BECKHOFF New Automation Technology

PC-based control
for warehouse and distribution logistics

# PC-based control for warehouse and distribution logistics

With PC-based control and EtherCAT, Beckhoff offers control solutions for highly efficient and flexible warehouse and distribution logistics tasks of any size. Due to its open interfaces and modularity, PC-based control technology is ideally suited for implementing customised intralogistics solutions that are tailored to the respective requirements, thereby opening up technological and economic competitive advantages.

Advanced warehouse and distribution systems have to meet stringent requirements. They must guarantee fast availability with maximum individualisation, as well as high efficiency and reliability in order to meet increasing customer demands. For example, industry relies on production-synchronous delivery of components and parts, while end customers in online retailing expect their orders to arrive next day. One of the greatest challenges for manufacturers of conveyor technology and logistics systems is flexible adaptation to changing market trends, new products and individual customer requirements. The PC- and EtherCAT-based automation technology from Beckhoff offers the solution: with high performance, modular design and precisely

Industrial PC   I/O

We reserve the right to make technical changes.
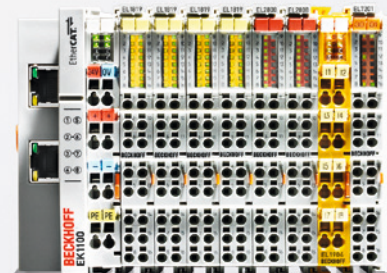
scalable capacity, it is suitable as a universal hardware and software platform both for controlling individual machines and for automating complete systems. Since all control functions are mapped in software, even unusual requirements can be implemented with little engineering effort.

Motion

Automation

Warehouse logistics

Separation, singulation and sorting

Material transport and conveyor belts

Packaging and distribution

An integrated platform for control and engineering

The Beckhoff solution for warehouse and distribution logistics is based on a uniform hardware and software platform consisting of Industrial PCs or PC-based Embedded Controllers, EtherCAT as communication system and decentralised I/Os and drives. TwinCAT is the universal automation software for engineering, runtime and diagnostics of all control functions. The open hardware and software interfaces offer a high degree of system design freedom and enable machine and plant manufacturers to integrate a wide range of devices, including equipment from third-party manufacturers. Support for all common networks, fieldbus systems and software protocols guarantees consistent horizontal and vertical communication.

Thanks to the high performance of multi-core and many-core processors, in addition to the core machines and system functions the warehouse management can also be implemented decentrally or centrally, for example. TwinCAT is the universal toolbox for controlling all functions, including PLC, motion control, CNC, robotics, HMI, vision, safety and measurement technology, cloud communication and analysis functions. Firstly, this ensures

customer- and industry-specific Control Panels

cloud-based automation, e.g. for predictive maintenance
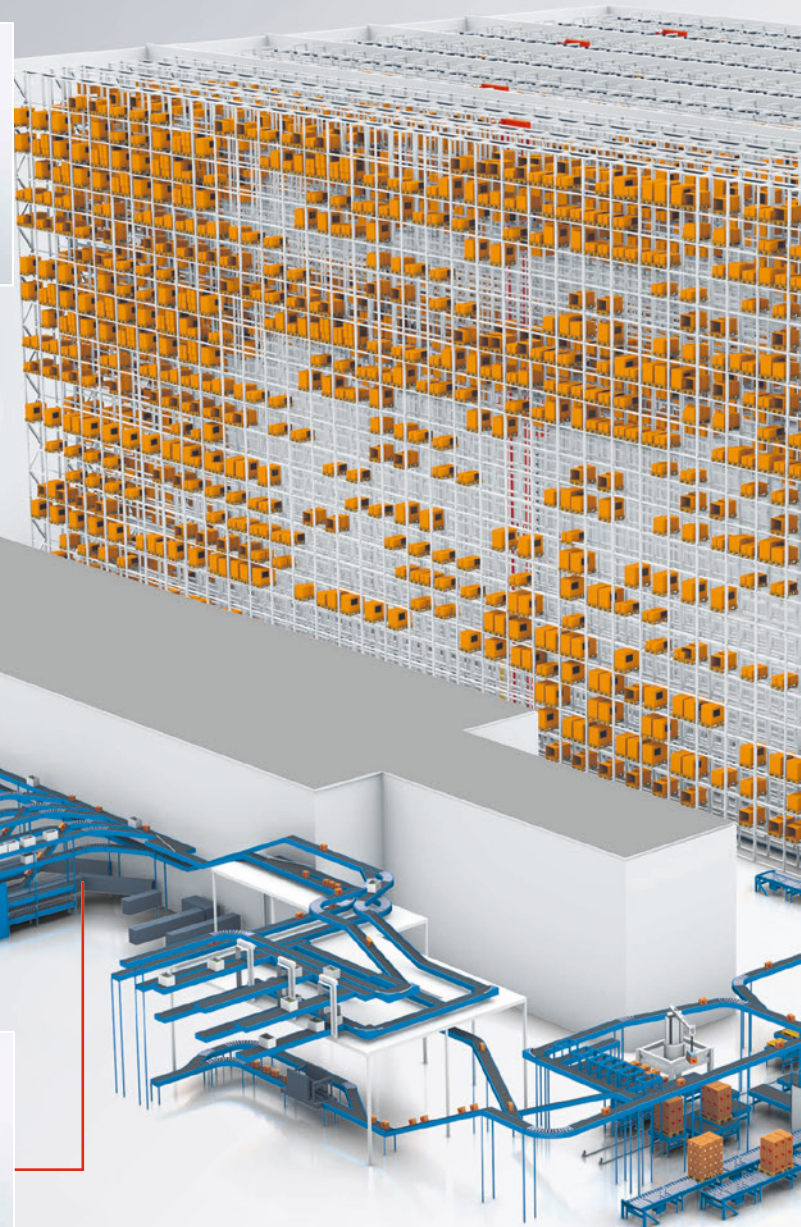
the efficient interaction of all system components and thus maximum productivity. The consistent implementation of all functionalities in the form of software modules eliminates the need for special devices. This not only reduces the initial hardware costs but also the engineering effort and the life cycle costs.
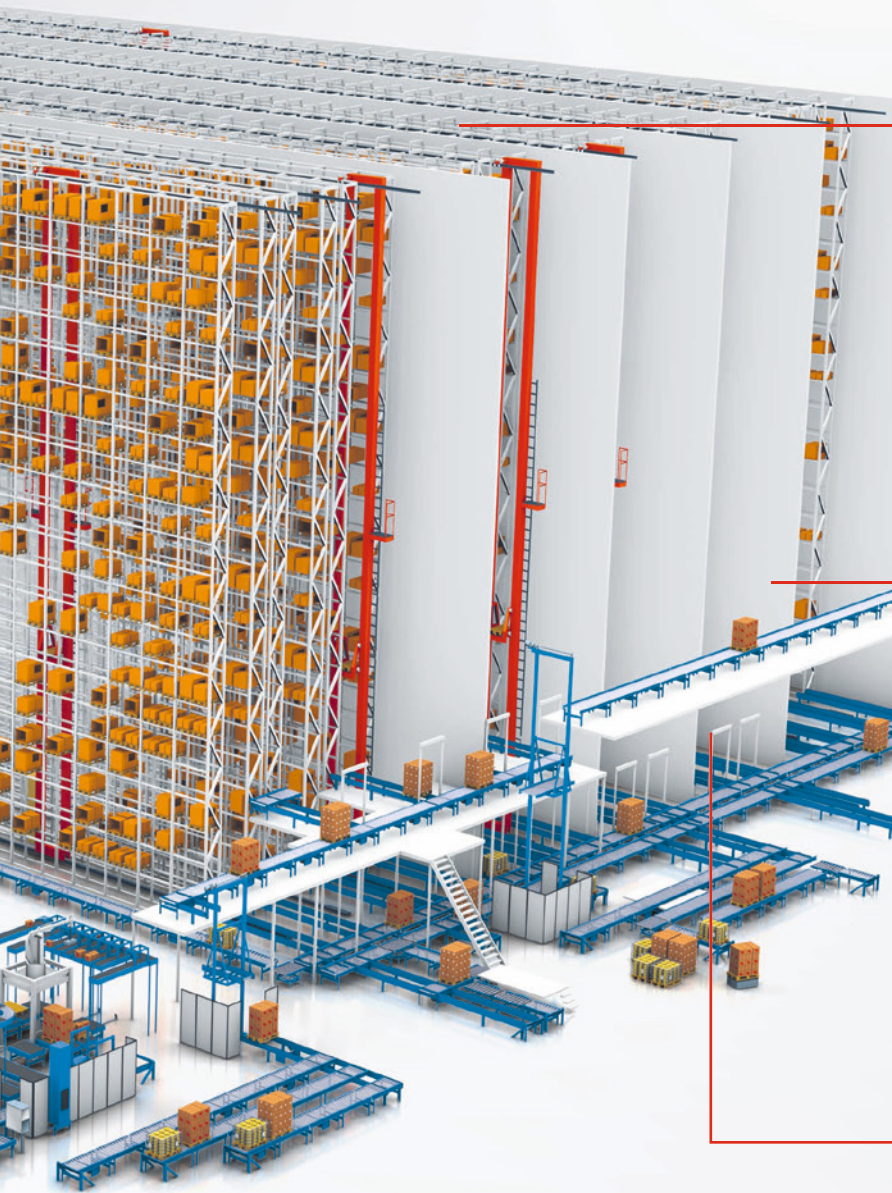
TwinCAT, the automation platform

TwinSAFE, the open and scalable safety technology

highly scalable drive technology

PC-based control: the scalable system for intralogistics applications

With its open, modular control solution in software and hardware that is precisely scalable in terms of computing power, complexity and costs, Beckhoff meets the high demands of modern intralogistics. As if from an automation kit, users can assemble the control solution that fits their system type and dimension it according to their performance requirements, from compact Embedded PCs with directly connected EtherCAT I/O level to high-end Industrial PCs. A wide range of multi-touch panels guarantees sophisticated functionality and state-of-the-art machine operator comfort. Over 100 signal types and 1,000 different Bus Terminals serve the entire range of sensors and actuators. TwinSAFE provides an integrated and standardised safety concept. The Drive Technology product range extends from compact drive amplifiers in terminal format to powerful high-end drives for highly dynamic servo applications. The core of the Beckhoff solution is the TwinCAT automation software as an integrated engineering and control platform.

EtherCAT®

EtherCAT: integrated real-time fieldbus
for ultra-fast process communication
▸ **www.beckhoff.com/ethercat**

Control Panel: Multi-touch display
and control panel
▸ **www.beckhoff.com/multitouch**

TwinCAT: software for engineering and runtime
▸ **www.beckhoff.com/twincat**

Industrial PC: Cabinet PC and panel PC
▸ **www.beckhoff.com/ipc**

TwinSAFE: integrated safety solution
▸ **www.beckhoff.com/twinsafe**

EtherCAT I/O: complete I/O system
in IP 20 and IP 67
▸ **www.beckhoff.com/io**
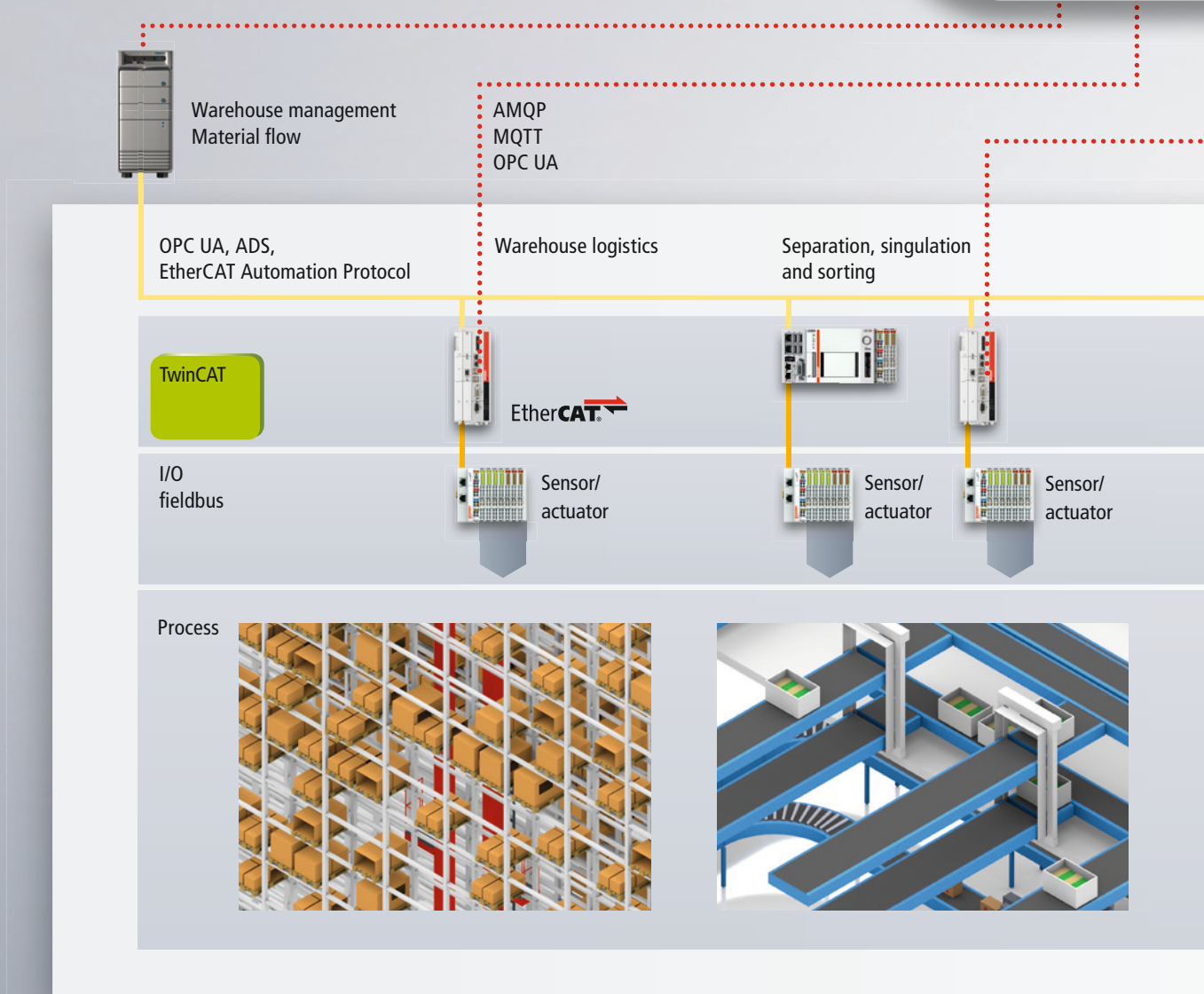
Compact servo drives
▸ **www.beckhoff.com/drive-technology**

IoT and Industrie 4.0 in the smart warehouse

With standardised industrial and IT-based communication interfaces, PC-based control offers the optimum basic technology for implementing IoT and Industrie 4.0 solutions in warehouse and distribution logistics. In intelligent warehouses, all systems are networked in an integrated manner, from the control level to warehouse management and the retailer's eCommerce software. Regardless of their shape, size and weight, products are automatically picked, packaged and shipped quickly and seamlessly via a fulfilment center to meet tight turnaround times from receipt of the order to package delivery. In addition to the conventional control technology tasks, TwinCAT can also be used to implement vision applications, e.g. for determining the position and orientation of goods, condition monitoring for carrying out preventive maintenance, as well as energy measurement and management. In this way, the efficiency and availability of machines and systems can be increased consistently.

Azure

Warehouse management
Material flow

AMQP
MQTT
OPC UA

OPC UA, ADS,
EtherCAT Automation Protocol

Warehouse logistics

Separation, singulation
and sorting

TwinCAT

EtherCAT.

I/O
fieldbus

Sensor/
actuator

Sensor/
actuator

Sensor/
actuator

Process

aws

...

Distribution centers

Retailers

Material transport
and conveyor belts

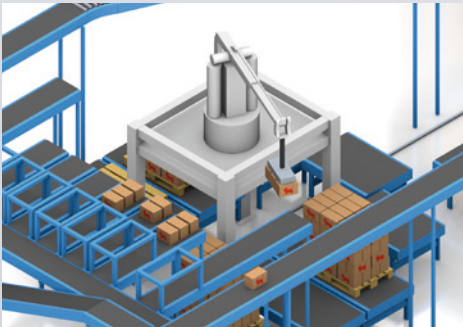Packaging
and distribution

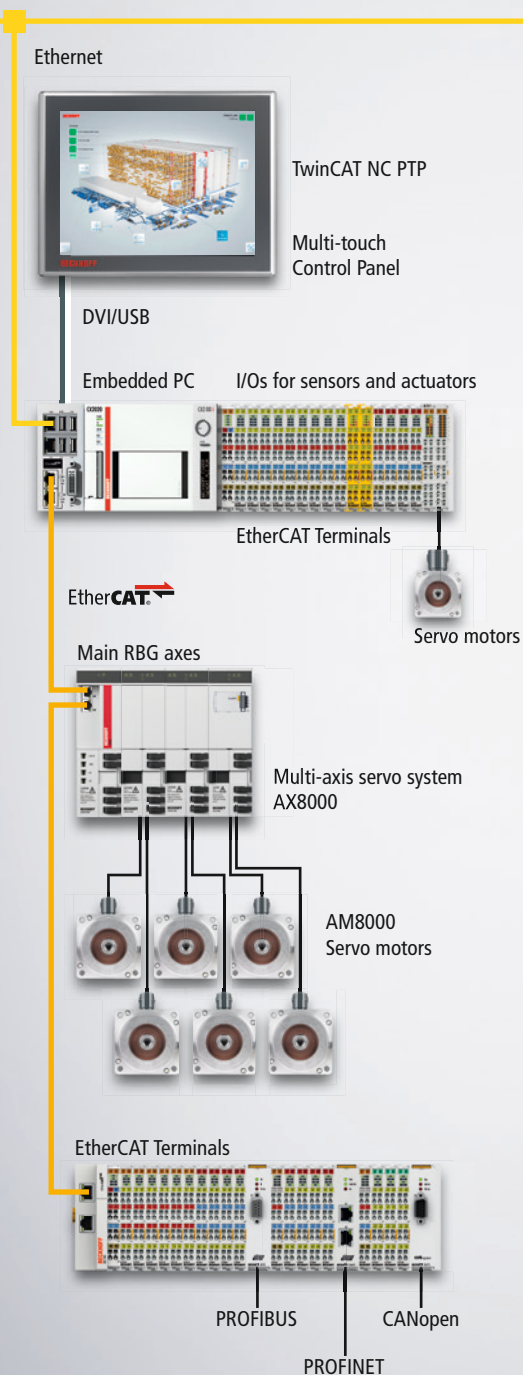Sensor/
actuator

Sensor/
actuator
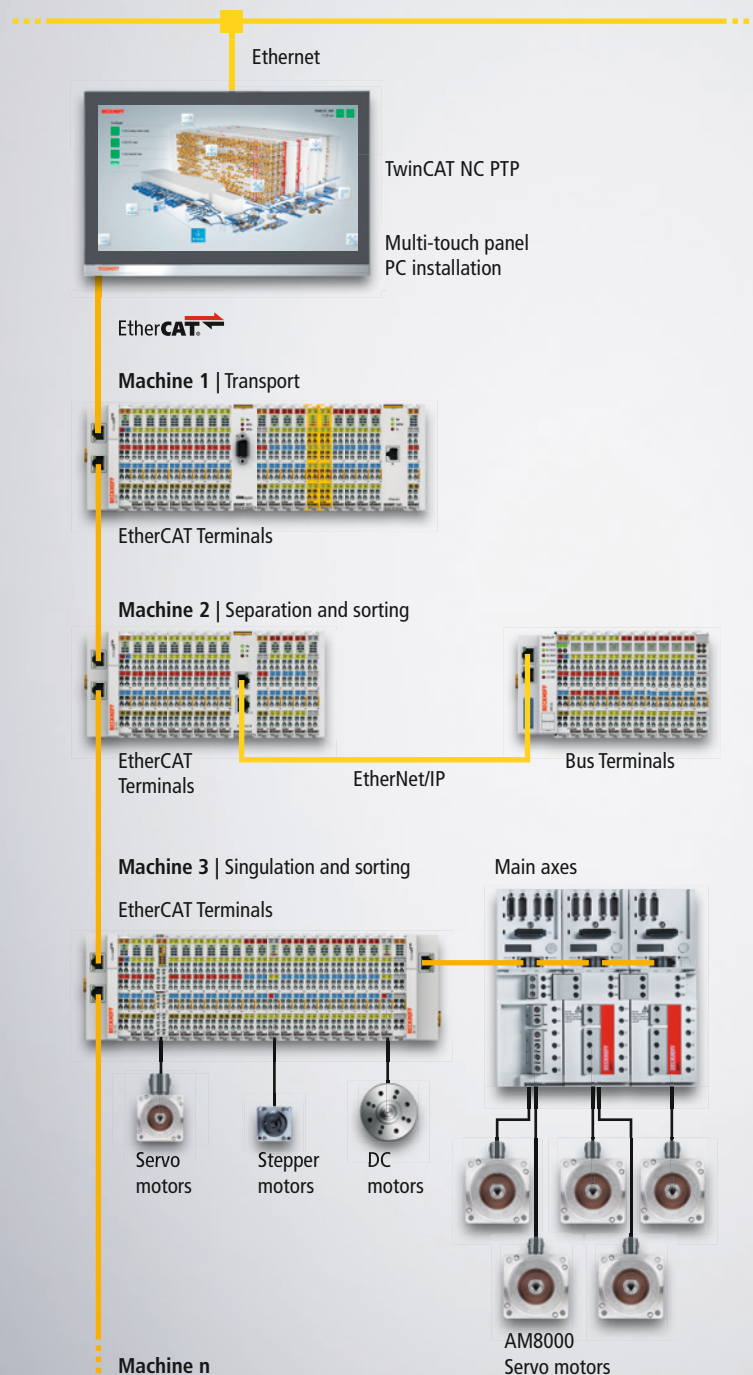
Sensor/
actuator

Sensor/
actuator

PC Control for warehouse logistics

High-bay warehouses and their storage and retrieval systems and peripherals are characterised by a large number of safe and standard inputs and outputs, combined with a wide variety of drive technologies. Scalable hardware and software components and manufacturer-neutral interfaces support the optimal integration of standard and industry-specific devices and thus the ideal implementation of projects.

Ethernet

TwinCAT NC PTP

Multi-touch
Control Panel

DVI/USB

Embedded PC   I/Os for sensors and actuators

EtherCAT Terminals

EtherCAT

Servo motors

Main RBG axes

Multi-axis servo system
AX8000

AM8000
Servo motors

EtherCAT Terminals
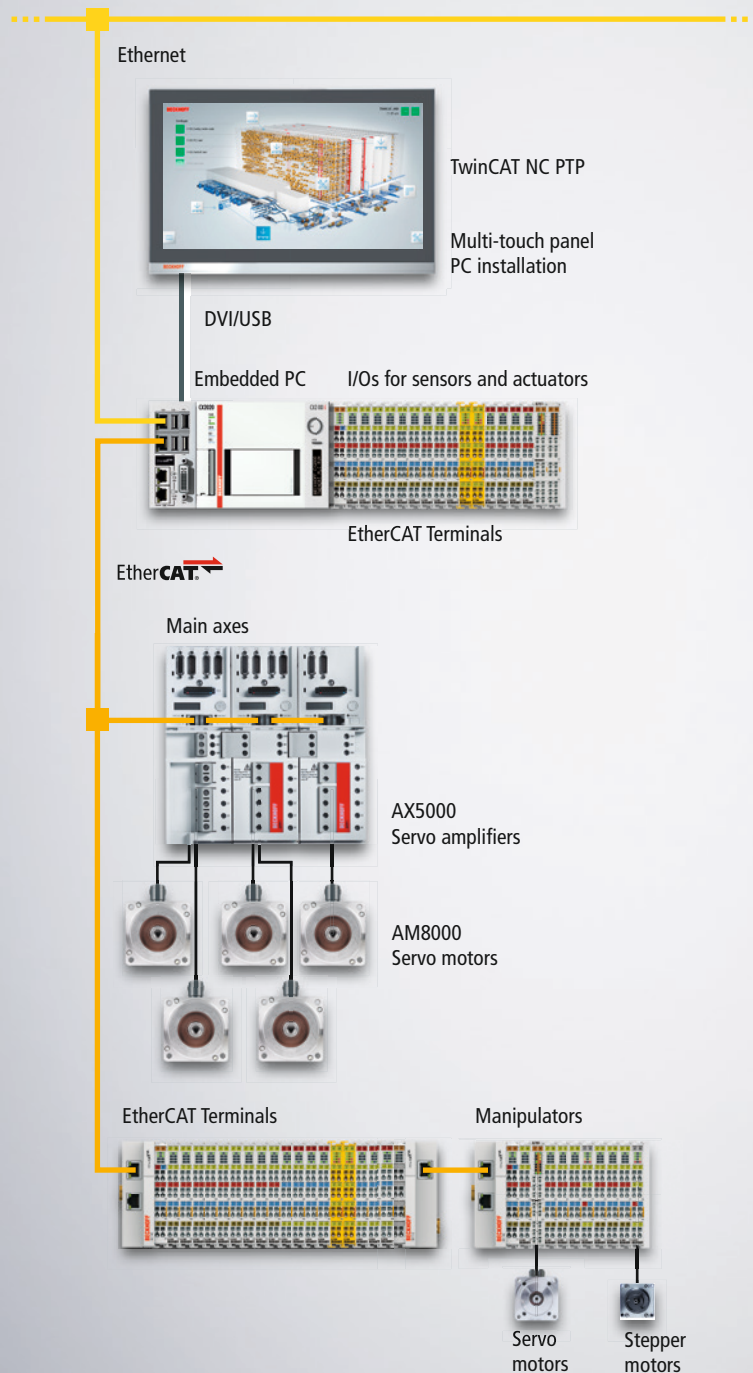
PROFIBUS   CANopen

PROFINET

PC Control for separation, singulation and sorting

Modern Industrial PCs, TwinCAT automation software and EtherCAT as the communication system form the basis of a flexible and exceptionally fast control platform. It can be used to control a wide range of axis types and an almost unlimited number of inputs and outputs in real-time, guaranteeing the speed and accuracy required by modern sorting systems. PC-based control is very powerful, so even computationally intensive vision systems and systems for preventive maintenance can be integrated.

Ethernet

TwinCAT NC PTP

Multi-touch panel
PC installation

EtherCAT

Machine 1 | Transport

EtherCAT Terminals

Machine 2 | Separation and sorting

EtherCAT
Terminals   EtherNet/IP   Bus Terminals

Machine 3 | Singulation and sorting   Main axes
EtherCAT Terminals

Servo   Stepper   DC
motors   motors   motors
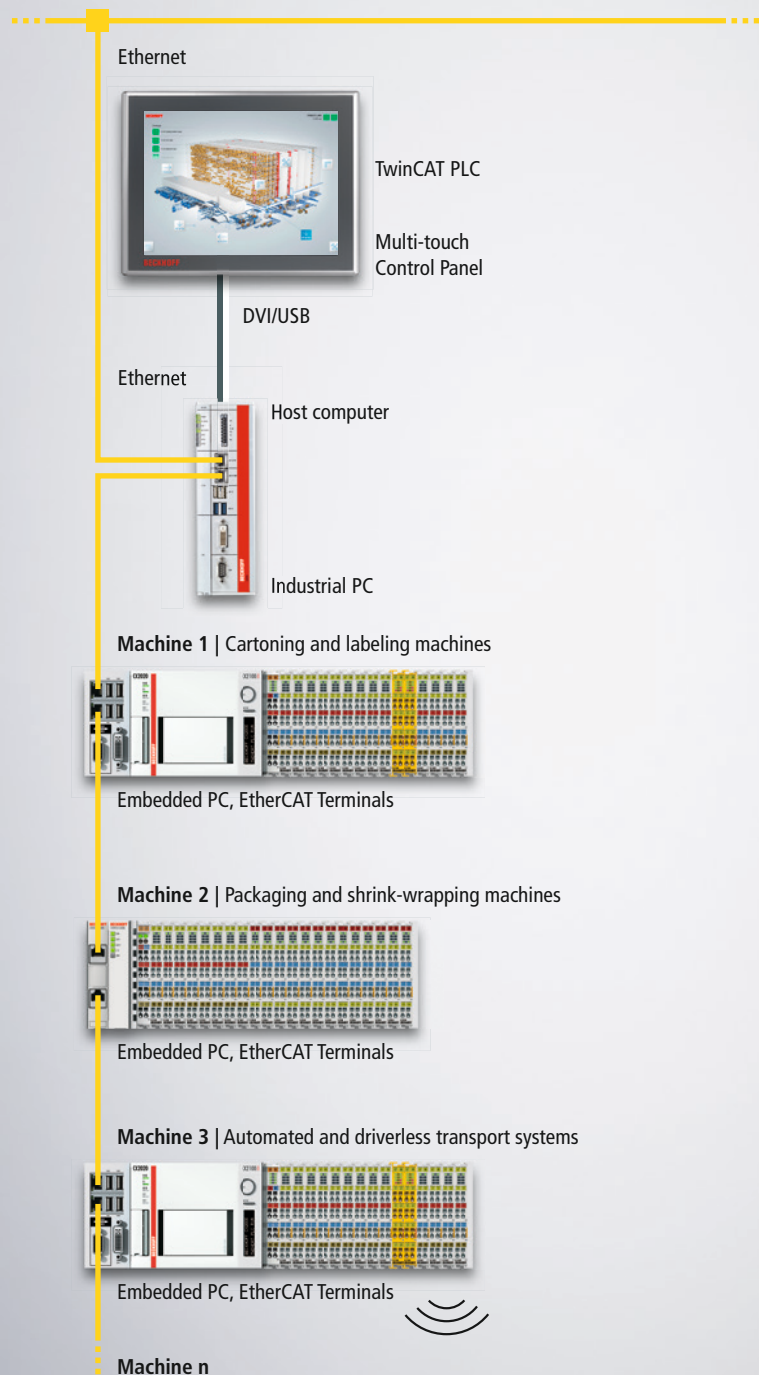
Machine n

AM8000
Servo motors

PC Control for material handling and conveyor systems

A feature of storage and retrieval systems, e.g. in high-bay warehouses, is the connection of numerous standard and safety I/Os, which may be combined with different drive technologies. Scalable hardware and software components from Beckhoff support all drive technologies, from the control of simple and inexpensive three-phase asynchronous machines for less dynamic processes or simple adjustments to highly dynamic servo drives for portals and storage and retrieval solutions. The integrated TwinSAFE safety solution ensures consistent safety up to SIL 3 (IEC 61508) and PL e (DIN EN ISO 13849-1).

Ethernet

TwinCAT NC PTP

Multi-touch panel
PC installation

DVI/USB

Embedded PC   I/Os for sensors and actuators

EtherCAT Terminals

EtherCAT

Main axes

AX5000
Servo amplifiers

AM8000
Servo motors

EtherCAT Terminals   Manipulators

Servo   Stepper
motors   motors

PC Control for packaging and distribution

The performance-related scalability of the control platform as well as support for different fieldbus systems while using the same programming and project engineering tools provide for universal, economical and flexible plant planning. The difficulties of integrating third-party units are thus consigned to the past. The extensive range of standardised, reusable functions in TwinCAT is supplemented by various robot kinematics for direct control of handling robots. This optimally meets the requirements of modern packaging and distribution systems in terms of speed and accuracy.

Ethernet

TwinCAT PLC

Multi-touch
Control Panel

DVI/USB

Ethernet

Host computer

Industrial PC

Machine 1 | Cartoning and labeling machines

Embedded PC, EtherCAT Terminals

Machine 2 | Packaging and shrink-wrapping machines

Embedded PC, EtherCAT Terminals

Machine 3 | Automated and driverless transport systems

Embedded PC, EtherCAT Terminals

Machine n

Fast, open and ideally suited as a fieldbus for intralogistics: EtherCAT

With outstanding performance, flexible choice of topology, comprehensive diagnostics and simple configuration, EtherCAT is ideally suited for use in intralogistics. EtherCAT communicates with 1,000 distributed I/Os in 30 µs, offers almost unlimited network size and optimum vertical and horizontal integration via standard Ethernet and internet technologies. But EtherCAT is not just about high performance. Controlling costs is at least as important: EtherCAT uses cost-effective Ethernet cables and supports flexible cabling topologies. In addition, neither switches nor special fieldbus cards or IP addresses are required in EtherCAT devices. Another advantage: Existing network and fieldbus technologies and devices can be fully integrated into an EtherCAT-based system.

- communication with 12,000 digital I/Os in 350 µs
- communication with 200 analog I/Os (16-bit) in 50 µs, which corresponds to a 20 kHz sampling rate
- communication with 100 servo axes every 100 µs
- network expansion: almost unlimited (> 500 km)
- up to 65,535 devices

▶ **www.beckhoff.com/ethercat**

EtherCAT P: One Cable Technology minimises cable and installation costs

EtherCAT P combines EtherCAT communication with the power supply for the connected consumers on a standard four-wire Ethernet cable. In addition, EtherCAT P enables energy transfer directly via the devices. Advantages of EtherCAT, such as free topology selection, high speed, optimum bandwidth utilisation, high-precision synchronisation, integration of safety functions and comprehensive diagnostics, are retained. EtherCAT P is the optimum bus system for sensors, actuators, drive and measurement technology in conveyor systems.

One Cable Automation simplifies system wiring in machine construction, since components, terminal boxes and machine modules only have to be linked via a single cable. Decentralised modules and units are supplied with control data and power via just one cable with One Cable Automation. This means that the usual switch boxes and control cabinets can be partially or completely dispensed with, thereby reducing the complexity and costs as well as the footprint of the storage systems. EtherCAT P makes it possible to implement modular machines and system concepts with high flexibility and considerably
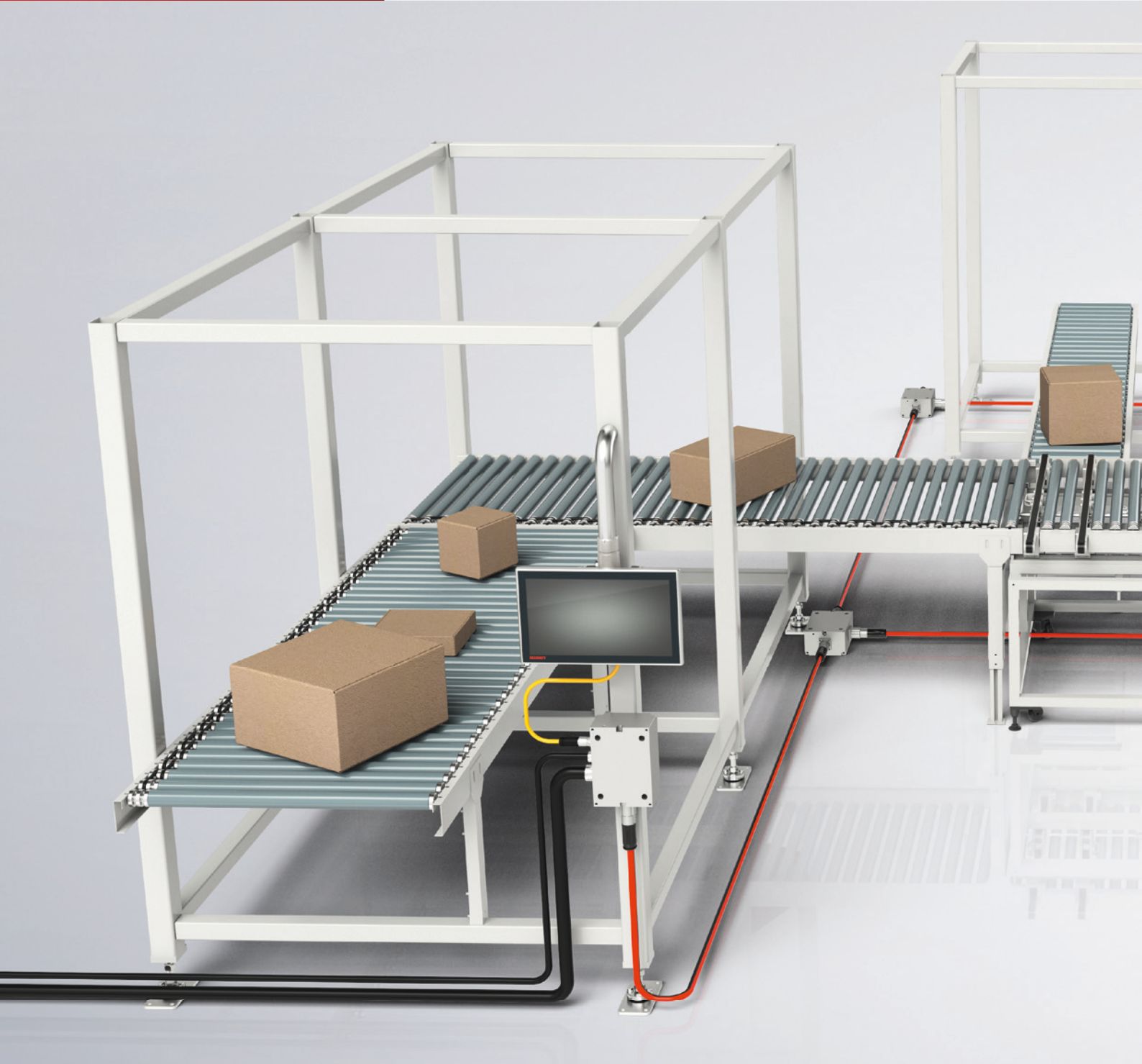
reduced installation and commissioning effort. Material costs, installation effort and time are saved; the error rate during the installation is reduced.

▶ **www.beckhoff.com/ethercat-p**
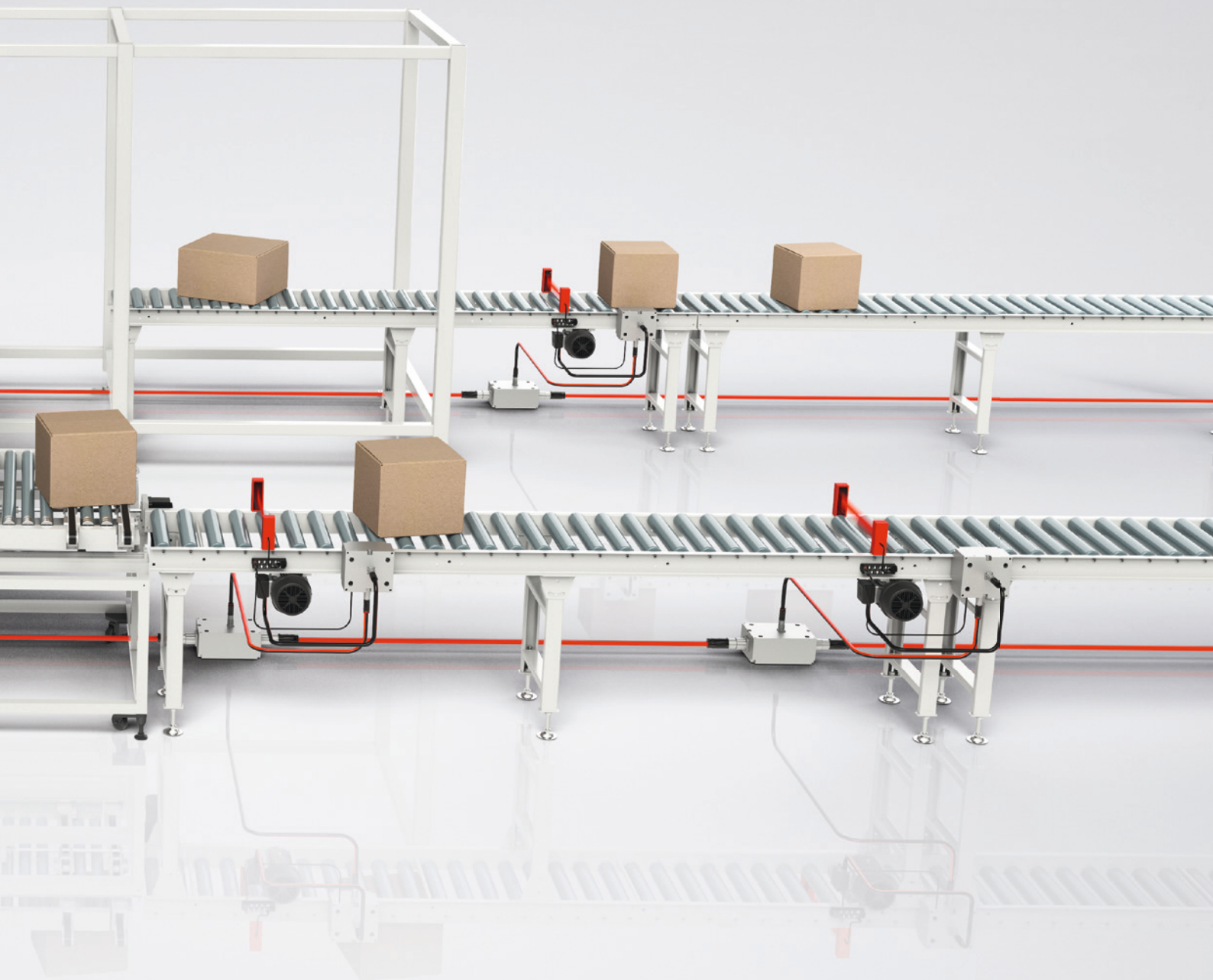
EtherCAT drives for highly dynamic positioning tasks

Warehouse and distribution logistics require a high degree of flexibility and scalability. Automated storage and retrieval systems, high sorting speeds, robotics and handling for transporting crates and pallets as well as driverless transport systems place different demands on control and drive technology. The scalable drive solutions from Beckhoff cover a broad range of applications: from compact servo terminals to the AX8000 or AX5000 EtherCAT servo drives. The integrated, fast control technology of the AX series supports fast and highly dynamic positioning tasks. EtherCAT enables interfacing of the

drive components with PC-based control technology and coupling with other communication systems. The AM8000 servomotor series is characterised by One Cable Technology (OCT), in which power and feedback systems are combined in a standard cable. In the lower performance range, EtherCAT drive terminals are an inexpensive and compact alternative for conveyor applications.

▶ **www.beckhoff.com/motion**

Servo drives
from 0.2 to 120 kW
Servo motors
from 0.2 to 180 Nm

TwinSAFE: the scalable safety solution in software and hardware

TwinSAFE from Beckhoff provides a universal safety concept that integrates safety functionalities into the standard control platform including the PLC, I/Os and drive technology. All safety functions such as emergency stop, safety door monitoring, two-hand operation, muting, safe position, safely limited speed etc. can be programmed and configured with the integrated TwinCAT engineering platform. Safety technology is seamlessly integrated into the terminal segment via the TwinSAFE I/O modules in protection class IP 20 or IP 67; safe signals can be mixed with standard signals as required.

The necessary safety functions can be implemented centrally or decentrally in almost all TwinSAFE devices to support modular system concepts. All solutions are programmed on the basis of standard safety function blocks according to the safety requirements and are suitable for applications up to SIL 3 according to IEC 61508 or performance level e according to DIN EN ISO 13849-1.

▶ **www.beckhoff.com/twinsafe**

TwinCAT: the integrated engineering and control platform

The TwinCAT automation software consists of a runtime system for the real-time execution of PLC, HMI, NC, CNC and robotic applications and is at the same time the development environment for programming, diagnostics and configuration. All main IEC 61131-3 programming languages are available for real-time applications. C/C++ and MATLAB®/Simulink® modules can be integrated in the IEC context via existing interfaces or operated independently in the TwinCAT 3 real-time environment. Moreover, open interfaces as well as the use of the latest technological standards based on Windows operating systems open up a wide range of options for the user, such as integration in existing visualisation, control and database systems. TwinCAT also supports functions and protocols that determine the implementation of the Smart Connected Warehouse concept as new standards for Industrie 4.0 and IoT solutions.

The TwinCAT engineering environment is a toolbox that is optimised for machine construction and can be used to implement all control functions, including HMI, Vision, IoT communication and a large number of online and offline analyses.
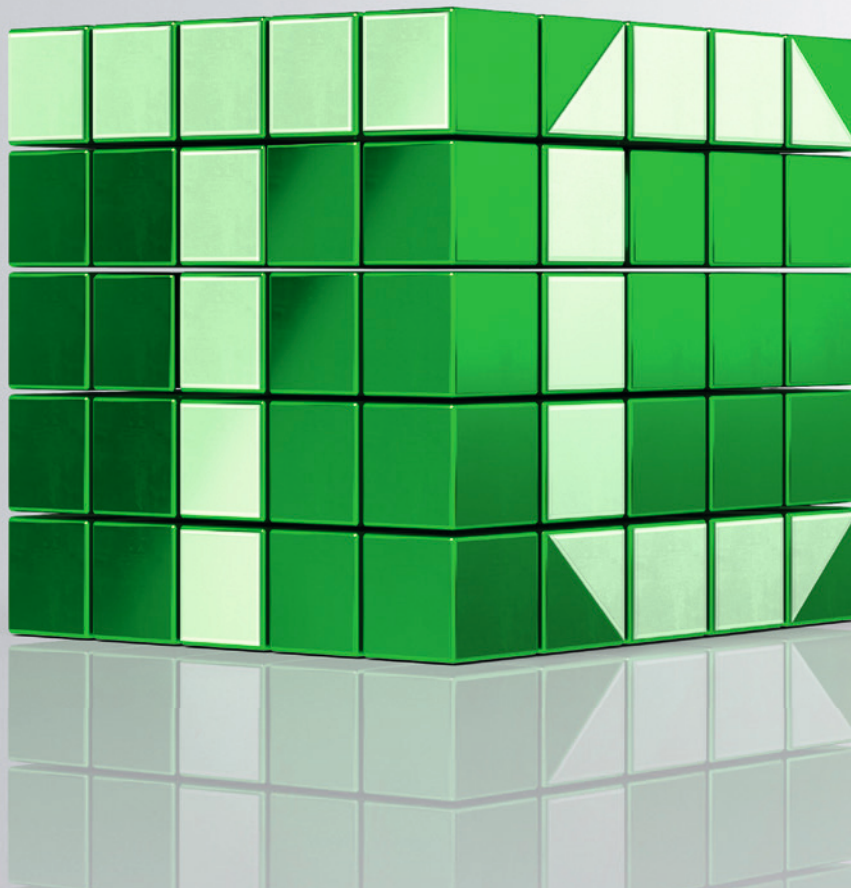
The object-oriented extensions of IEC 61131-3 enable the modularisation of the programming code, the software encapsulation of machine functions and, in conjunction with that, improved code structuring, simpler maintenance, re-usability and expandability of the software. Extensive software function blocks and libraries for typical industry applications facilitate the engineering and implementation of the machine functions.

▶ **www.beckhoff.com/twincat**

Robotics

Condition Monitoring

Motion

Analytics

IoT

TC HMI

Measurement

PLC

Beckhoff: globally present on all continents

New Automation Technology

Beckhoff implements open automation systems using proven PC-based control technology. The product spectrum 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 either individual components or as a complete system solution. The Beckhoff "New Automation Technology" philosophy stands for innovative and open control and automation solutions that are used worldwide in a diverse variety of applications ranging from CNC machine tools to intelligent building automation systems.

EUROPE

Piteå, Oulu, Seinäjoki, Kuopio, Tampere, Hyvinkää, Ålesund, Horten, Stockholm, Tallinn, St Petersburg, Stavanger, Gothenburg, Vladimir, Moscow, Hobro, Glasgow, Malmö, Køge, Rotherham, Kolding, Kaunas, Lübeck, Hanover, Huntingdon, Haarlem, Münster, Berlin, Poznań, Piaseczno, Henley-on-Thames, Enschede, Eindhoven, Dresden, Wrocław, Zwevegem, Moers, Verl, Erfurt, Katowice, Kyiv, Ankara, Lummen, Frankfurt, Prague, Brno, Bras-sur-Meuse, Nuremberg, Hagenberg, Trenčín, Paris, Balingen, Vienna, Beirut, Orvault, Schaffhausen, Arbon, Munich, Budapest, Lod, Yverdon-les-Bains, Zürich Bürs, Innsbruck, Medvode, Cluj-Napoca, Cairo, Lyssach, Losone, Zagreb, Annecy, Padua, Milan, Bologna, Galicia, Bilbao, Sofia, Aveiro, Madrid, Barcelona, Istanbul, Bursa, Murcia, Athens, Izmir, Mosta

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Globally present on all continents

Beckhoff is present in 75 countries, providing globally active customers with rapid service worldwide and technical support in their local language. Moreover, Beckhoff sees close proximity to customers as a prerequisite for an in-depth understanding of the technical challenges they face.

Beckhoff at a glance

- headquarters in Verl, Germany
- 1182 billion euros in global sales in 2021
- 5000 employees worldwide
- 1900 engineers
- 40 subsidiaries/representative offices worldwide
- 24 branch offices in Germany
- more than 75 distributors worldwide

(Status: March 2022)

Further information

Additional Beckhoff catalogs and flyers are available to download on the Internet.

▶ **www.beckhoff.com/media**
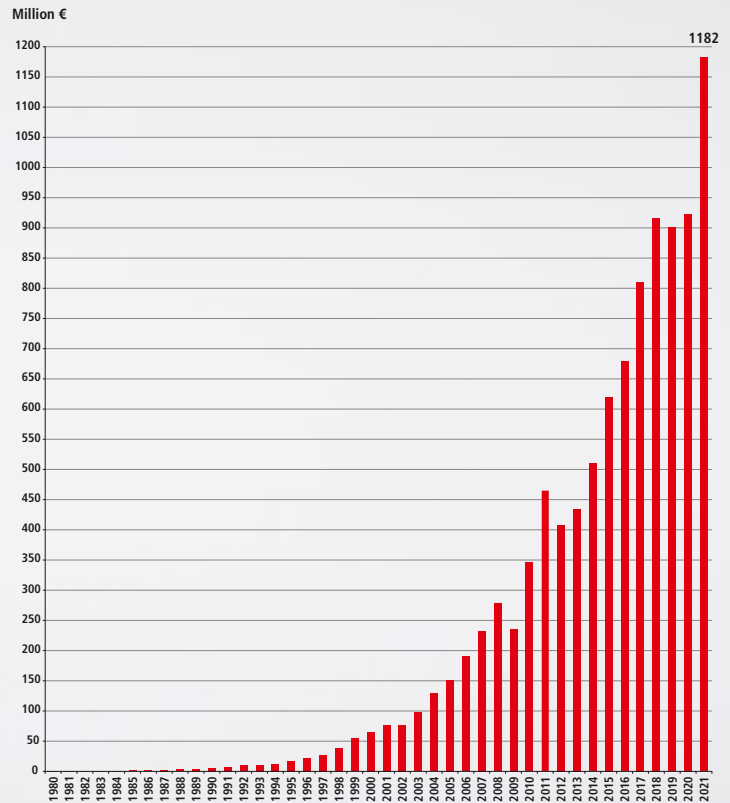
Sales development

Headquarters
Subsidiary
Distributor

Safeguard your warehouse and distribution logistics
advantages with PC-based control:
▶ **www.beckhoff.com/intralogistics**