Highly efficient, flexible and resource-conserving: PC-based control for the packaging industry
PC-based control optimizes packaging machine automation

With its PC-based technology and EtherCAT, Beckhoff offers a control solution for highly efficient, flexible and resource-conserving packaging machines. Predestined for applications where high speed and precision are of utmost importance, the PC platform is perfect for synchronizing all process and motion control workflows. The bottom line: work steps are accelerated, and the consumption of packaging materials declines. For example, the fast and precise recognition of fiducials means that you can seal blister packs closer to the product they contain, and the precise control of the sealing temperature makes it possible to use very thin plastic film. Even the wall thickness of PET bottles can be minimized thanks to the Beckhoff technology’s fast and highly accurate process control capabilities. The same applies to the use of paper and aluminum when manufacturing cardboard containers. And the more accurate approximation of the minimum fill level generates significant material and cost savings when packaging high-volume products.

The Beckhoff automation portfolio comprises everything you need for a technologically and financially superior packaging solution. All control and drive components are scalable to meet the performance requirements of the respective application perfectly. Optimally coordinated hardware
and software interfaces as well as extensive expertise in implementing each process step guarantee a high level of process stability. Applications can be realized by Beckhoff, a Beckhoff solution partner, or the customer himself. Another benefit of the Beckhoff automation platform is its support for common industry standards like FDA, EHEDG, FDA, Weihenstephaner Standards, OMAC, and GPM.
PC-based control automates the entire packaging process

Thanks to its openness and continuity, you can use PC- and EtherCAT-based control technology from Beckhoff to automate individual packaging machines as well as entire lines. All steps such as forming, filling, sealing, labeling, collecting, boxing and palleting can be programmed and controlled via a single platform. This ensures maximum flexibility for applications where packaging systems must be quickly adaptable to changing requirements or be able to easily accommodate new features. Open interfaces in hardware and software allow for continuous communication from the sensor to the cloud.

On the hardware side, Beckhoff offers a broad spectrum of Control Panels, control cabinet PCs and Panel PCs, I/O components, and highly dynamic servo drive technology. TwinCAT is the uniform software and engineering platform for automation processes ranging from PLCs, visualization, motion control, robotics, safety technology and measurement technology to vision system integration and cloud-based communication. Software libraries for items like stepper control, cam plate functionality, register control or cross-cutting cover all the standard packaging machine requirements. Their compatibility with industry standards like OMAC and
WS Food enables Beckhoff technologies to be easily integrated into existing installations and packaging lines.

With the linear transport system XTS (eXtended Transport System) and the XPlanar eXtended planar motor system, Beckhoff has brought to market two intelligent drive solutions that are revolutionizing packaging machine design with their exceptionally flexible transport capabilities. Besides making machines much more compact and easily adaptable to packaging design changes, they support the demand for sustainability and efficiency with their reduced resource consumption.
Intelligent product transport optimizes packaging machines

Thanks to its versatility, the eXtended Transport System (XTS) has quickly become a known factor in the packaging machine market. With the introduction of the XPlanar eXtended planar motor system, Beckhoff is now taking the next step towards maximum flexibility in product transportation. Like the XTS, XPlanar is based on the principle of passive movers that can be moved individually and with outstanding precision. The necessary planar tiles can be arranged in any pattern and allow for smooth and touchless movements along six axes.

Thanks to the individually controllable movers and the flexible topologies of these transport systems, packaging machines can be designed in entirely new ways. The flexibility with which the planar tiles or the raceway modules of the XTS can be arranged provides the machine manufacturer with nearly unlimited freedom in designing the machine’s transport paths, and the functionality of the track management software makes the product streams fully user-definable. Workstations can be skipped, buffer areas added as needed, and movers freely inserted or removed. Beckhoff’s intelligent transport systems increase product throughput, minimize travel between workstations, and reduce the machine’s footprint. By integrating software-driven format changes, the machine’s...
flexibility can be increased further so that even small lot sizes can be produced efficiently and cost-effectively.

As a specialist for PC-based control technology, Beckhoff offers perfectly coordinated and highly scalable hardware and software components to ensure that its intelligent transport systems run with maximum performance at all times. First among these is the TwinCAT control software that ensures not only continuous travel path optimization and collision avoidance but integrates all other machine functions from PLC to robotics, vision, measurement technology and IoT on a central platform. The application runs on an Industrial PC from the extensive and scalable Beckhoff portfolio. The communication functions run over high-performance EtherCAT and EtherCAT G fieldbus systems.
The eXtended planar motor system features movers that use electromagnetic force to float smoothly over freely arrangeable tiles at speeds of up to 4 meters per second along six axes without bumping into each other. Traveling magnetic fields, which are generated within the planar tiles, position the movers accurately and dynamically.

With XPlanar, packaging machines can be designed in entirely new ways. Since the tiles can be arranged as needed, product streams can be freely directed. Quick setup changeovers shorten the machine downtime and allow for the economic production of small lot sizes. The system’s two-dimensional arrangement makes it easy to set up buffer zones and shorten the distances between the processing stations. The total area and geometry are fully variable. XPlanar tiles can also be combined to bridge long distances. Since adding more tiles along the route is all it takes to set up a waiting area or a passing lane, typical congestion situations can be easily prevented.

Each mover can travel and be positioned dynamically with no danger of becoming involved in a collision. The system can also accommodate production-specific moves such as lifting, lowering, weighing, tilting or rotating an item while it is

- jerk-free positioning
- high dynamics
- flexible application
- no spilling of liquids
- no carryover of contaminations

- excellent cleanability
- chemically resistant surfaces
- hygienic product handling
- no friction, no wear
being transported. The movers are available in various formats and for different loads. The bandwidth ranges from small and light movers to large ones that accommodate loads of up to 6 kilograms. Larger loads can be handled by combining movers. Different types of movers can travel simultaneously across the planar tiles.

XPlanar puts an end to friction, wear and contamination. The dynamic, touchless motion prevents the surface from being contaminated. Even liquids can be moved without slopping over, and there is no friction that can cause emissions from wear. Since the surfaces of glass, stainless steel or plastic are chemically stable and easy to clean, the XPlanar system is ideal for handling products in accordance with strict hygiene standards of the kind required in the food and pharma industries or in cleanroom environments.

Applications

Overtaking: Movers can change lane and accelerate.

Divider: Simple flow division, e.g. diversion of a product flow into several channels.

Geometries

Waiting zones: Can be set up directly alongside the track.

Free-form shapes: Provide a match for any space requirements.
With XTS, machine manufacturers offer their customers the opportunity to individualize their own products far more easily – via smaller batch sizes with significantly shorter product throughput times. And that up to lot size 1.

The XTS eXtended Transport System combines the benefits of a linear transport system with those of a rotary solution. In addition to routing flexibility, the user benefits from all the advantages of direct drive technology such as highly dynamic and accurate positioning, low vibration, wear-free operation, and low power consumption. Since both straight sections and the curves are used to transport materials, there are no empty trips, making for a faster overall packaging process. With the XTS, products can be transported independently of each other, which opens the door to totally new machine designs. The packaging steps are optimally synchronized to prevent any downtime. And since the motion profiles don’t require any complex mechanics, there is less maintenance, and the machine footprint can be reduced by up to 50 percent.

Rapid format changes during product changeovers and small lots – for example, for special advertising campaigns or to produce individualized packaging with lot sizes of 1 – are no longer a problem with the XTS. The PC-based control platform executes machine setup or packaging changeovers essentially through software by changing the process parameters. This speeds up the process considerably, resulting in faster product changes and more line efficiency for the

Lot size 1

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XTS Track Management maximizes transportation flexibility for parts handling.

The XTS motor modules can be combined as desired. owner. And with the XTS’s Track Management software functionality, you can split the XTS system into individual, physically separate sections to do things like inserting or removing movers. You can thus carry out tool changes or maintenance activities without having to interrupt the regular production flow.

To enable application-specific system designs, the XTS comprises various motor module geometries. The modules are easily linked via lateral contacts for the transmission of power and data. For food and pharmaceutical applications, the XTS is available in a hygienic version. The fully encapsulated system made of stainless steel is chemically stable and easy to clean while delivering all the benefits of this intelligent transport system.
Scalable and modular control solutions for packaging machines

With its open, modular and precisely scalable control technology, Beckhoff meets the packaging industry’s demand for solutions that are performance-oriented and cost-efficient. You can pick precisely the components you need for your particular type of machine and/or production line from a wide-ranging portfolio of Industrial PCs as well as Control Panels and displays in all performance categories and form factors. EtherCAT, the global standard for real-time communication, offers maximum performance for all components, including those from third-party providers. And the Beckhoff I/O system covers a broad spectrum of sensor and actuator technologies that interface with many fieldbus systems. For machines being produced in high volumes, Beckhoff EJ modules provide an efficient and compact solution, and TwinSAFE is an integrated safety solution for I/O and motion control applications. Beckhoff’s drive technology portfolio ranges from compact servo terminals to powerful EtherCAT drives and servomotors with One Cable Technology to the XTS eXtended Transport System and the eXtended XPlanar planar motor system. TwinCAT integrates the engineering environment and the controller in a single software platform.

For packaging applications in the food, beverage and pharmaceutical industries, Beckhoff offers 

- Control Panel: multi-touch display
- Industrial PC: control cabinet and Panel PCs
- Embedded PC: IPC with integrated I/O level
- XTS: eXtended Transport System
- EtherCAT I/O: broad I/O spectrum in IP 20 and IP 67
- Highly dynamic servo drive technology
- Servo terminals: compact drive technology
- Linear actuators with integrated power electronics
a complete control solution in stainless steel with its hygienic design that meets the strictest sanitary and cleanroom requirements.
The TwinCAT 3 automation software integrates all engineering and runtime processes and features a consistent development environment for implementing all control tasks in the packaging industry. Thanks to TwinCAT’s support for programming in all common IEC PLC dialects and the integration of C/C++ algorithms and MATLAB®/Simulink®, the machine builder can pick the programming method that works best for his application. TwinCAT’s interfaces to machine learning algorithms make it possible to use AI methods in the traditional controller environment. The use of Microsoft Visual Studio® as the standard programming workbench supports different version management systems and simplifies team-based programming. For high-volume production applications, TwinCAT features open interfaces for integrating commercial IT systems into the machine program generation process.

Prefabricated packaging software modules for functions like dancer control, cam plate, register control or cross-cutter control as well as support for PackML standards in the latest version of the OMAC specification simplify the engineering and shorten the development and commissioning times.

Extensive TwinCAT libraries for motion control and supplements for various robot kinematics
with tested and optimized algorithms save on development time. You can accelerate and improve commissioning and service procedures with TwinCAT Scope, a software oscilloscope that is fully integrated into the TwinCAT system architecture.

With TwinCAT Vision, images can be processed directly in the unified control platform. Since components like these allow you to perform configuration and programming tasks in a familiar environment, they simplify the engineering process considerably. They also allow you to synchronize all image-derived control functions in real time. Latencies are eliminated, and all image algorithms are executed in real-time.

The software-based TwinSAFE safety technology simplifies the wiring of complex installations because variants can be mapped in software. That way, you can develop and commission production cells module by module, to name just one example.

The integrated, browser-based TwinCAT HMI visualization solution makes it easy to develop and maintain visualization objects and user interfaces. The information is presented on the machines or in a web browser over the internet.

By supporting standardized communication protocols for cloud applications, TwinCAT IoT enables you to aggregate data in the cloud or locally at the production site. The collected data can then be analyzed with the help of TwinCAT Analytics. And with TwinCAT Cloud Engineering, the well-known TwinCAT engineering and runtime products can be used directly in the cloud.
For the communication between machine controllers and cloud-based services, Beckhoff has developed the TwinCAT IoT software library. It supports the standardized OPC UA, AMQP, and MQTT protocols for communication with common cloud systems such as Microsoft Azure™, Amazon Web Services and private cloud systems on your corporate network. Built-in security mechanisms prevent misuse of data as a result of unauthorized access and protect your intellectual property.

With TwinCAT Analytics, the process data is recorded and analyzed simultaneously with each machine cycle. It can be used for predictive maintenance and machine improvements, to name just two examples. With the appropriate tools, you can derive the information you need to improve the machine in terms of its energy usage or process workflow. Post-mortem analysis, intermittent-error diagnostics and the early detection of quality shortfalls and production bottlenecks improve the installation’s reliability and availability.

The data analysis also provides extensive information about a machine’s operating behavior, which can be used to reduce costs and make layouts more efficient by improving future machine design and production procedures.
TwinCAT Cloud Engineering enables the instantiation and use of existing TwinCAT engineering and runtime products directly in the cloud. Easy access is provided via the Beckhoff website, where registered users can generate TwinCAT Cloud Engineering instances. Real control hardware is linked to the TwinCAT Cloud Engineering instance via a secure transport channel. That way, the user gains access to the benefits of the TwinCAT architecture directly in the cloud, which makes it much easier for multiple developers to work together, to name just one of the advantages.
The EtherCAT technology was launched on the market by Beckhoff in 2003 and made available as an open standard for automation technology. With outstanding performance, flexible choice of topology, comprehensive diagnostics and simple configuration, EtherCAT is ideally suited for use in packaging machines. Beckhoff offers the largest number of EtherCAT-compatible automation modules for I/Os and for drive technology. Using the EtherCAT P standard, the AMP distributed servo drive system is supplied with power and data via a single cable, thus saving mounting space in the control cabinet.

EtherCAT is one of the most widely used standards in packaging technology. A large number of EtherCAT-compatible sensors and actuators are available on the market, which guarantees a high level of investment security. Future TSN implementations will be realized on the basis of the EtherCAT automation protocol.

The fast and high-precision Beckhoff control solution eXtreme Fast Control (XFC) is based on the fast communication network EtherCAT and special I/O modules optimized for XFC that record signals or trigger actions with a high degree of precision. With I/O response times of less than
100 milli-seconds, the system scans the machine’s status up to 10,000 times per second for exceptional process control precision and repeat accuracy. This improves the productivity of packaging machines and reduces waste and the consumption of resources.

For high-performance machines and highly complex applications, Beckhoff has introduced EtherCAT G to the market. As an advanced version of the successful EtherCAT principle, it offers speeds ranging from 1 Gbit/s to 10 Gbit/s, which makes it possible to increase the current EtherCAT transmission rate of 100 Mbit/s 100-fold. Both performance stages represent system-compliant enhancements of Beckhoff’s EtherCAT technology – the well-known “on-the-fly” function principle remains unchanged. And thanks to the branching concept of EtherCAT G, 100 Mbit/s EtherCAT segments can be integrated into the network to reduce throughput times in large networks by processing segments in parallel.
As a supplier of scalable drive technology, Beckhoff offers a broad portfolio of hardware and software for all drive concepts, price classes and application segments. The motion control solutions of the TwinCAT automation software are supplemented by a broad spectrum of servomotors and drive controllers ranging from compact servo drives in terminal format to the AX5000 servo drives for highly dynamic positioning tasks.

The AMP8000 distributed servo drive system breaks new ground in modular machine design. It integrates the servo drive directly into the servomotor, resulting in a highly compact form factor. By relocating the power electronics directly to the machine, the control cabinet needs to house only a single coupling module that supplies multiple servo drives over a single cable via a distribution module. The result: significant savings in terms of materials, cost, space, and installation effort. A supply module featuring a high protection class can even shift the entire system directly to the machine. With its few components, the AMP8000 system is easy to configure. Only a single type of cable is needed to connect supply modules, distribution modules and drives with each other. No additional components like motor chokes, circuit breakers or filters are needed. All connection and supply modules have an additional
EtherCAT P connector for the Beckhoff I/O portfolio, which simplifies connections to additional inputs, encoders or latch units significantly.

The AMI812x servo drive combines servomotor, output stage and fieldbus connection in a compact design and supports the principle of control cabinet-free machines. Pooling the individual components in a single system results in a connection level with all interfaces directly on the drive, which eliminates the need for an upstream I/O level.

AMP8000 | Distributed servo drive system

- compact design
- installation directly on the machine
- saves material, space and cost
Packaging solutions from Beckhoff:
highly efficient, flexible and eco-friendly

Syntegon Packaging Systems AG,
Switzerland
High performance packaging systems
for the food industry
► www.syntegon.com

Plasmatreat GmbH,
Germany
XPlanar simplifies transportation of sensitive workpieces.
► www.plasmatreat.com
Syntegon Packaging Systems AG,
Switzerland
High performance packaging systems
for the food industry
www.syntegon.com

Plasmatreat GmbH,
Germany
XPlanar simplifies transportation of sensitive workpieces.
www.plasmatreat.com

Triowin Automation Machinery Co., Ltd., China
PC-based control optimizes robot-based packaging line.
en.triowin.com

L’Oréal and Secad,
France
Intelligent product transport in cosmetics filling and packaging line with XTS
www.loreal.com
www.secad02.fr

Triowin Automation Machinery
Co., Ltd., China
PC-based control optimizes robot-based packaging line.
en.triowin.com
Packaging solutions from Beckhoff: highly efficient, flexible and eco-friendly

Unista/Shiseido Co., Ltd., France

The compact Shiseido machine for closing cosmetics containers is based on XTS technology.

- www.shiseidogroup.com/emea
- www.unista.fr

KOCH Pac-Systeme GmbH, Germany

The XTS is used at the core of a labeling and grouping unit in a blister packaging line for toothbrushes.

- www.koch-pac-systeme.com
Unista/Shiseido Co, Ltd., France

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www.unista.fr

KOCH Pac-Systeme GmbH, Germany

The XTS is used at the core of a labeling and grouping unit in a blister packaging line for toothbrushes.

www.koch-pac-systeme.com

Goldfuß engineering GmbH, Germany

XTS boosts flexibility for a pill bottle cap assembly line.

www.goldfuss-engineering.com

MULTIVAC Sepp Haggenmüller SE & Co. KG, Germany

TwinCAT robotic kinematics and Beckhoff servo drive technology for food packaging application.

www.multivac.com
New Automation Technology

Beckhoff implements open automation systems using PC-based control technology. The product portfolio comprises these main areas: Industrial PCs, I/O and fieldbus components, drive technology and automation software. Product lines are available for all areas and can be used as individual components or as a complete system.

The New Automation Technology philosophy from Beckhoff represents innovative and open control and automation solutions that are used worldwide in a variety of applications ranging from CNC machine tools to intelligent building automation.
Worldwide presence on all continents
With local presence in 75 countries, Beckhoff ensures fast service worldwide and technical support in the local language for globally operating customers. In addition, Beckhoff sees close geographic proximity to customers as a prerequisite for a profound understanding of the technical challenges facing customers.

Beckhoff at a glance
- headquarters: Verl, Germany
- 2019 sales: € 903 million (−1%)
- employees worldwide: 4,350
- offices in Germany: 23
- subsidiaries/branch offices worldwide: 39
- distributors worldwide: 75

(as of 04/2020)

Further information
The Beckhoff catalogs and flyers are available for download on our website.

► www.beckhoff.com/media
Secure your lead in packaging industry with PC-based control from Beckhoff:

▶ www.beckhoff.com/packaging