BECKHOFF New Automation Technology

Automation solutions 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 customized 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 individualization, as well as high efficiency and reliability in order to meet increasing customer demands.

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 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. PC-based control has evolved and Beckhoff, as

a pioneer of PC-based technology, has evolved with it, now offering a non-Windows option, TwinCAT/BSD, a UNIX-based operation system for Beckhoff control devices.

▶ **www.beckhoff.com/intralogistics**

Industrial PC

I/O

Motion

Automation

Warehouse logistics

Separation, singulation and sorting

Material transport and conveying

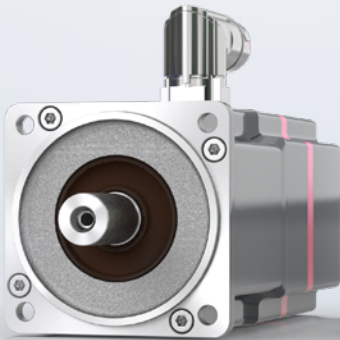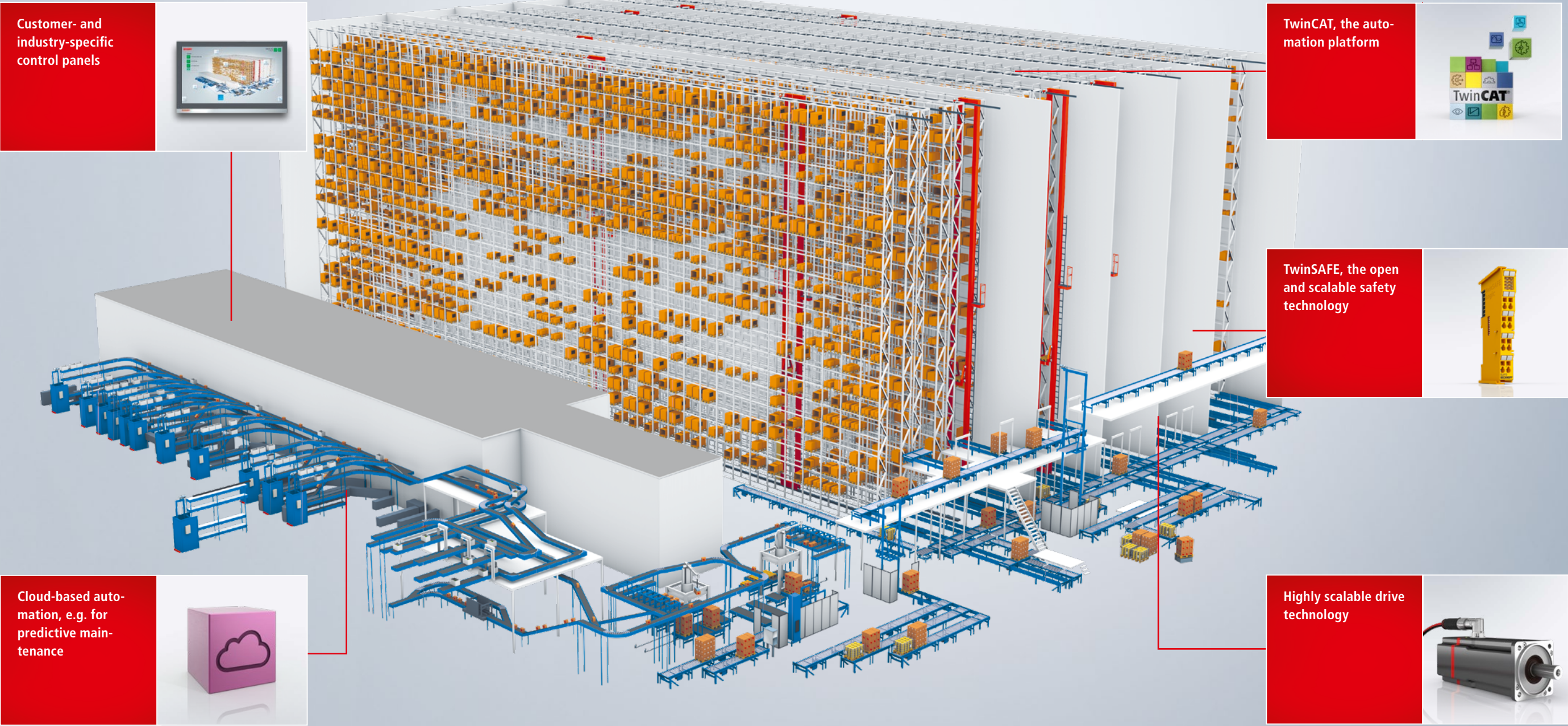Packaging and SLAM

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 decentralized I/Os, drives, mechatronics, and robot arms. 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 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.

▶ **www.beckhoff.com/intralogistics**

Customer- and industry-specific control panels

Cloud-based automation, e.g. for predictive maintenance

TwinCAT, the automation platform

TwinSAFE, the open and scalable safety technology

Highly scalable drive technology

# The scalable automation 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 tool 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. Over 100 signal types and 1,000 different bus terminals serve the entire range of sensors and actuators. TwinSAFE provides an integrated and standardized 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 intelligent transport systems XPlanar and XTS replace rigidly timed product transport. The core of the Beckhoff solution is the TwinCAT automation software as an integrated engineering and control platform.

▶ **www.beckhoff.com/products**

Control panel: multi-touch display and control panels
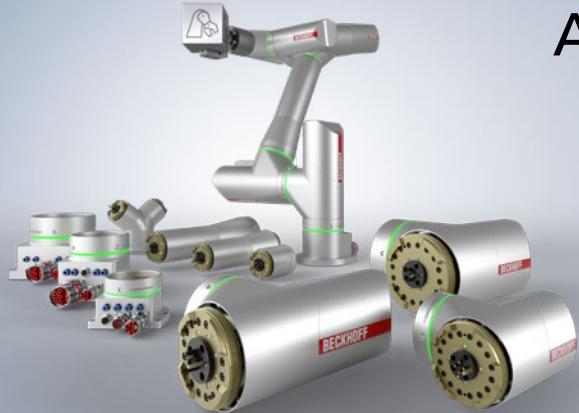
ATRO: Automation Technology for Robotics

Pluggable system solution for control cabinet-free automation: MX-System
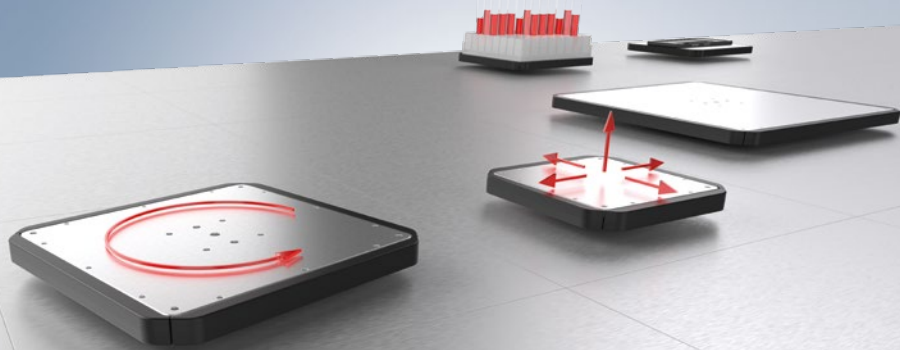
MX-System

EtherCAT I/O: complete I/O system in IP20 and IP67

Embedded PC: PLC and motion control in a small format

Highly dynamic servo drive technology

XPlanar: eXtended planar motor system

TwinCAT: software for engineering and runtime

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. 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. Existing network and fieldbus technologies and devices can be fully integrated into an EtherCAT-based system.

EtherCAT highlights at a glance:
- 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

▶ **www.beckhoff.com/ethercat**

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 utilization, high-precision synchronization, integration of safety functions and comprehensive diagnostics, are retained. 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. Decentralized modules and units are supplied with control data and power via just one cable. 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 reduced installation and commissioning effort.

▶ **www.beckhoff.com/ethercat-p**

Pluggable system solution for control cabinet-free automation

For the first time, the MX-System enables completely control cabinet-free automation solutions in machine and system engineering through a comprehensive, modular, and pluggable IP67 system. The combination of baseplate and function modules resulting from the modular system combines all tasks and features of a control cabinet from the power supply to the connection level for the field devices. The full system integration of all machine functionalities is achieved via freely selectable IPC, coupler, I/O, drive, relay, and system modules, which can be configured and combined according to the specific application.

The consistently systemic approach of comprehensively coordinated assemblies enormously reduces the effort required for planning, assembly, machine installation, and maintenance. Since considerably fewer components are required than in traditional control cabinet design to implement the same requirements, the entire MX-System is significantly more compact than previous solutions. The system footprint is reduced, and system availability and flexibility are also increased. In each life cycle phase of a control system, the MX-System offers significant advantages over the classic control cabinet.

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 cartons, bins, 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 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 characterized by One Cable Technology (OCT), in which power and feedback systems are combined in a standard cable. In the lower performance range, compact drive technology is an inexpensive and compact alternative for conveyor applications and particularly the compact control requirements of shuttles of an AS/RS.

Safety is available across the entire drive portfolio including STO (Safe-torque Off) option or a full range of motion safety including safe stop, safe speed, safe position, safe accelleration, safe direction, as well as safe braking which is critical to crane and lift controls.

Drive technology

XTS®

Linear motor

Compact drive technology

XPlanar®

TwinCAT: The integrated engineering and control platform

The TwinCAT automation software consists of a runtime system for the real-time execution of PLC, HMI, Vision, NC, CNC, and robotic applications and is at the same time the development environment for programming, diagnostics and configuration. All 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 visualization, 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 optimized for machine construction and can be used to implement all control functions. The object-oriented extensions of IEC 61131-3 enable the modularization 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.

The same benefits are available for the non-Windows OS, TwinCAT/BSD, a UNIX-based option. A hypervisor is also optionally available to combine the benefits of many OS via virtual machines running on a single industrial PC. This creates new possibilities to take advantage of the powerful multi-core processors in the Beckhoff portfolio.

▶ **www.beckhoff.com/twincat**

Machine learning

Visualization

Robotics

Motion control

IoT

TcCOM modules encapsulate customer-specific IP

Analytics

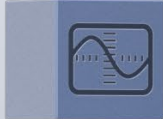Scope

TcCOM Customer expertise

PLC

Condition monitoring

Safety

Vision

TwinCAT®

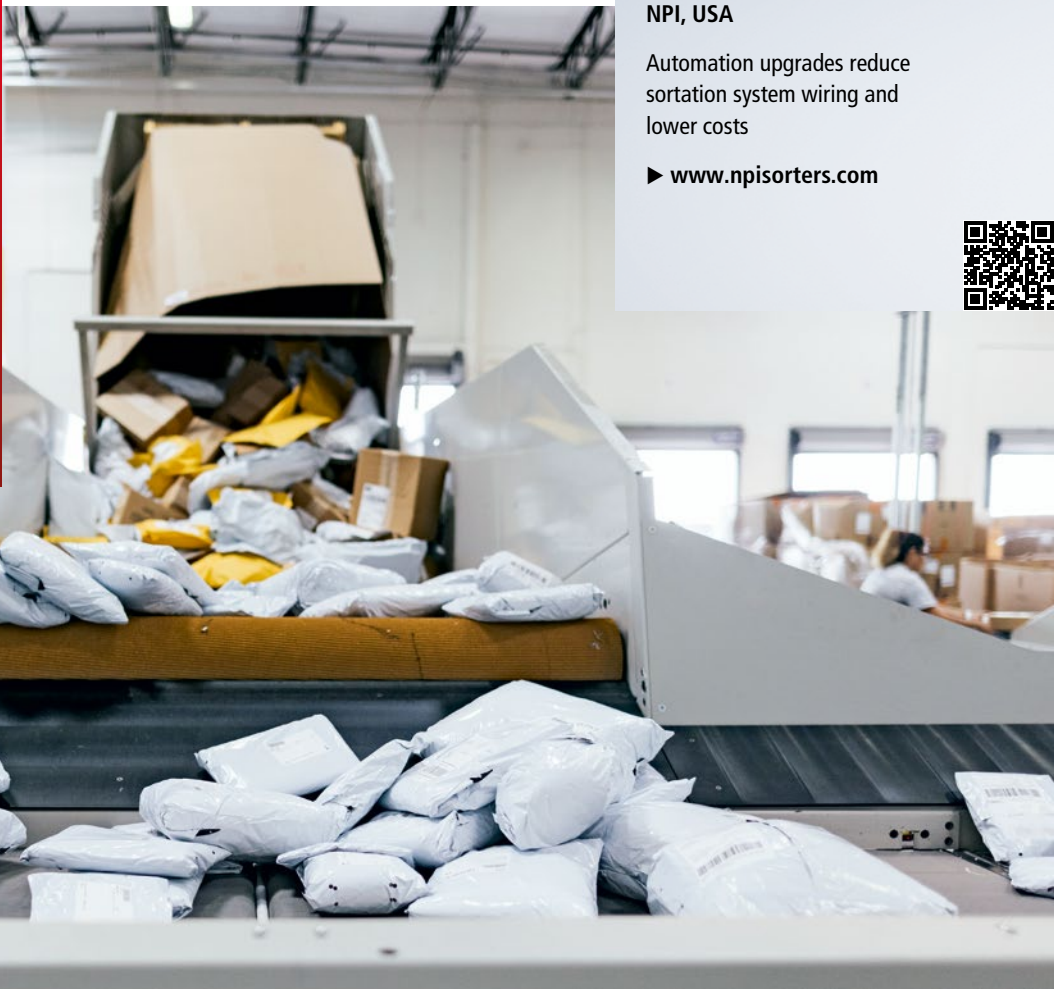# IoT and Industrie 4.0 in the smart warehouse

With standardized 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, orientation, and quality condition of goods condition monitoring for carrying out predictive maintenance, as well as energy measurement and management. In this way, the efficiency and availability of machines and systems can be increased consistently.

Azure aws …

Distribution centers

Retailers

Warehouse management
Material flow

MQTT, OPC UA,
OCPP, HTTPS,
WebSockets

OPC UA, ADS,
EtherCAT Automation Protocol

Warehouse logistics

Separation, singulation
and sorting

Material transport
and conveying

Packaging
and distribution

TwinCAT

EtherCAT

I/O
fieldbus

Distribution/
fulfillment
process

Selected references

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NPI, USA

Automation upgrades reduce sortation system wiring and lower costs

▶ **www.npisorters.com**

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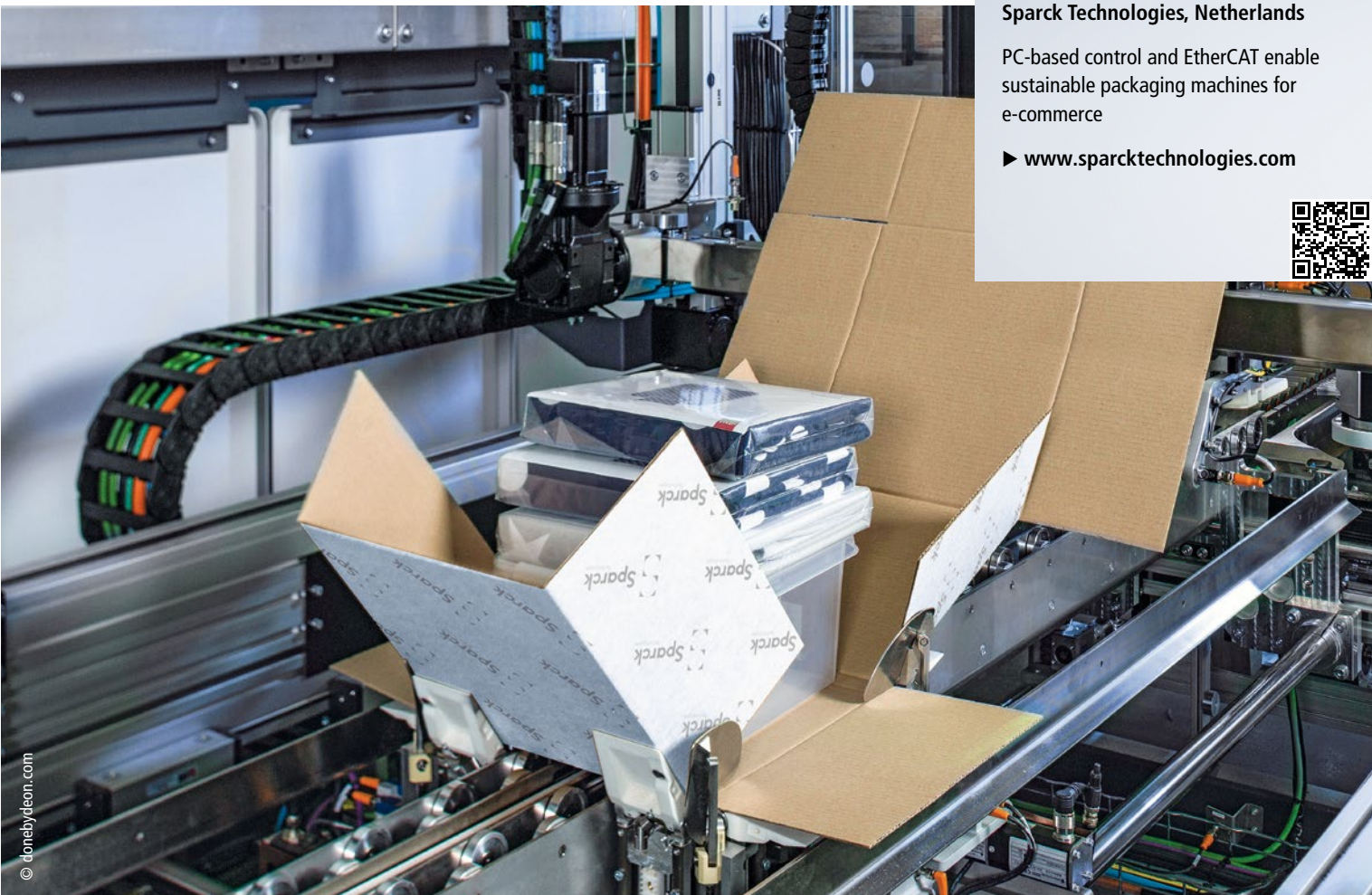
Sparck Technologies, Netherlands

PC-based control and EtherCAT enable sustainable packaging machines for e-commerce

▶ **www.sparcktechnologies.com**

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Oceaneering Mobile Robotics, Netherlands

Highly compact, maneuverable material handling robots

▶ **www.oceaneering.com**

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Boston Dynamics, USA

Mobile robot solution with automation and integrated safety technologies from Beckhoff
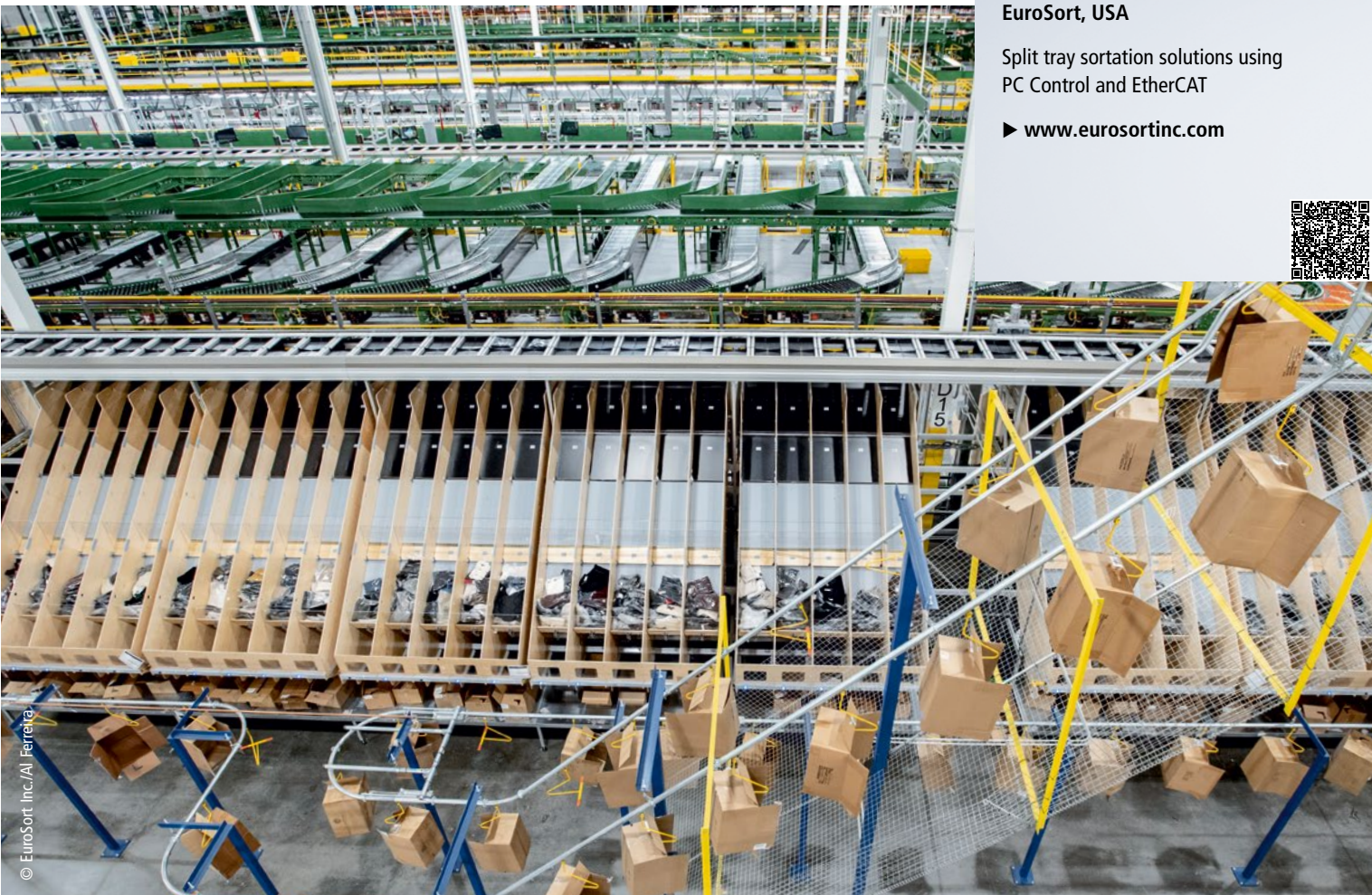
▶ **www.bostondynamics.com**

Selected references

More applications and references:

Swisslog, Switzerland

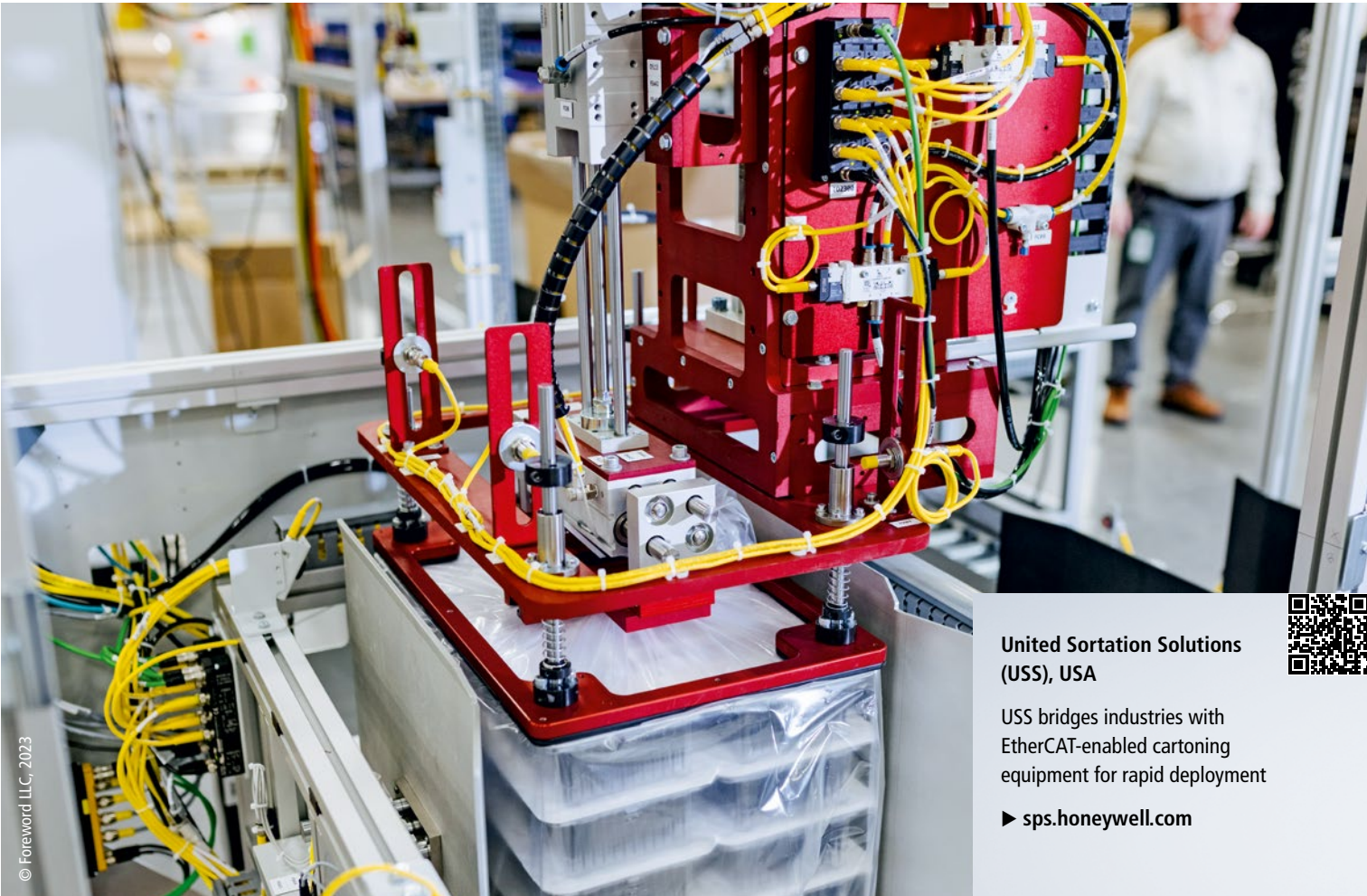Swisslog shuttle system gets smart to meet e-commerce demands

▶ www.swisslog.com

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EuroSort, USA

Split tray sortation solutions using PC Control and EtherCAT

▶ www.eurosortinc.com

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United Sortation Solutions (USS), USA

USS bridges industries with EtherCAT-enabled cartoning equipment for rapid deployment

▶ sps.honeywell.com

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Fortna, USA

Retailer Journeys sets course for dynamic growth in e-commerce

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▶ www.journeys.com

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