the powerful EtherCAT Terminals, you have access to more than 100 signal types with variable channel densities: from standard I/Os and high-precision measurement and safety terminals to compact drive technology in terminal block format. In addition, all of the common fieldbus systems are supported, providing you with optimal flexibility and openness in terms of the I/O level in the machine layout. The integration of local or cloud-based data analysis applications along with automatic dashboard creation via the TwinCAT Analytics software tool enables convenient monitoring of machine states. For example, the printhead can be monitored at any time and from any location in order to implement predictive maintenance – resulting in reduced machine downtime.

Open and modular I/O portfolio

The fieldbus-neutral Bus Terminals and the EtherCAT Terminals support all common fieldbus systems and enable any desired I/O architecture with a variable channel density.

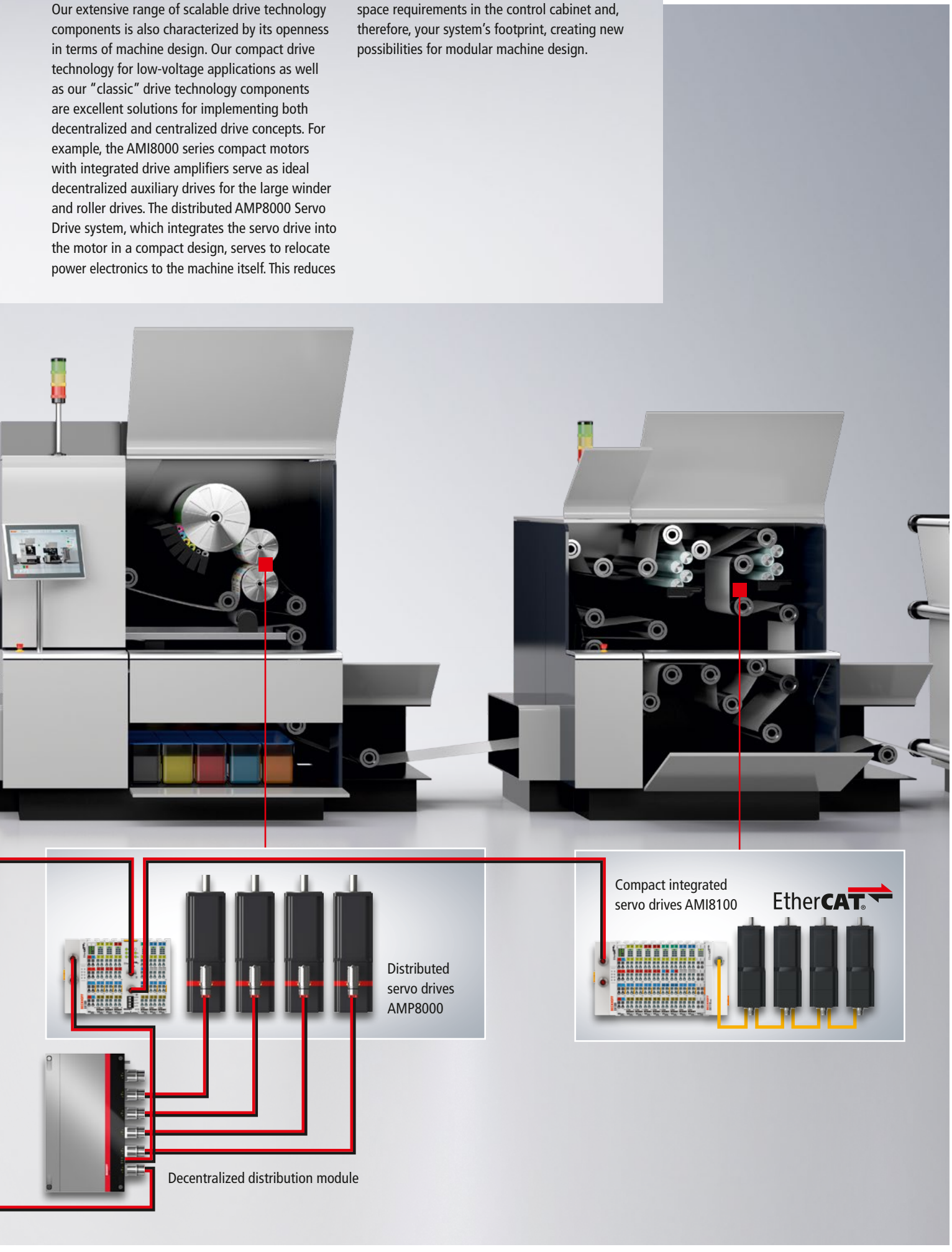
Highly scalable drive technology

A broad spectrum of power-scalable motors and servo drives with EtherCAT connection are available for precise motion control.

Open, modular and scalable: PC-based control technology suites all machine types

Our open, modular and precisely scalable PC-based control technology addresses the diverse requirements of the machines used in the print industry. Using our modular system, you can combine the components to create the perfect control solution for your system or machine and flexibly dimension with respect to performance, price and design. For this purpose, we offer an extensive portfolio of Industrial PCs with scalable processor performance along with a broad range of different designs and dimensions. Combined with the powerful EtherCAT fieldbus, our control system enables end-to-end communication throughout the field level, down to the detailed control of print heads or register control. Furthermore, vertical communication extending to the cloud can also be implemented via EtherCAT in combination with TwinCAT automation software. The support for all common fieldbus systems and software protocols guarantees completely open vertical and horizontal communication. This enables seamless process integration, for example, when linking real-time image processing with complex printing machine winding applications. Utilizing cloud-based data analysis via TwinCAT Analytics and TwinCAT Cloud Engineering, you can control your machine processes more precisely, increasing machine efficiency and product quality.

Our extensive range of scalable drive technology components is also characterized by its openness in terms of machine design. Our compact drive technology for low-voltage applications as well as our "classic" drive technology components are excellent solutions for implementing both decentralized and centralized drive concepts. For example, the AMI8000 series compact motors with integrated drive amplifiers serve as ideal decentralized auxiliary drives for the large winder and roller drives. The distributed AMP8000 Servo Drive system, which integrates the servo drive into the motor in a compact design, serves to relocate power electronics to the machine itself. This reduces space requirements in the control cabinet and, therefore, your system's footprint, creating new possibilities for modular machine design.



PC-based control in the print industry: references

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HP Indigo V12 Digital Press for label printing. With a print speed of up to 120 m/min, the HP Indigo V12 achieves productivity comparable to analog solutions.

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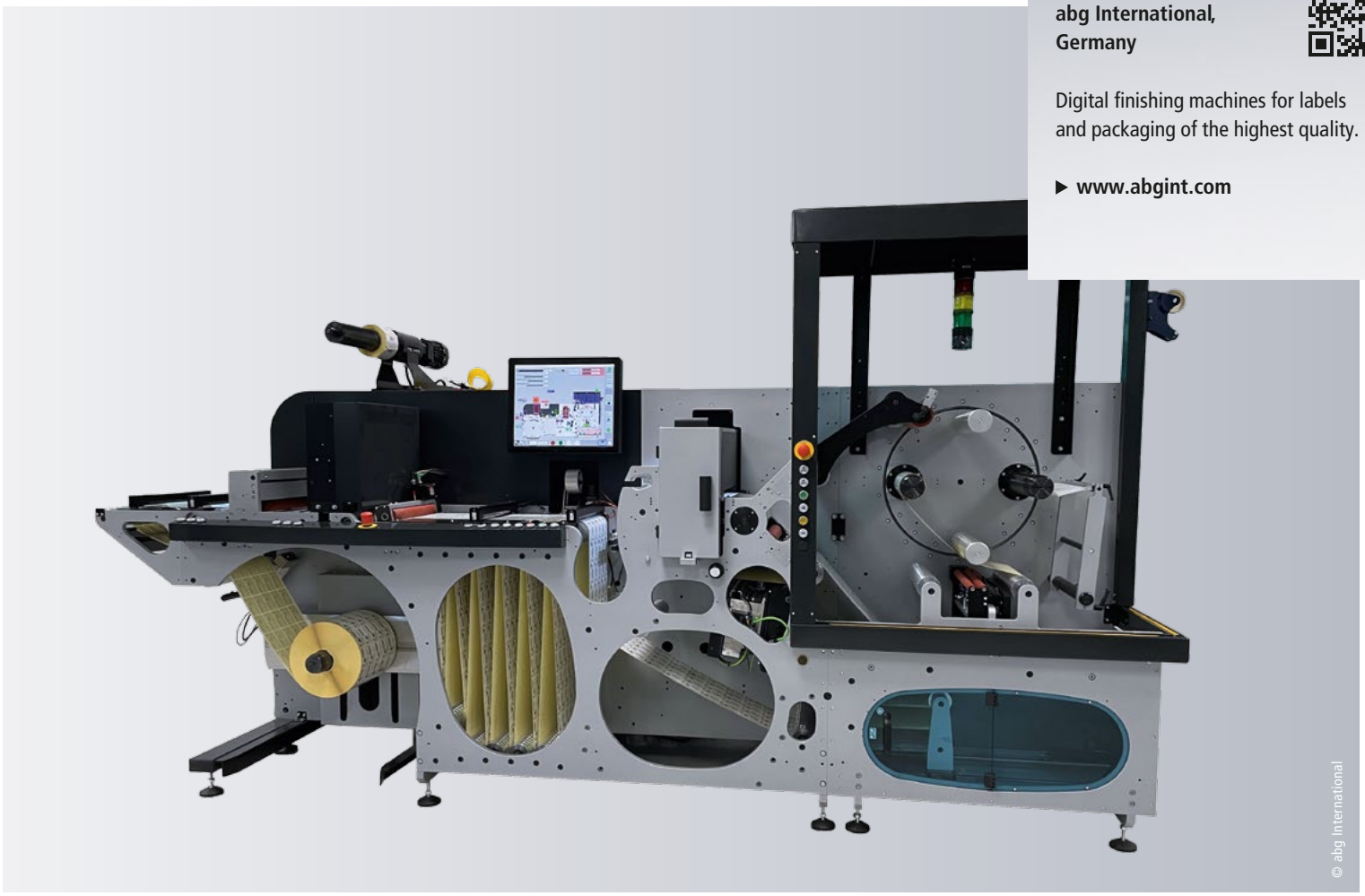

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Octo-1 for the production of rigid bags for the packaging of liquid food products

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BT-Watzke, Austria

Beckhof servo drive technology optimizes finishing of bottle caps.

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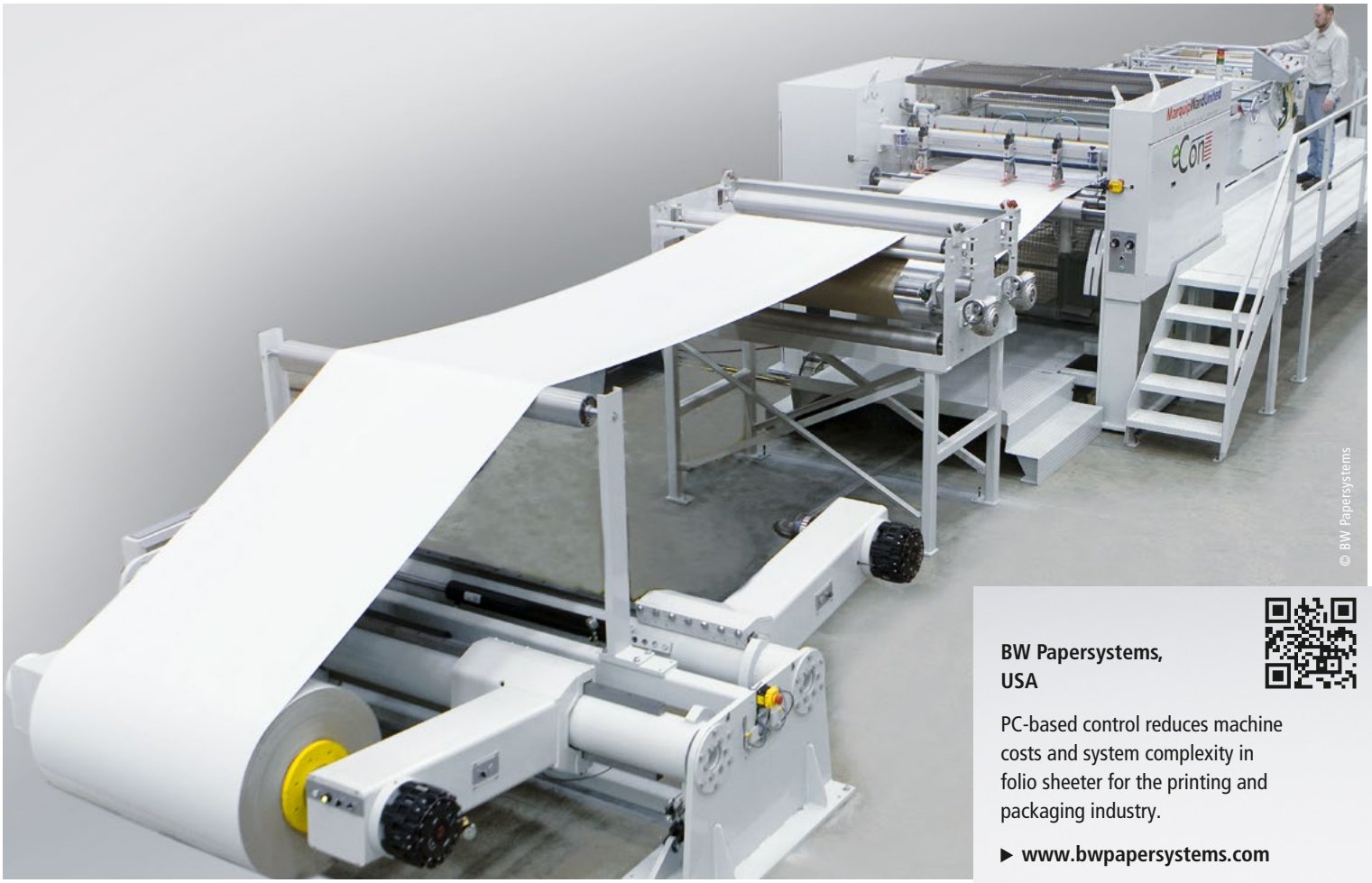

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PC-based control reduces machine costs and system complexity in folio sheeter for the printing and packaging industry.

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Beckhoff automation technology ensures highest speeds and precision for finishing digital print labels.

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