BECKHOFF New Automation Technology
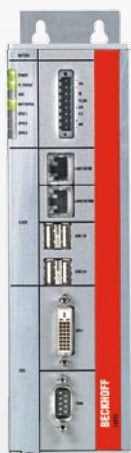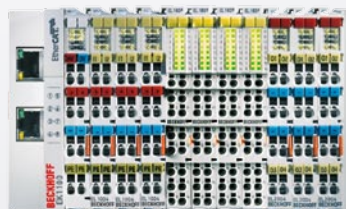
PC-based Control for Forming Technology and Sheet Metal Working

IPC

I/O

Motion

Automation

IPC   I/O   Motion   Automation

Beckhoff technological expertise …

PC-based control technology from Beckhoff has been successfully implemented into a wide range of industries and applications for over 30 years. Globally operated, with headquarters and production facilities in Verl, Germany, the company employs more than 2,500 people worldwide*. 30 subsidiaries* and distributors ensure a global presence in more than 60 countries. Continuous economic growth, a high level of in-house manufacturing, large production capacities, as well as compliance with international standards guarantees long-term availability and reliable delivery of Beckhoff solutions. Mature technologies, robust industry-proven components, and over 20 years of industry experience in metal forming and sheet metal working make Beckhoff a trusted solution partner, offering considerable industry expertise coupled with worldwide customer service and support.

* (as of 04/2014)

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SCHULER

… increases efficiency and quality in metal forming and sheet metal working.

High-profile references in the fields of metal forming and sheet metal working confirm that high-performance Beckhoff control solutions, based on state-of-the-art PC technology and the high-speed bus system EtherCAT, significantly increase control quality and thus the speed and precision of machines. The openness of the PC-based control platform, with its multitude of interfaces and adherence to international standards, offers machine manufacturers a high degree of flexibility, enabling simple and yet cost-effective implementation of customer requests. The high scalability and modularity of all Beckhoff components, including the software, permits the performance and cost of the control solution to be tailored precisely to individual application requirements.

▶ **www.beckhoff.com/forming**

Picture: Schuler Group

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BECKHOFF New Automation Technology

All-in-one: The integrated Beckhoff solution …

High-performance PCs with industrial motherboards, multi-touch Control Panels as operator interfaces, fast I/O modules, EtherCAT as an open and high-speed communication system, flexible and dynamic servo drive technology, and the TwinCAT PLC and Motion Control software provide a technological foundation for the highly integrated control philosophy „Scientific Automation". Apart from PLC and visualisation, the PC-based platform also handles Motion Control, robotics, safety, measurement technology, and Condition Monitoring. Fully leveraging the multi-core technology of latest generation processors, complex algorithms can be expertly handled by TwinCAT without loss of PLC performance.
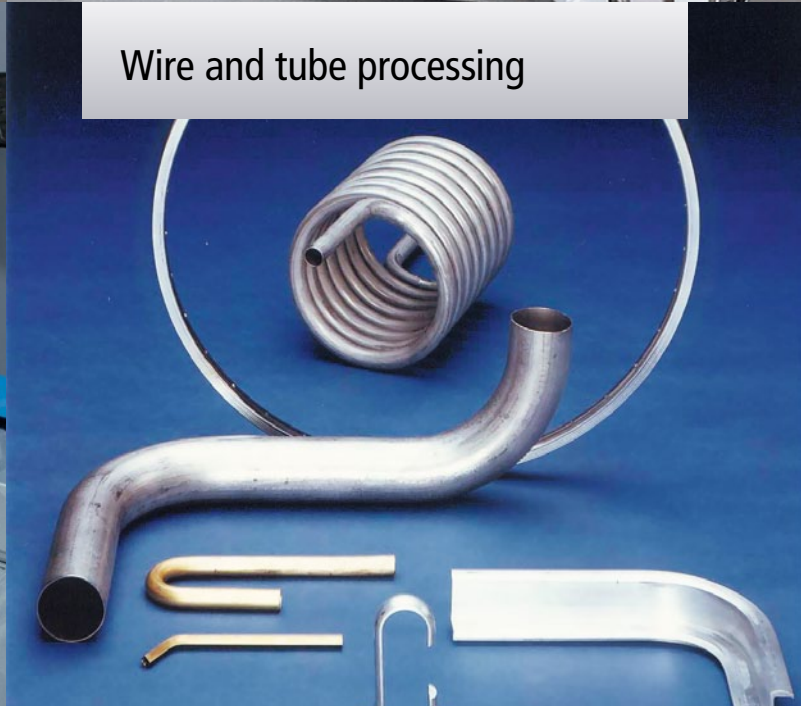
BECKHOFF New Automation Technology

Pressing

Cutting and welding

Punching and nibbling
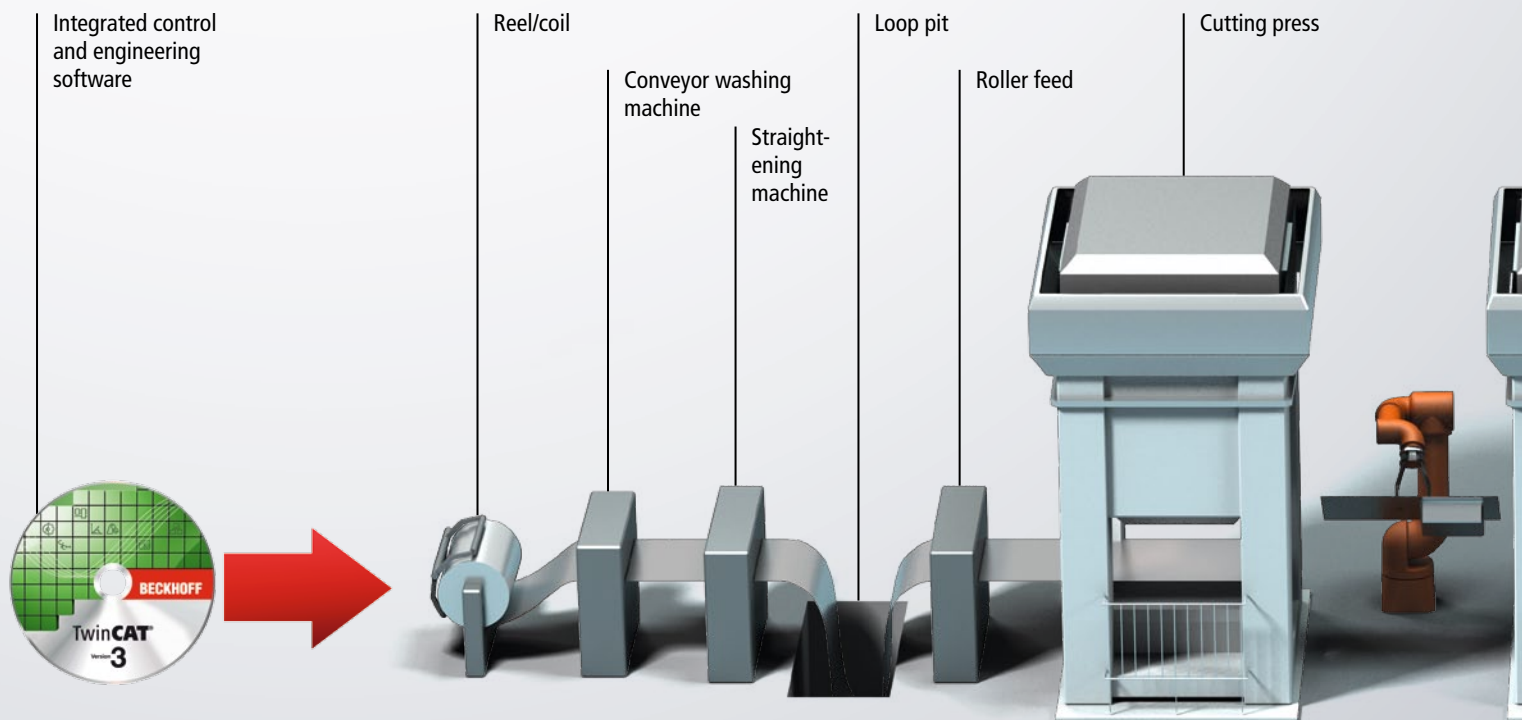
Prima
Power
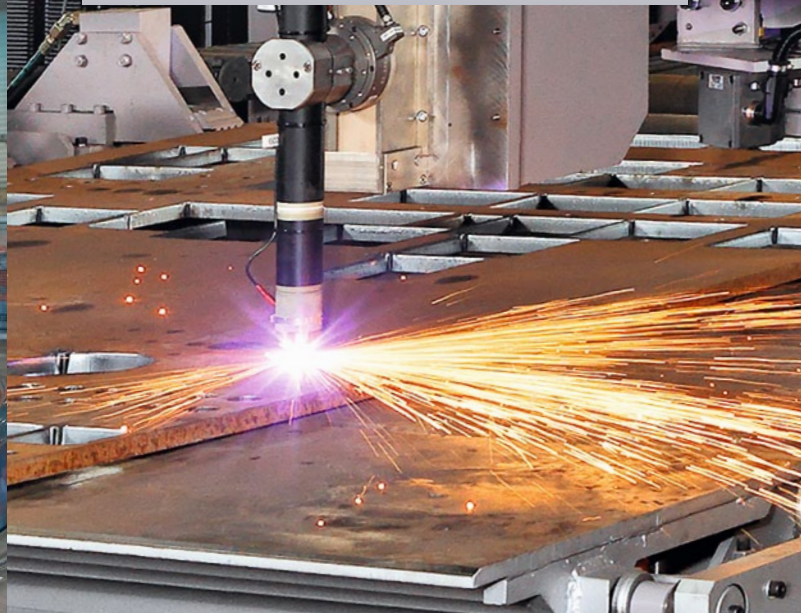
Wire and tube processing

… bundles all control tasks into one platform.

The production processes in metal forming are just as variable as the applications and uses of formed sheet metal products: a PC- and EtherCAT-based control platform spans numerous application areas, from presses to cutting and welding systems, and from punching and nibbling machines to wire and pipe processing. The universality of the PC Control solution and its high degree of integration ensure the efficient interaction of all components, as well as maximum transparency. Friction losses or latencies, such as those that occur in communication between different systems, are thus avoided. The user benefits not only from a higher degree of process synchronisation and optimisation, but also from cost advantages gained by reduced hardware and engineering requirements.

BECKHOFF New Automation Technology

Integrated control
and engineering
software

Reel/coil

Conveyor washing
machine

Straight-
ening
machine

Loop pit

Roller feed

Cutting press

Universal PC- and EtherCAT-based control …

The PC- and EtherCAT-based control platform is in use throughout press line automation: all processes can be automated with the universal hardware and software platform, from coil processing, belt straightening machines, cutting and punching plants and the actual press, through to the transfer facilities, and the feeding, loading, and unloading stations. I/O response times of less than 100 µs can be achieved with EtherCAT and eXtreme Fast Control (XFC) technology. The Distributed Clocks in the EtherCAT system enable all inputs and outputs to be synchronously read in and output with a precision of ~100 ns. All values can optionally be provided with time stamps for optimum system traceability and diagnostics.

Hydraulic die cushion   Press   Feeder systems   De-stacking
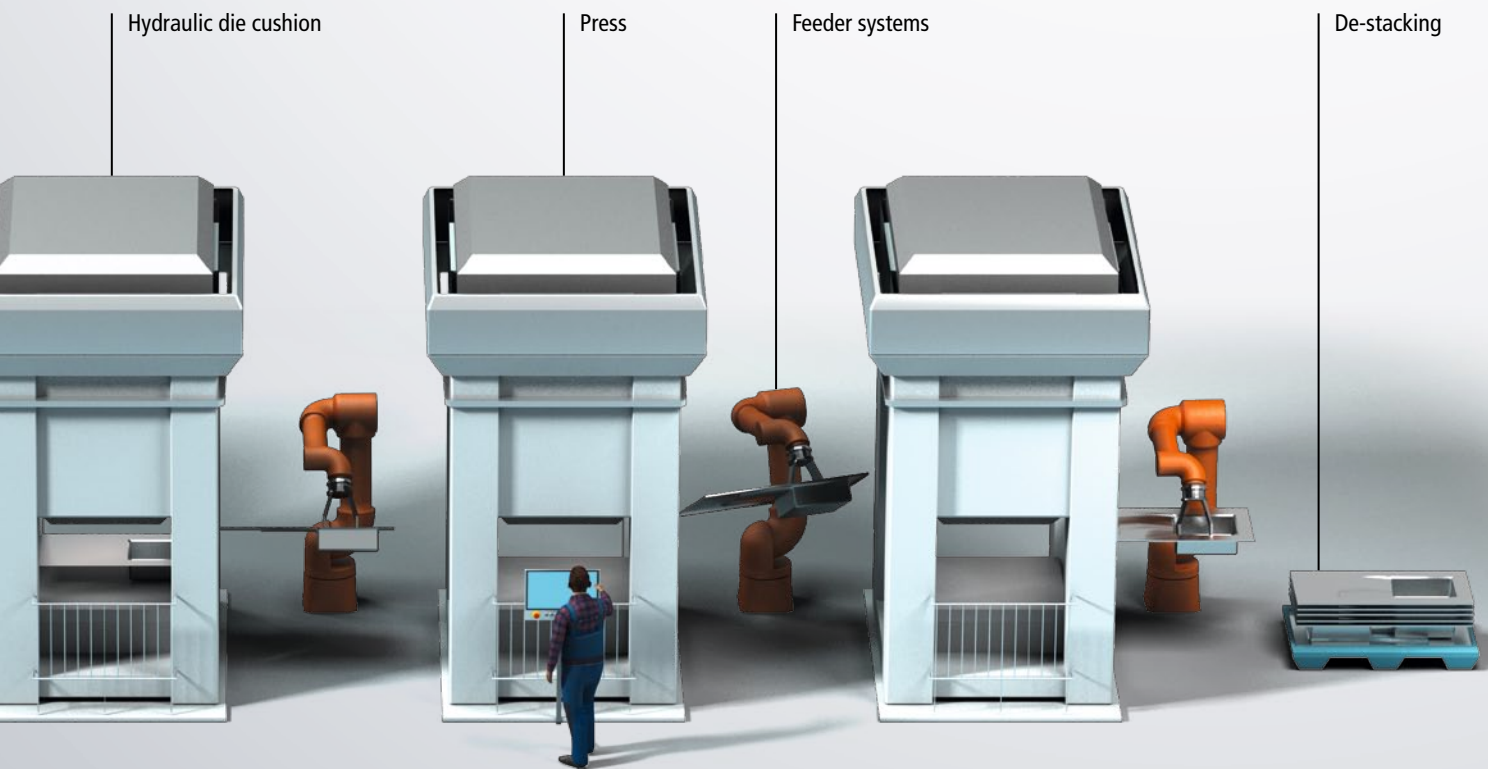
… enables maximised performance and accuracy.

A press controller must precisely coordinate all mechanical components. For example, to start the pre-acceleration of a die cushion with high precision and repeatability, the position and speed of the plunger must be detected exactly. EtherCAT enables, for example, sampling times of approximately 250 µs for a hydraulic die cushion controller, regardless of how many axes the die cushion encompasses. As a result, the machine runs faster and more precisely, effectively eliminating special regulator hardware. Time synchronisation via the Distributed Clocks functionality can be used locally on a controller or in a network of controllers in order, for example, to synchronise an entire production facility.

Pressing

Modular and scalable Beckhoff control technology is ideal for all press types, including hydraulic drawing and punch presses, and sintering or transfer presses, among others. Industrial PCs (IPCs) are available in the most diverse configurations and performance classes, equipped with state-of-the-art processor technology. Offering I/O systems for all common fieldbuses; TwinCAT, the automation software for PLC and Motion Control, servo drive technology; and TwinSAFE, the integrated safety system, solutions from Beckhoff cover all control requirements for a press line.

Ethernet

Multi-touch Control Panel, TwinCAT PLC, OPC

Industrial PC, TwinCAT PLC, NC

Industrial PC, TwinCAT PLC, NC

Industrial PC, TwinCAT PLC, NC

EtherCAT.

EtherCAT.

EtherCAT.

Industrial PC, TwinCAT PLC

Press

Light barrier

Line PC, visualisation, data server

Transfer, loader, de-stacker

Press (plunger axis, slide adjustment)

Hydraulic die cushion
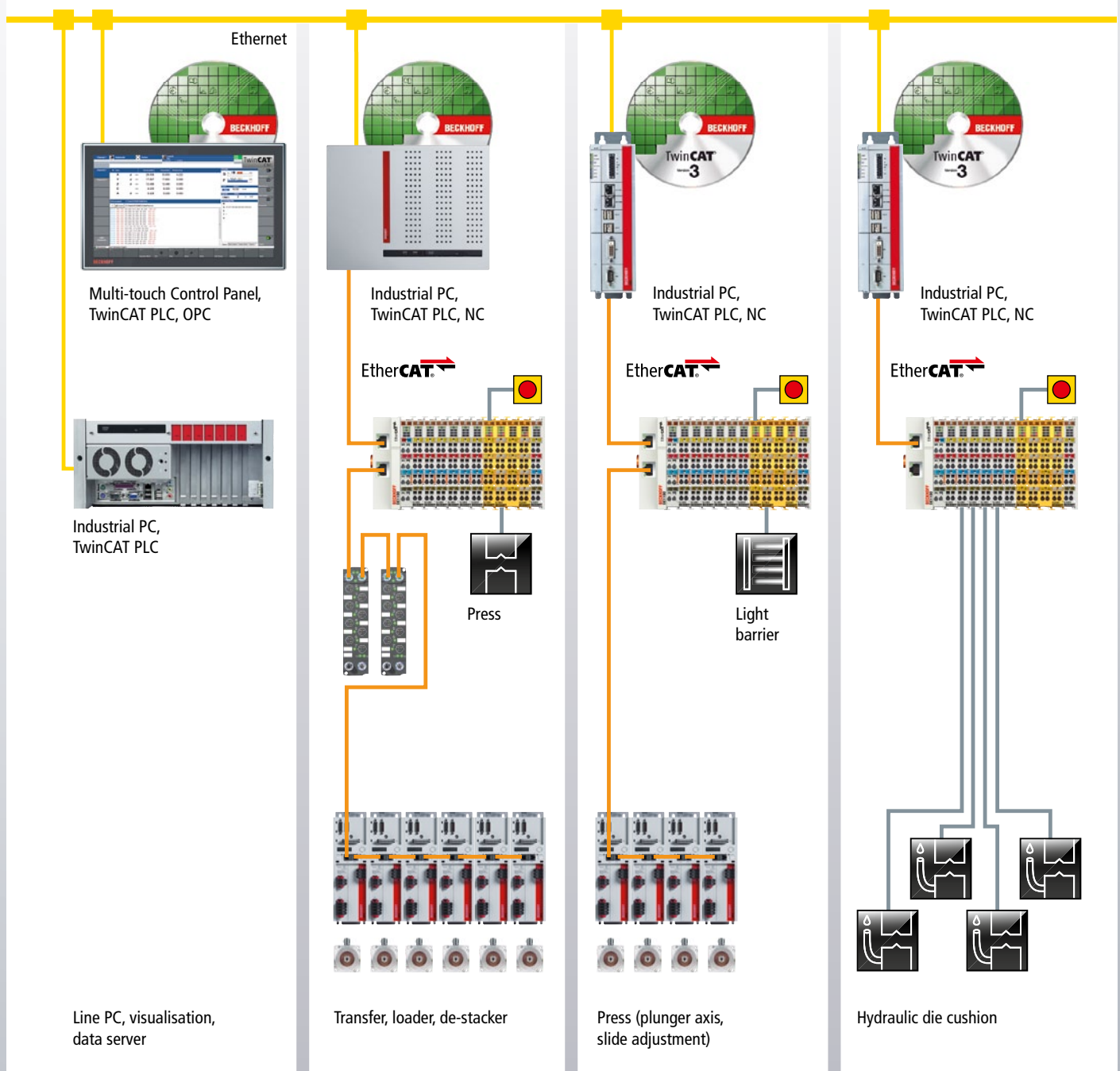
Cutting and welding

Beckhoff CNC controllers are widely used in autogenous, plasma, laser, and water jet applications for cutting and welding. The TwinCAT NC I and CNC automation software packages are ideally suited to support technology-specific functions such as adaptive jet control, reverse driving, or resetting on paths. In addition, EtherCAT and the XFC technology enable ultra-fast switching functions coupled with high machining speed.
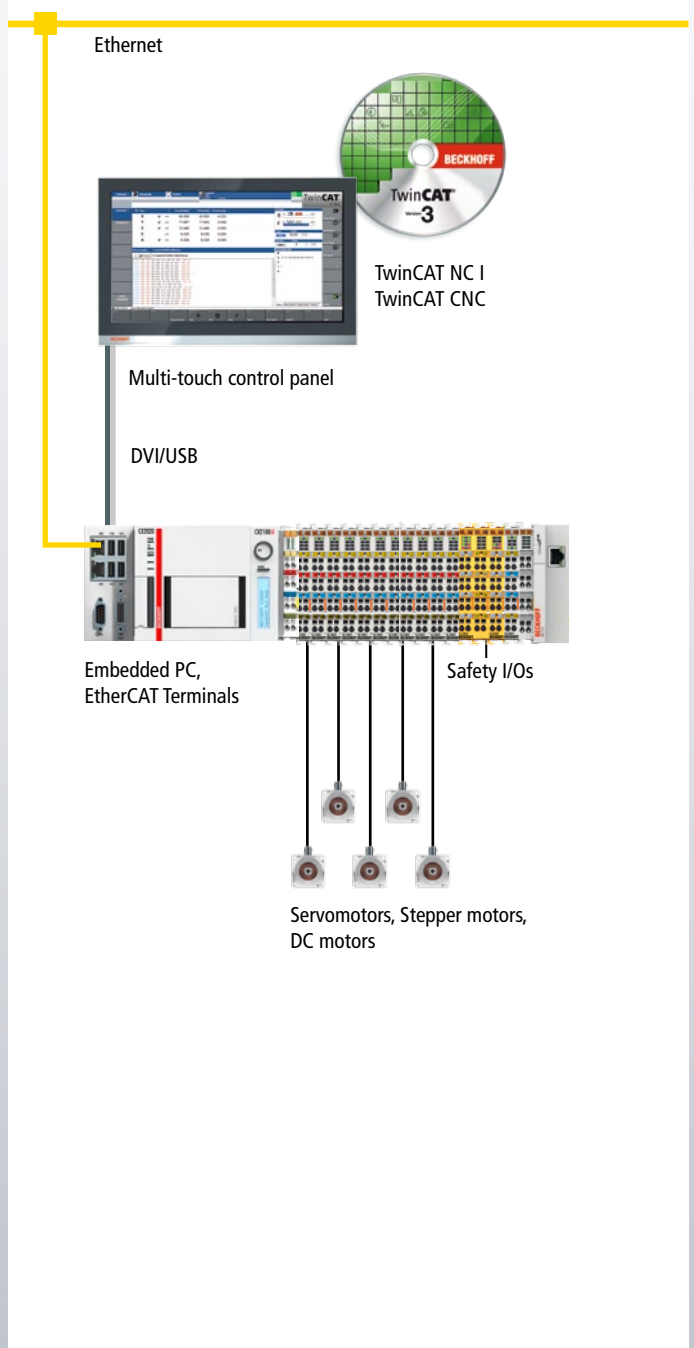
Ethernet

TwinCAT NC I
TwinCAT CNC

DVI/USB

Industrial PC   Control Panel

EtherCAT.

PROFIBUS
PROFINET

EtherCAT Coupler, EtherCAT Terminals   Safety I/Os
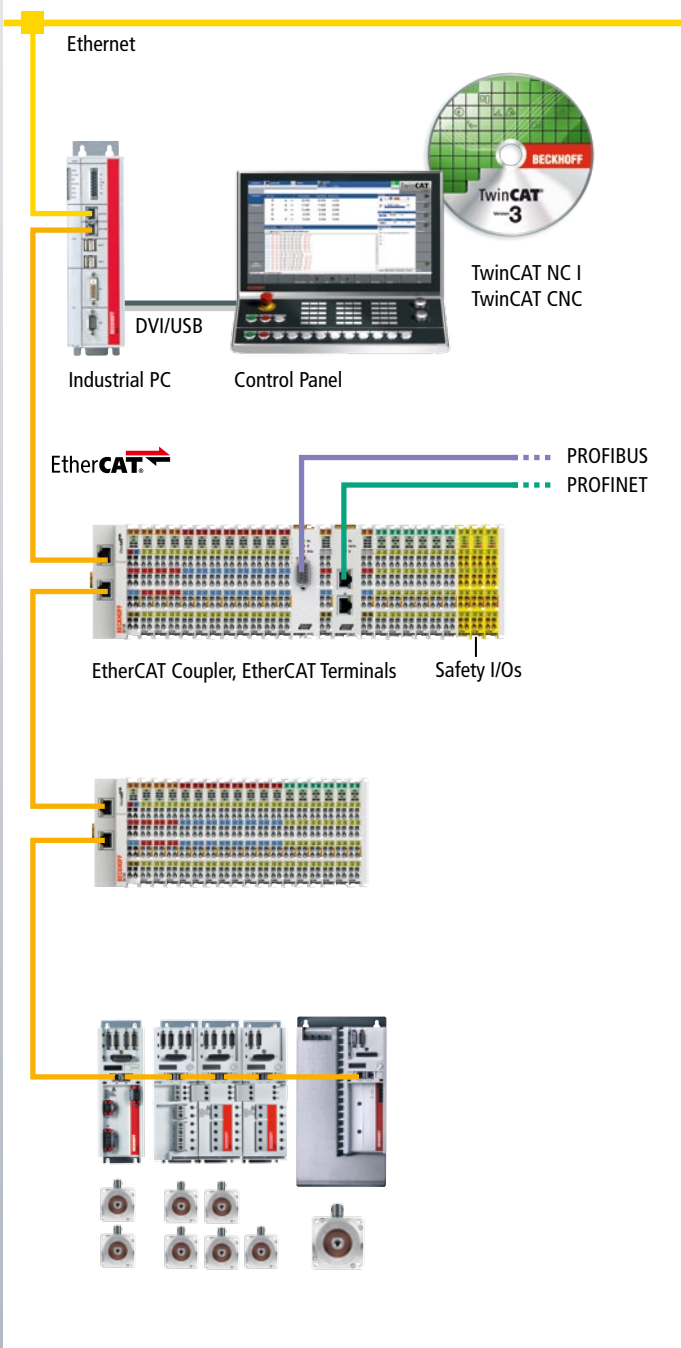
Punching and nibbling

Highly dynamic axis movements and fast control functions of punching and nibbling machines for sheet metal working can be implemented with the mid-size CNC solution from Beckhoff. Precisely programmable strokes, automatic tool changes, and the possibility to change the programming and settings on the machine without interrupting ongoing operations lead to significant increases in productivity.

Ethernet

TwinCAT NC I
TwinCAT CNC

Multi-touch control panel

DVI/USB

Embedded PC,
EtherCAT Terminals   Safety I/Os

Servomotors, Stepper motors,
DC motors

BECKHOFF New Automation Technology

TwinCAT, the universal control platform with multi-core support …

TwinCAT integrates programming, configuration, a real-time environment and all runtime modules necessary for machine and plant controllers: multi-PLC, motion and CNC, visualisation, safety technology, robotics, measuring technology, and Condition Monitoring. All control modules run in one runtime environment that can be executed on a scalable selection of available processors. Open communication interfaces support integration into existing visualisation, control and database systems. An extensive and modular range of software function blocks and libraries simplifies the implementation of even complex applications. With support for IEC 61131-3 (including object-oriented extensions), C/C++ and MATLAB®/Simulink®, TwinCAT delivers a wide variety programming tools for real-time applications.

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… provides a leap in efficiency, even during the engineering phase.

Through multi-core support in TwinCAT, additional control hardware can be replaced by one dynamic software solution. Apart from reducing hardware costs, this also results in a significant reduction in the development and commissioning time of machines, while also reducing training costs. Comprehensive TwinCAT libraries with preconfigured control algorithms, such as cam and hydraulic controls, as well as "flying saw" and "cam plates", simplify programming. In particular, the possibility to use master and slave axes in almost any architecture solves many industry-specific challenges in a simple manner. Moreover, the integration of the TwinCAT engineering into Microsoft Visual Studio® provides developers with the ideal infrastructure for generating reusable software modules.

Hydraulics library

The TwinCAT hydraulics library is the ideal platform for PC-based hydraulic control technology and makes special hardware assemblies a thing of the past. PLCopen-compliant software blocks for the positioning, control, and monitoring of hydraulic drives enable fast implementation in a standardised control architecture. Practice-proven function blocks are available for common tasks, such as characteristic curve linearisation and smooth pressure control switching. The system also supports hybrid concepts containing a mixture of hydraulic and servo-electric drive axes.

PC-based control, the complete solution for CNC machining …

TwinCAT NC I and TwinCAT CNC cover the entire range of traditional CNC path controllers, up to high-end systems for complex motion and kinetic requirements, with a comprehensive software solution. Through support for multi-core processing and 64-bit operating systems, TwinCAT 3 opens up new performance capacities that can be put to work for high-precision control of high-speed laser cutting machines, for example. A wide range of Beckhoff multi-touch panels in different display sizes and formats meets all requirements for advanced HMI concepts. The .NET-based CNC user interface covers, as standard, basic functions such as on-line language changeover, setup functions, global message systems, and user management. Application-specific parameterisation and expandability facilitates the flexible and fast implementation of unique customer requirements.
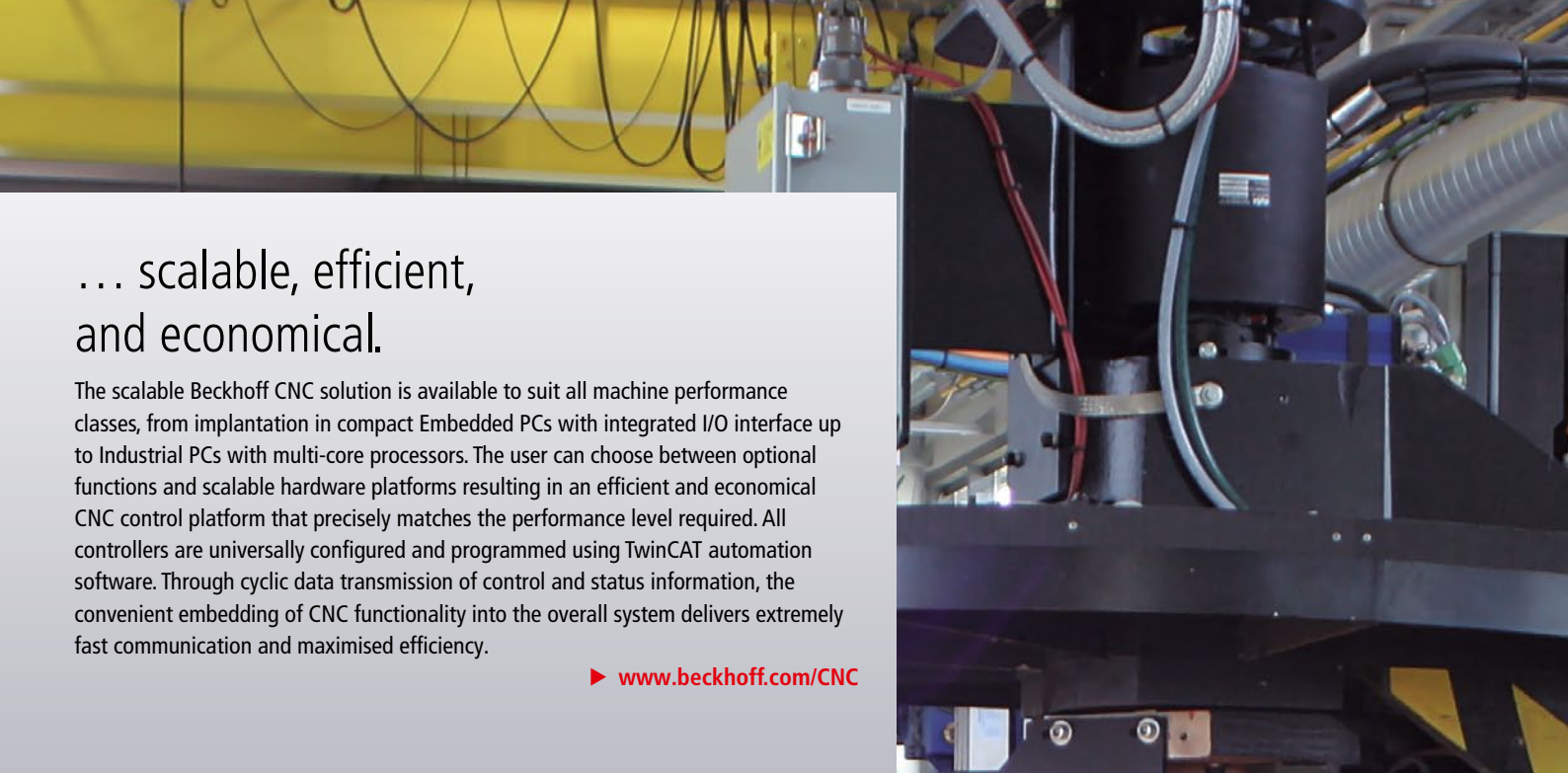
Control Panels for sheet metal working with innovative multi-touch operating technology
Display sizes from 7 to 24 inches are available. With a wide range of display formats, connection technologies and processor performance the multi-touch panel portfolio offers users maximum versatility and flexibility to meet their individual requirements.

CNC push-button extension
A push-button extension that is optimised for CNC applications is available for simple and convenient machine operation.

… scalable, efficient, and economical.

The scalable Beckhoff CNC solution is available to suit all machine performance classes, from implantation in compact Embedded PCs with integrated I/O interface up to Industrial PCs with multi-core processors. The user can choose between optional functions and scalable hardware platforms resulting in an efficient and economical CNC control platform that precisely matches the performance level required. All controllers are universally configured and programmed using TwinCAT automation software. Through cyclic data transmission of control and status information, the convenient embedding of CNC functionality into the overall system delivers extremely fast communication and maximised efficiency.

▶ **www.beckhoff.com/CNC**

© Messer Cutting Systems GmbH

Cloud

Internet   Service PC

MES/ERP

Ethernet

EAP (EtherCAT Automation Protocol)

Industrial PC

Embedded PC (data capture)

EtherCAT Terminals (IP 20)

TwinSAFE Compact Controller

TwinSAFE
Terminals   PROFINET

PROFIBUS   CANopen   EtherCAT Box Modules (IP 67)
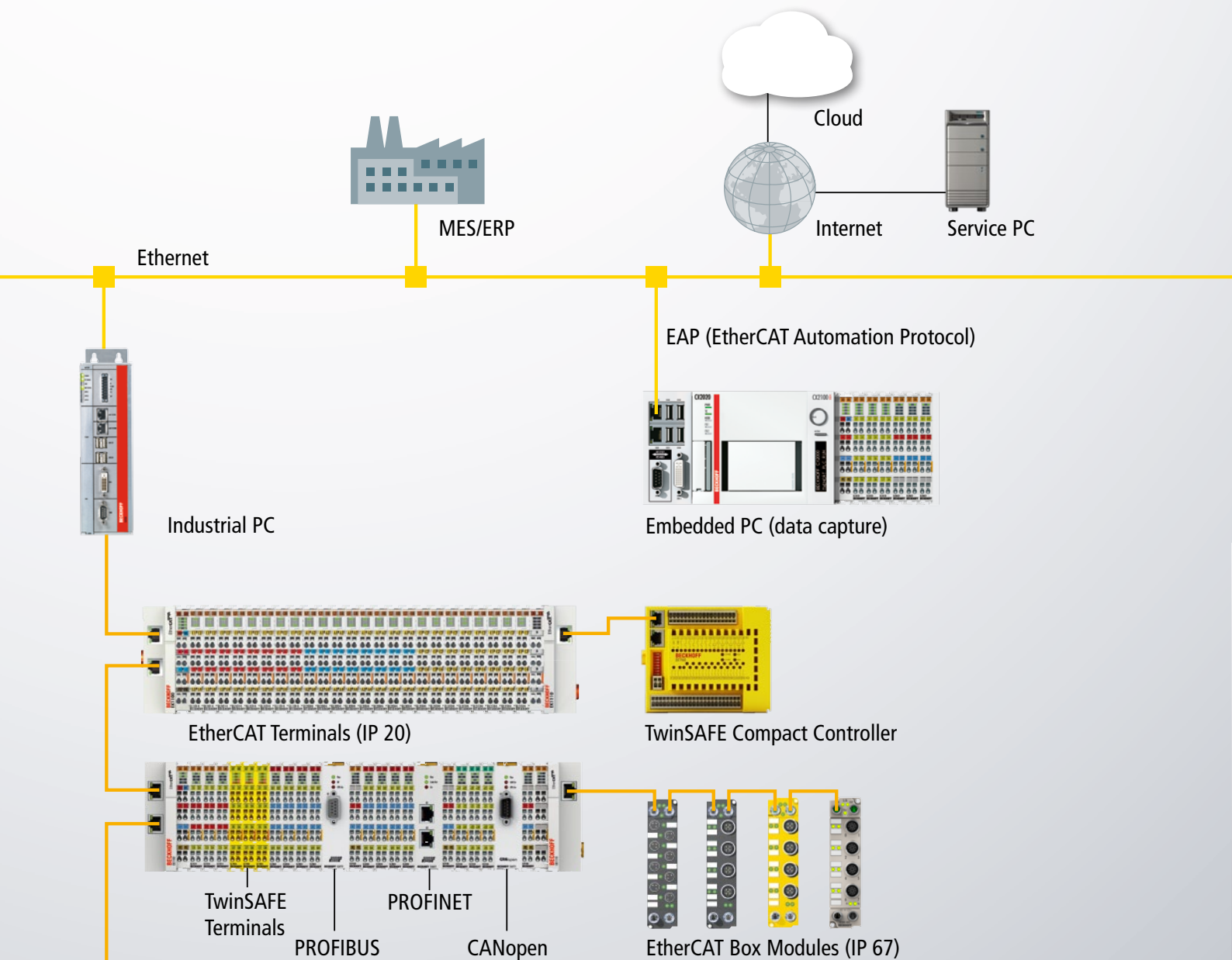
EtherCAT®

EtherCAT, the communication standard in metal forming …

EtherCAT as the real-time Ethernet solution for industrial automation, is characterised by outstanding performance, almost unrestricted network expansion, flexible topologies, and simple handling. All necessary process signals can be transmitted easily and inexpensively into the controller via the comprehensive Beckhoff I/O system, available in protection class IP 20 or IP 67. These solutions cover a wide range of application areas, from standard I/Os and safety functionalities to highly precise measuring terminals. Since the EtherCAT protocol remains fully intact right into each EtherCAT device, lower-level bus systems can be eliminated, resulting in extremely short response times. As an option, further fieldbus systems can be integrated via gateways in the form of master/slave terminals. Safety data transmission is ensured with the Safety over EtherCAT protocol, which is designed for applications up to SIL 3 of IEC 61508.

EtherCAT drives
(optionally with TwinSAFE
functionality)

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… increases precision and reduces cycle times.

EtherCAT increases the speed of punching, embossing, bending, and laser etching. Due to the Distributed Clock functionality with time stamps, actuators can be switched with an exactly defined rate time and a precision of better than 100 ns. Oversampling terminals that capture analog values with a resolution of 10 µs per measured value enable the precise determination of signal curves, as is required in welding seam monitoring, for example. Reduced cycle times, oversampling, and time stamps permit press repeatability and parallelism accuracy of ±0.01 mm with press brakes. Force curves can thus be set more exactly, reducing delays and tolerances. Motion control applications with many axes can also be synchronised exactly and with high repeatability via the EtherCAT Distributed Clocks.

TwinSAFE, the integrated safety solution

With TwinSAFE I/O modules, safety technology can be seamlessly integrated into the overall I/O system, where the safe signals can be mixed with standard signals as needed. This reduces expenses for project engineering, installation, and materials. Maintenance is also simplified through faster diagnostics and a reduced number of components. Typical safety functions such as emergency stop, safety door, and two-handed control, are pre-programmed, for example, in the EL6900 TwinSAFE Terminal and configured with TwinCAT to meet the individual safety requirements of each application.

BECKHOFF New Automation Technology

Servo Drives from 0.2 to 120 KW
Servomotors from 0.2 to 180 Nm

Highly dynamic,
scalable drive technology solutions …

In combination with the feature-filled Motion Control solutions in TwinCAT automation software, Beckhoff Drive Technology offers a complete system of finely scalable components in terms of performance, form, and function. The AX5000 Servo Drive series with EtherCAT system communication delivers high-end performance and dynamics. With rated currents of up to 170 A and integrated control technology with up to 62.5 µs current control cycles, these drives are ideal for fast and highly dynamic positioning tasks. The servo terminals for stepper or DC motors represent a cost-efficient alternative in the lower power range, implemented in a space-saving I/O terminal format. The AM8000 servomotor series offers additional savings with the One Cable Technology (OCT) option. With OCT, power and feedback system are combined into a standard cable, reducing hardware and commissioning costs.
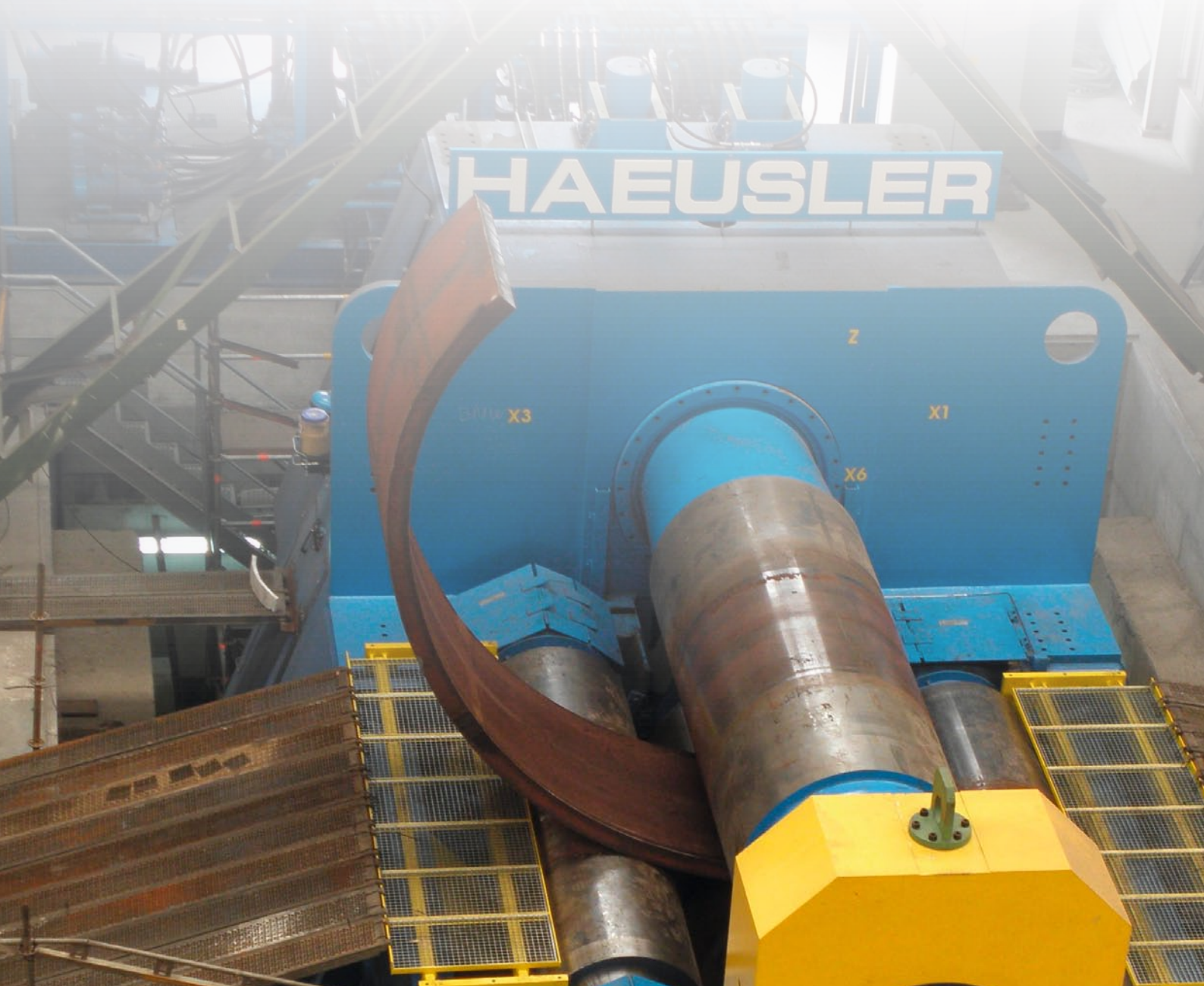
… exceed all requirements in sheet metal processing and metal forming.

The drive system from Beckhoff covers the entire range of requirements in sheet metal processing and metal forming. As a powerful bus system, EtherCAT enables the ideal integration of drive technology with the PC-based control platform. With support for further communication systems such as Ethernet, PROFIBUS, CANopen, DeviceNet, SERCOS interface or Lightbus, drives with alternative interfaces can also be used. The use of EtherCAT as a bus for I/O and drive technology positively affects the total lifecycle of a machine, from uniform engineering and simple commissioning to diagnostic functions for service and support efforts.

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Beckhoff – Worldwide presence on all continents

The worldwide presence of Beckhoff in over 60 countries is maintained by 33 subsidiaries as well as numerous distributors. The company is represented in all major industrial centres and guarantees fast on-site service and support in the respective national language for globally operating customers. Solid industry expertise in metal forming and sheet metal working position Beckhoff as a partner with in-depth knowledge of customers' technical challenges. A creative corporate culture, enthusiasm for technology, and profound technical expertise are upheld by Beckhoff and its sales partners around the world.

▶ **www.beckhoff.com**

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Auckland

■ Headquarters   ■ Headquarters distributor
● Subsidiary   ● Subsidiary distributor

Beckhoff at a glance

- Headquarters: Verl, Germany
- Turnover 2013: 435 million euros (+7 %)
- Staff worldwide: 2,510
- Subsidiaries/branch offices in Germany: 11
- Subsidiaries/branch offices worldwide: 33
- Distributors in over 60 countries

(April 2014)

Further information

- For more information and industry solutions, visit:
  ▶ **www.beckhoff.com/forming**

- To download Beckhoff catalogues and brochures, go to:
  ▶ **www.beckhoff.com/media**

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