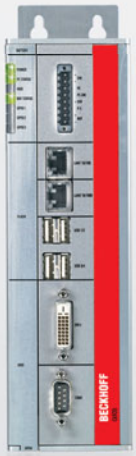
BECKHOFF New Automation Technology

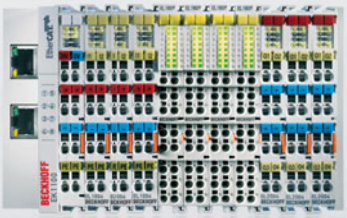
PC-based Control for Forming Technology/Sheet Metal Working

IPC
I/O
Motion
Automation

Picture: Schuler AG



IPC



I/O

Motion

Automation

Beckhoff technological expertise …

PC-based control technology from Beckhoff has been successfully proven in a wide range of industries and applications for over 30 years. The globally operative company, with headquarters and production facilities located in Verl, Germany, employs over 2100 people worldwide*. With 30 subsidiary companies* as well as distributors, Beckhoff is represented in over 60 countries.

The Beckhoff brand stands for innovative strength and technological progress in automation and Drive Technology. Continuous economic growth, ground-breaking product development, large production capacities as well as the use of international standards guarantee the user long-term availability and reliable deliveries. Mature, yet high performance technologies, robust industry-proven components and over 20 years of know-how in metal forming make Beckhoff a reliable partner with considerable problem-solving expertise and worldwide customer service and support.

* (as of 03/2012)

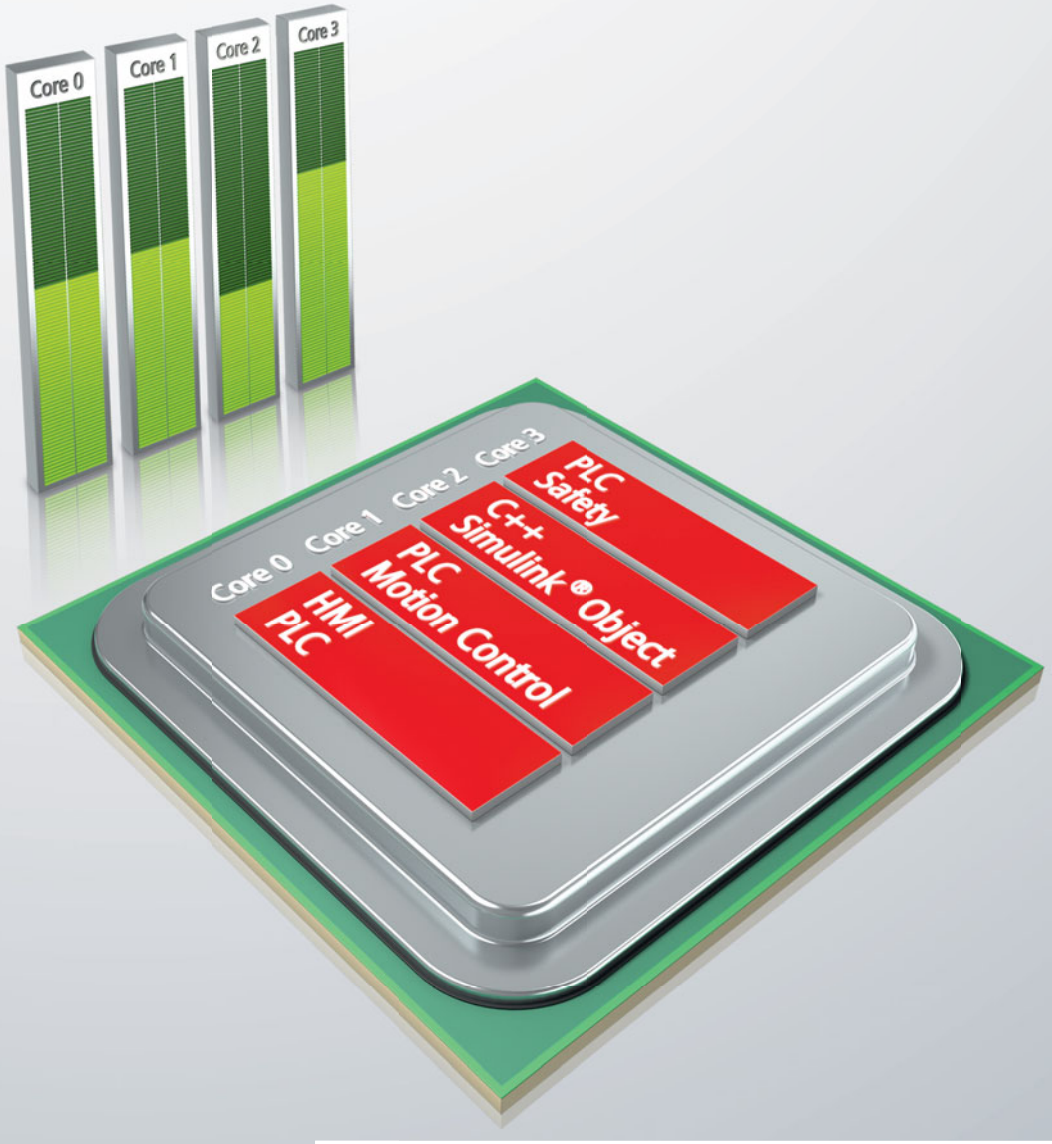
We reserve the right to make technical changes.

… increases the efficiency and quality of sheet metal working.

The processes for producing sheet metal parts are just as varied as their dimensions and areas of use: beginning with rolling and cutting, followed by embossing, folding, drawing, pressing and joining, through to cleaning and surface refinement. High-profile references in the fields of metal forming and sheet metal working confirm that PC- and EtherCAT-based control from Beckhoff increases the control quality and thus the speed and precision of machines and production processes. Since the automation controller, regulation, Motion Control and HMI can all be executed on a single Industrial PC (IPC), expensive special hardware and additional CPUs can be eliminated. The modularity and openness of the PC-based control platform offer the machine manufacturer the necessary flexibility to successfully implement customer requests simply and cost-effectively.

▶ **www.beckhoff.com/forming**

Picture: Schuler AG



The integrated Beckhoff approach: One powerful control platform …

Modern high-performance processor architectures, the fast EtherCAT communication system as well as TwinCAT, the universal automation software, constitute the basis of the leading edge control concept Beckhoff introduced to the market under the name of "Scientific Automation." Taking full advantage of processor performance and multi-core support in modern computers, Scientific Automation enables the execution of safety technology, measurement functions and robotics on one centralised control platform along with the automation controller, regulator, visualisation and Motion Control. The goal is to integrate specialised "black box" functions such as those from deep-drawing controllers into a standard software environment. TwinCAT 3, the Beckhoff automation software platform with multi-core support, forms a standard platform for configuration, programming and diagnostics in a universal engineering environment.

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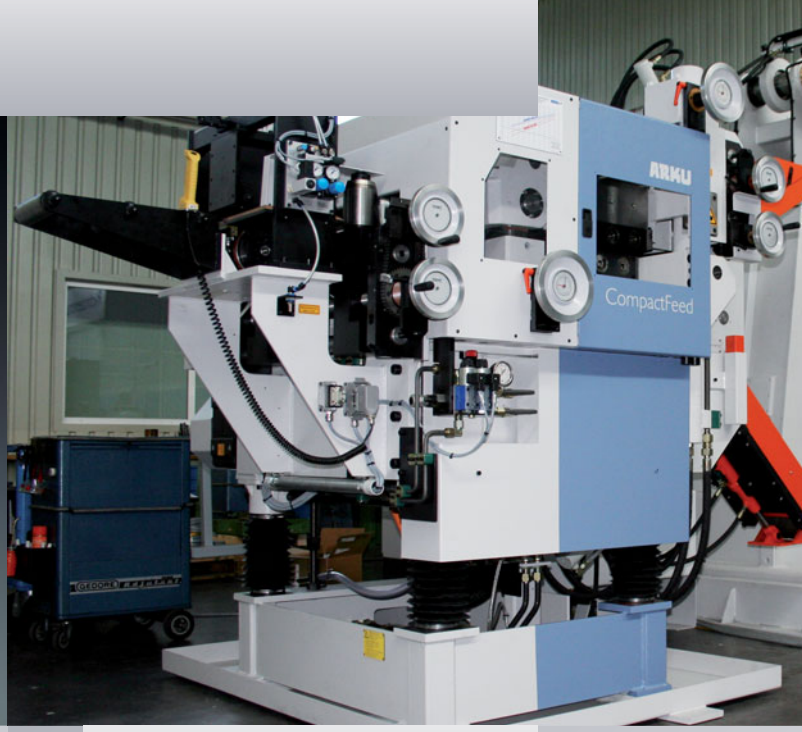
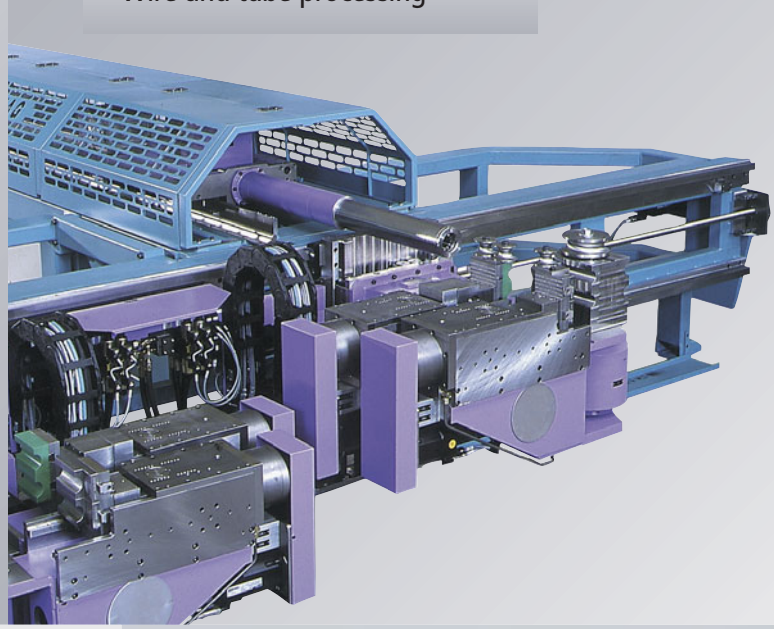
Presses

Picture: Schuler AG



Fast-running punches

Wire and tube processing



… reduces hardware costs and engineering time.

The universality of the PC- and EtherCAT-based control solution and its high degree of integration ensures the efficient interaction of all components and maximum transparency. Even with complicated control algorithms, the IPC provides ample performance for further functions such as measuring tasks. As a result, Beckhoff automation platforms can now be found not only in the presses themselves, but also in the entire periphery of a press line, from coil processing to stacking. Thanks to multi-core support in TwinCAT 3, additional control hardware such as external hydraulic regulators can be replaced by the central IPC.

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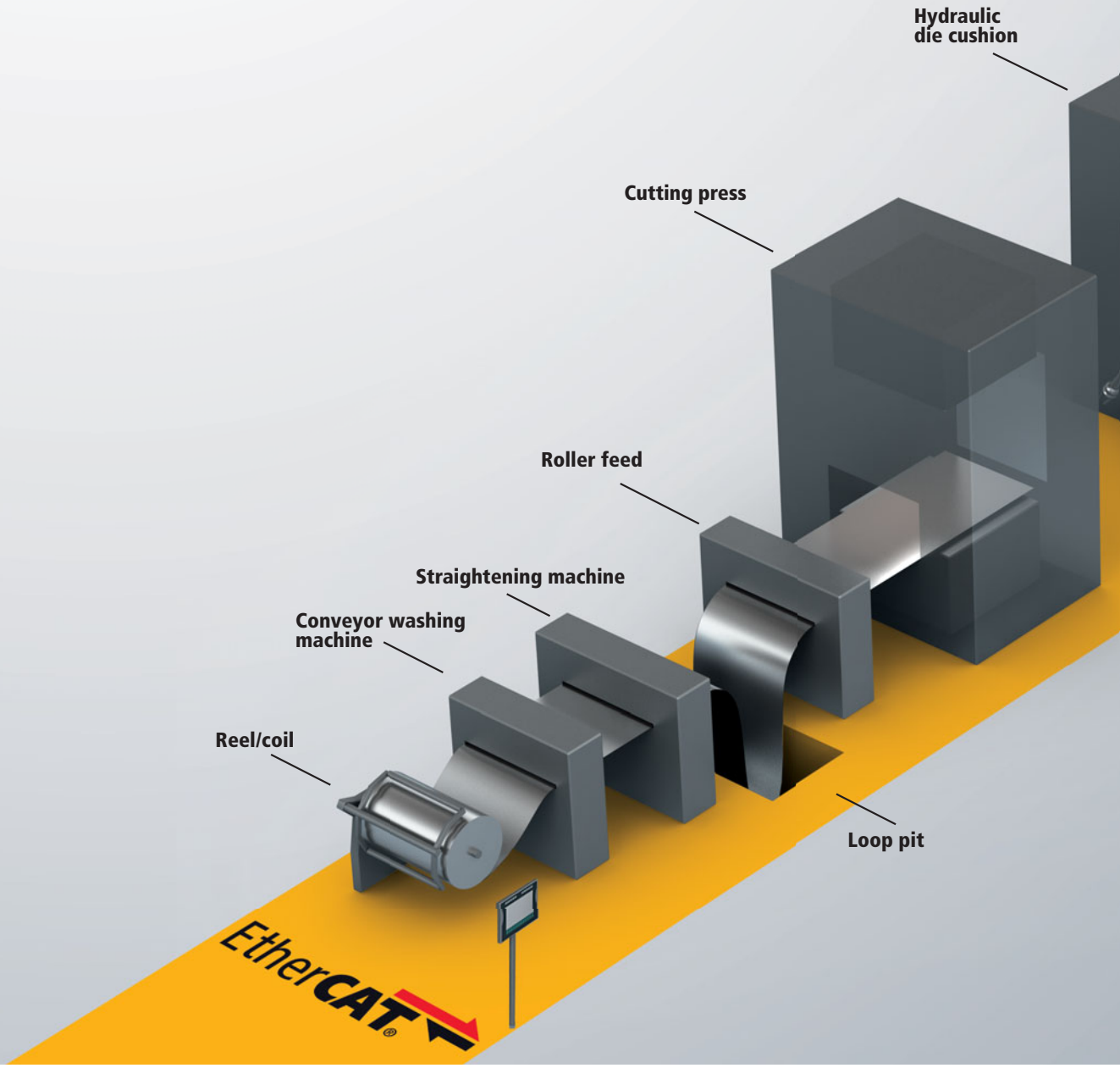

EtherCAT communication …

PC- and EtherCAT-based control technology from Beckhoff can play fully to its strengths in the automation of press lines: all processes can be automated with a universal hardware and software platform, from the coil processing, the belt straightening machine, the cutting and punching equipment and the actual press, through to the transfer facilities and the feeding, loading and unloading station. Implementation of EtherCAT, the fast real-time Ethernet technology from Beckhoff, leads to a significant improvement in reaction times compared with traditional fieldbus systems: Reaction times of less than 100 µs can be achieved with eXtreme Fast Control (XFC), an advanced Beckhoff solution enabled by EtherCAT. Distributed clocks in the EtherCAT system enable all inputs and outputs to be read in and output synchronously with a precision of ~100 ns. All values can optionally be provided with time stamps.

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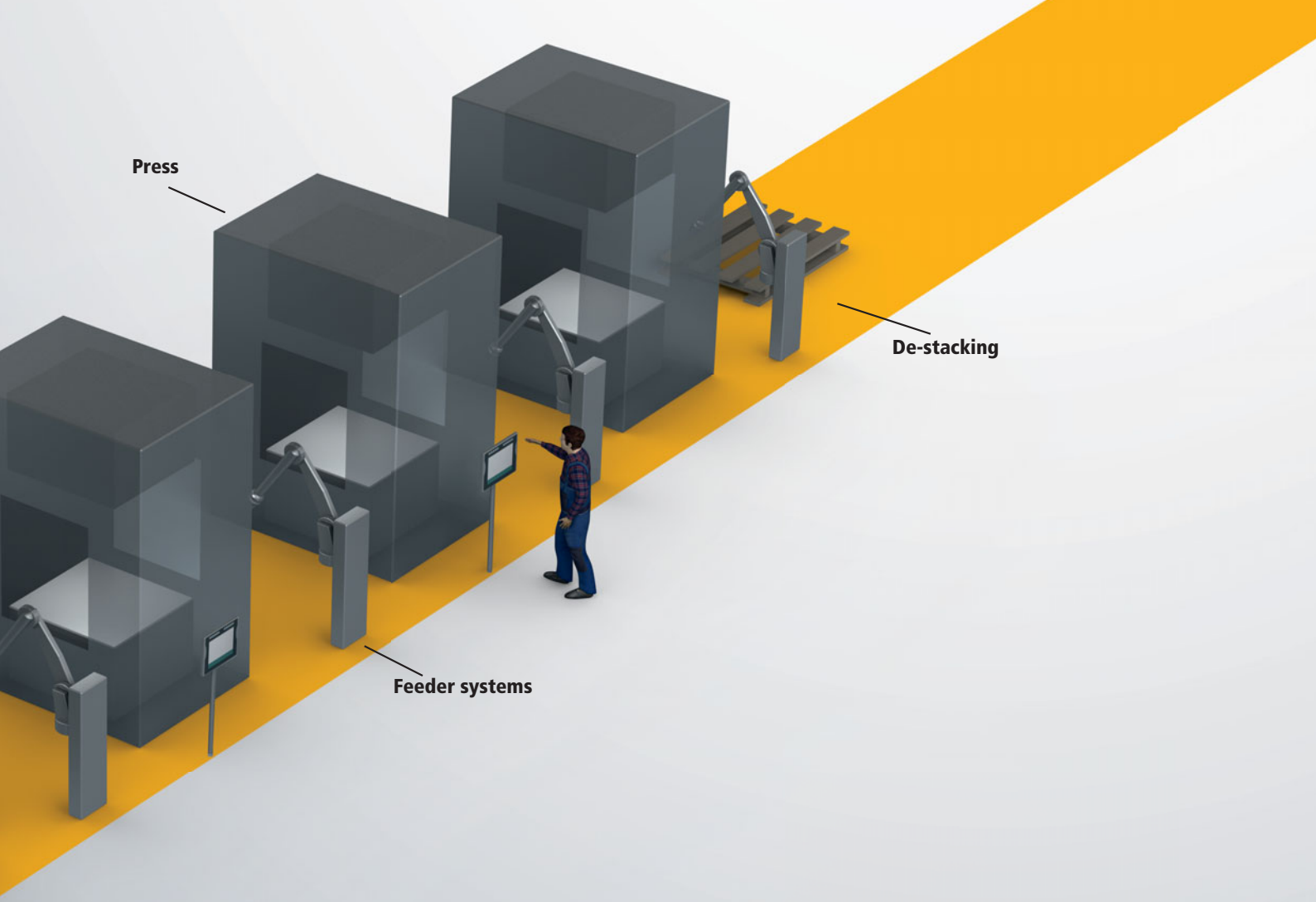

… ensures maximum performance and accuracy.

A press controller must precisely coordinate all of the mechanical components involved: in order, for example, to start the pre-acceleration of the die cushion precisely and reproducibly, the position and speed of the plunger must be detected exactly. The sampling times of a hydraulic die cushion controller are, for example, around 250 µs, independent of how many axes the die cushion encompasses. As a result, the machine runs faster and more precisely and special regulator hardware is eliminated. Time synchronisation via the distributed clocks of the EtherCAT system can be used locally on a controller. With the EL6692 bridge terminal, however, it can also be used in a network of controllers in order, for example, to synchronise an entire production facility. The universality of the PC- and EtherCAT-based controller not only reduces the hardware costs and the expenditures for engineering and wiring; maintenance and stock keeping are also simplified.

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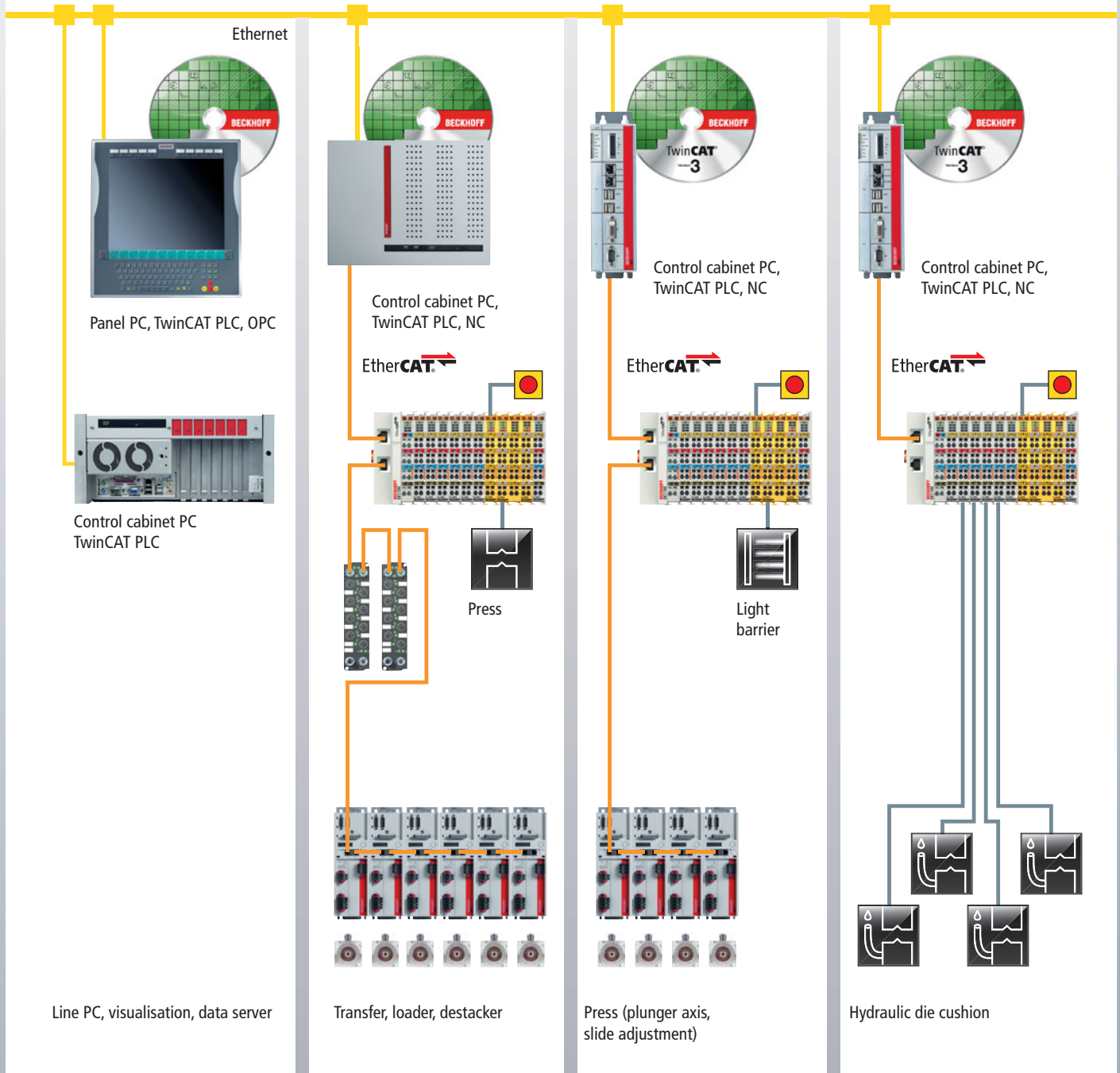
Pressing

Beckhoff offers a modular and scalable control technology for all press types, such as hydraulic drawing and punch presses, sintering or transfer presses. Industrial PCs are available in the most diverse designs and performance categories, equipped with state-of-the-art processor technology. I/O systems for all major fieldbuses, TwinCAT (the automation software for PLC and Motion Control), Servo Drive technology and TwinSAFE (the integrated safety solution), cover every control requirement for a press line.



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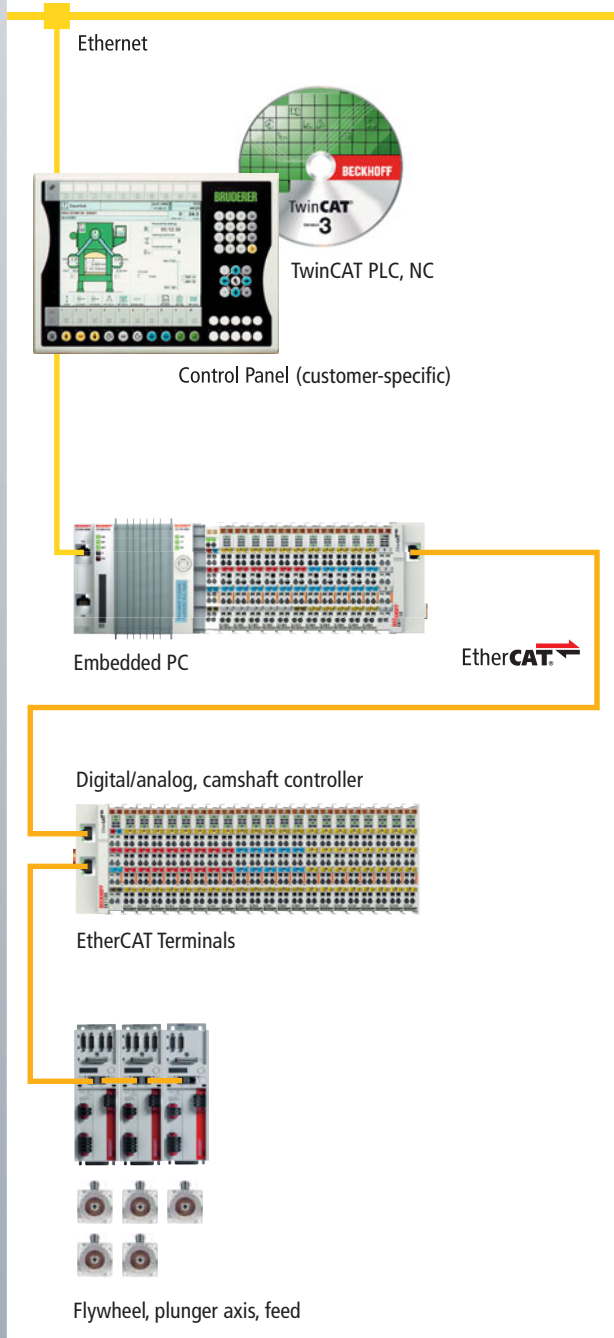
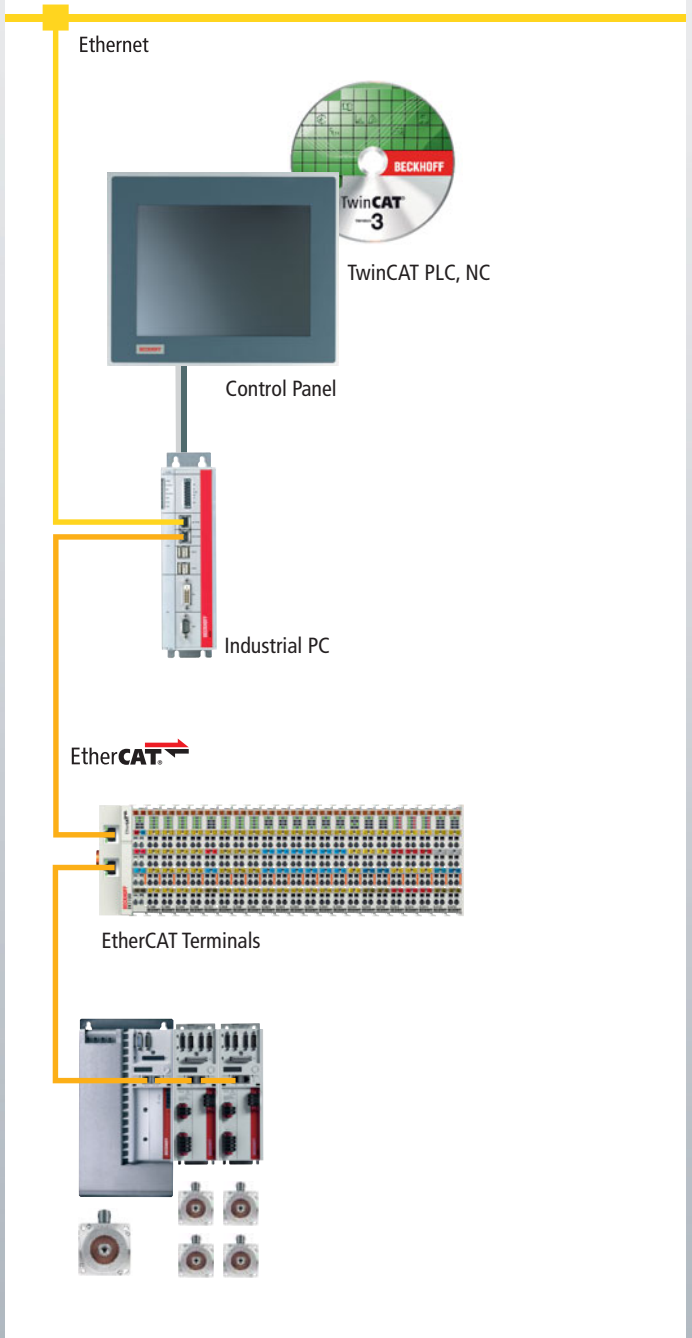
Punching

Beckhoff PC-based control enables high-speed punching at up to 2000 strokes/minute. The adjustment of the plunger axis takes place manually or fully automatically while the process is running. Special functions such as cam controllers are realised using software libraries. Defined procedures assist the machine operator when retooling. No additional hardware components are required, since all functions are integrated by the central and universal PC control platform.



Wire and tube processing

The scalable performance control concept from Beckhoff offers maximum flexibility in configuration: from a bending centre for small parts up to the pipe bending machine, which forms sheet metals of up to 240 mm in thickness. Short retooling times ensure high productivity of the machines. The uniform basis is formed by TwinCAT, EtherCAT and the Drive Technology.



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Industrial PC

Embedded PC

Embedded Controller

Automation and engineering software

Modular and scalable control technology from Beckhoff …

The complete Beckhoff control system is scaled in relation to performance: from compact Embedded PCs with integrated I/O interface to high-end Industrial PCs with multi-core processors, PCI card slots, RAID controller, etc. A wide range of Control Panels in various designs and formats, equipped with state-of-the-art technology such as the multi-touch operating concept, covers all requirements with regard to operation and monitoring. Where I/O components are concerned, Beckhoff offers a large signal variety and fine granularity. Scalable solutions are also available for I/O and Motion Control applications for safety technology. The range of products for Drive Technology extends from servo and stepper motor connection in the I/O terminal through to high-power EtherCAT drive amplifiers and the associated motors. The range of Beckhoff solutions is rounded off by the TwinCAT automation software with extensive software libraries.

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… guarantees performance-optimised controller designs.

With a control solution that is scalable with regard to computing power, performance, complexity and costs, Beckhoff meets the multifaceted requirements in metal forming and sheet metal processing: as if from an automation toolkit, the user can assemble a control solution to suit their machine type and dimension it in accordance with their performance requirements. There is also flexibility in the choice of central or local control architectures. The TwinCAT automation software, supplemented by the appropriate libraries, is used from the smallest to the largest controller as a universal tool for configuration and programming. This simplifies operation and reduces training needs. The modularity of the Beckhoff solution also enables future extensions and modifications of presses or press lines to be realised smoothly and without great expense.

▶ www.beckhoff.com/forming

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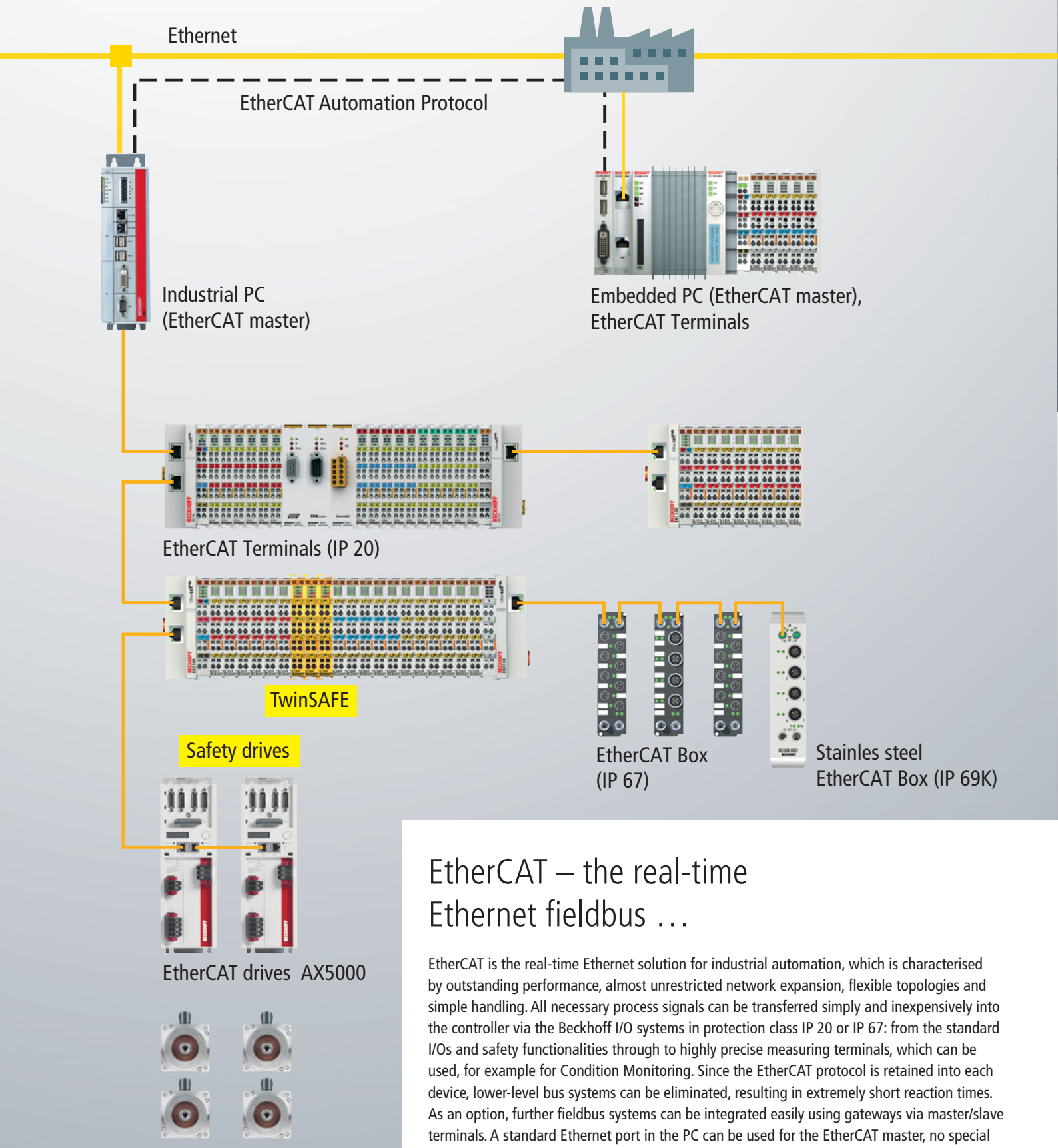

EtherCAT – the real-time Ethernet fieldbus …

EtherCAT is the real-time Ethernet solution for industrial automation, which is characterised by outstanding performance, almost unrestricted network expansion, flexible topologies and simple handling. All necessary process signals can be transferred simply and inexpensively into the controller via the Beckhoff I/O systems in protection class IP 20 or IP 67: from the standard I/Os and safety functionalities through to highly precise measuring terminals, which can be used, for example for Condition Monitoring. Since the EtherCAT protocol is retained into each device, lower-level bus systems can be eliminated, resulting in extremely short reaction times. As an option, further fieldbus systems can be integrated easily using gateways via master/slave terminals. A standard Ethernet port in the PC can be used for the EtherCAT master, no special hardware is needed. Safe transmission of data can be achieved with the Safety over EtherCAT protocol up to SIL 3 of IEC 61508.

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… increases precision and reduces cycle times.

EtherCAT permits higher speeds when punching, embossing or laser etching. Due to the distributed clock functionality with time stamps, actuators are switched with an exactly defined time rate and a precision of < 100 ns. As a result, the machine runs faster and more precisely. With oversampling terminals that record analog values with a resolution of 10 µs per measured value, signal processes can be determined precisely and accurately, as is required in welding seam monitoring, for example. Reduced cycle times, oversampling and time stamps permit a press repeatability and parallelism accuracy of ±0.01 mm with press brakes. Force curves can be set more exactly, thereby reducing delays and tolerances. Motion Control applications with many axes can also be synchronised exactly and with high repeatability via the EtherCAT distributed clocks.

Picture: Schuler AG

TwinSAFE

With TwinSAFE I/O modules, advanced safety technology is integrated seamlessly into the terminal node, wherein the safe signals can be arbitrarily mixed with the standard signals. This reduces expenditures for project engineering, installation and material. Maintenance is also simplified with faster diagnostics and fewer components to manage. Typical safety functions such as emergency stop, safety door, two-handed control, etc. are pre-programmed in the EL6900 TwinSAFE Terminal and configured in TwinCAT in accordance with the safety requirements for the respective application. The EL6900 is suitable for applications up to SIL 3 according to IEC 61508 or Performance Level e of ISO 13849-1.

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Beckhoff Drive Technology offers solutions …

In combination with the Motion Control solutions offered by TwinCAT automation software, Beckhoff Drive Technology represents a complete system of components that are precisely scaled according to performance. The AX5000 Servo Drive series with EtherCAT system communication delivers maximum performance and dynamics. With rated currents up to 170 A and integrated control technology, with up to 62.5 µs current control cycle, these drives are ideal for fast and highly-dynamic positioning tasks. The AM8000 motor series, which is precisely matched to the AX series, offers servomotors with One Cable Technology, i.e. power and feedback system are combined in a standard cable. Beckhoff I/O terminals that can control small servo, stepper or DC motors in a compact terminal block format represent an inexpensive alternative to the servo technology in the lower power range.

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… for the demanding requirements in sheet metal processing and metal forming.

The drive system from Beckhoff covers the entire spectrum of requirements in the world of sheet metal processing and metal forming. As a powerful bus system, EtherCAT enables the ideal connection of the Drive Technology to the PC-based control platform. Drives with alternative interfaces can also be used thanks to support of further communication systems such as Ethernet, PROFIBUS, CANopen, DeviceNet, SERCOS interface or Lightbus. The use of EtherCAT as a bus for I/Os and Drive Technology positively affects the total life cycle of a machine: from uniform engineering and simple commissioning to powerful diagnostics in the case of service. The AX5000 Servo Drive systems with the AM8000 servomotors and One Cable Technology make cables and plug connectors at the motor and controller ends superfluous, reducing hardware and commissioning costs.

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

TwinCAT integrates programming, configuration, a real-time environment and all run-time modules necessary for the machine and plant controller: multi-PLC, Motion Control, robotics, measuring technology, Condition Monitoring and safety. Open communication interfaces support integration into existing visualisation, control and database systems. An extensive tool kit of software function blocks and libraries facilitates the creation of even highly complex applications. TwinCAT makes all essential programming languages for real-time applications available in a single development environment: IEC 61131-3, including the object-oriented extensions, C/C++ and Matlab®/Simulink®. Support for multi-core CPUs can lead to a substantial increase in output while at the same time reducing hardware costs; the modularity makes the configuration of the software simpler and error-free. All control modules run in one runtime that can be used on scalable processors, from the ARM to the multi-core CPU.

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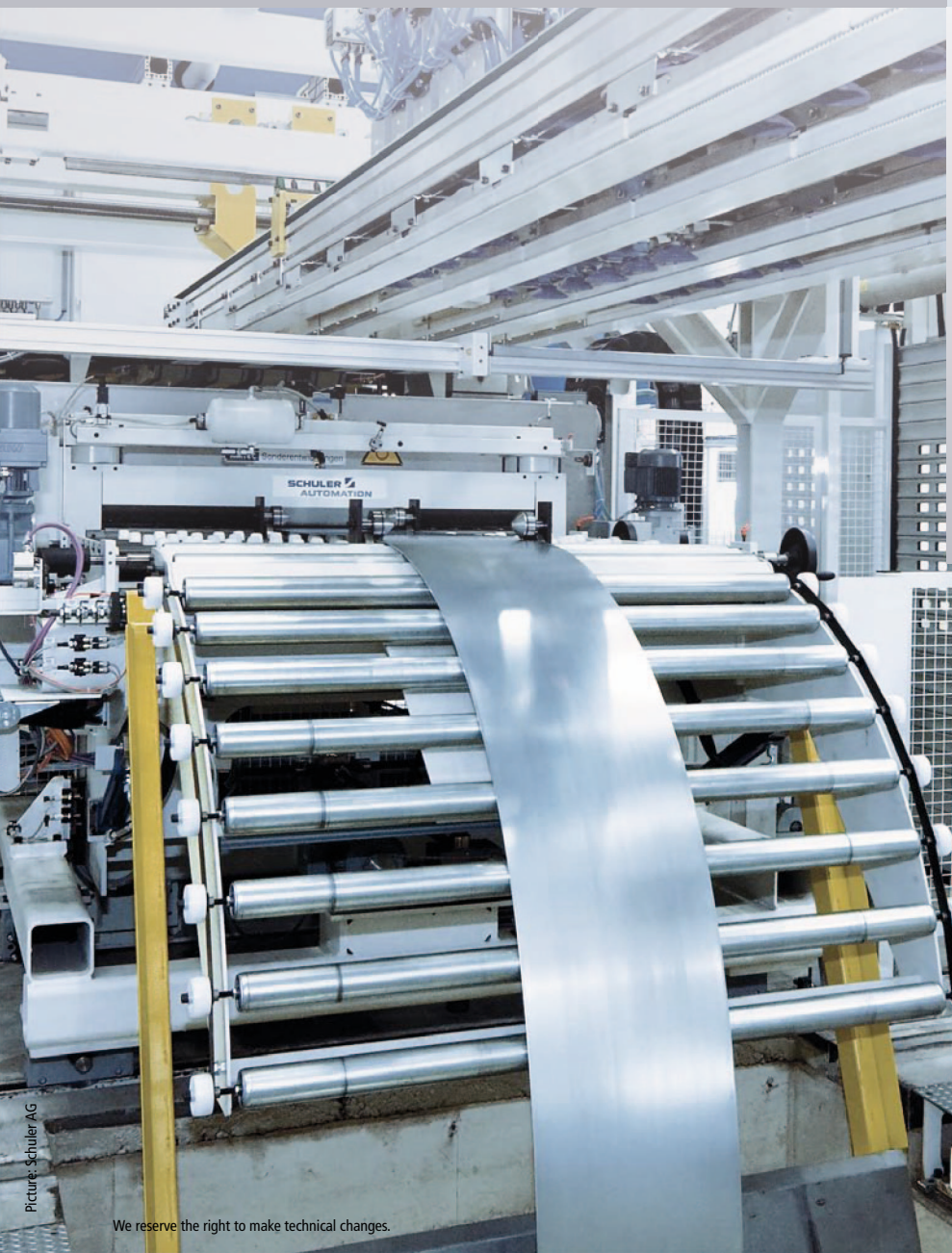
… provides a leap in efficiency even during engineering.

In TwinCAT the machine manufacturer has a universal development environment at their disposal with which all control tasks in sheet metal processing can be solved efficiently and elegantly. Thanks to multi-core support, additional control hardware can be replaced by software, which runs on the centralised IPC. This results in a significant shortening of the development and commissioning time of machines, while also reducing training costs. Extensive TwinCAT libraries with various control algorithms, cam and hydraulic controllers, "flying saw" and "cam plates" are simple to use. In particular, the extensive possibilities to use master and slave axes in almost arbitrary structures solve many of the industry's typical problems in a simple manner. The integration of the TwinCAT engineering in Microsoft Visual Studio® provides the developer with the optimum infrastructure for the generation of reusable software modules. The possibility to use different programming languages such as IEC 61131, C/C++ or Matlab®/Simulink® also offers great flexibility.



Picture: Schuler AG

Hydraulics library

The TwinCAT hydraulics library is the platform for PC-based hydraulic control technology that makes special assemblies things of the past. PLCopen-compliant software blocks for the positioning, control and monitoring of hydraulic drives enable fast implementation in a standardised control architecture. Proven function blocks are available for typical 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 axes.

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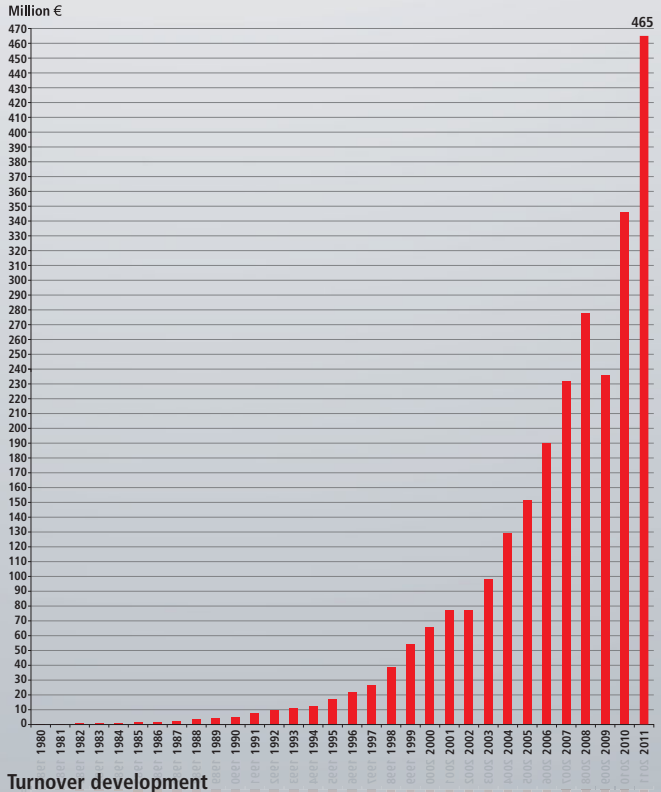
Beckhoff – New Automation Technology

Beckhoff implements open automation systems based on PC Control technology. The product range covers Industrial PCs, I/O and Fieldbus Components, Drive Technology and automation software. Products that can be used as separate components or integrated into a complete and seamless control system are available for all industries. The Beckhoff "New Automation Technology" philosophy represents universal and open control and automation solutions that are used worldwide in a wide variety of different applications, ranging from CNC-controlled machine tools to intelligent building automation.

▶ **www.beckhoff.com**

Beckhoff at a glance

- Headquarters Verl, Germany
- Sales 2011: 465 million €
- Staff worldwide: over 2,100
- Branch Offices Germany: 11
- Subsidiaries/Branch Offices worldwide: 30
- Distributors worldwide: in more than 60 countries (as of 03/2012)



Turnover development

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Worldwide presence on all continents

The central divisions of Beckhoff, such as development, production, administration, distribution, marketing, support and service are located at the Beckhoff Automation GmbH headquarters in Verl, Germany. Rapidly growing presence in the international market is taking place through 30 subsidiaries. Through worldwide co-operation with partners, Beckhoff is represented in more than 60 countries.

Further information

The web pages "PC-based Control for Forming Technology/Sheet Metal Working" offer further information, e. g. application reports or industry-specific solutions.

▶ www.beckhoff.com/forming

The Beckhoff catalogs and flyers are available for download on the Internet.

▶ www.beckhoff.com/media

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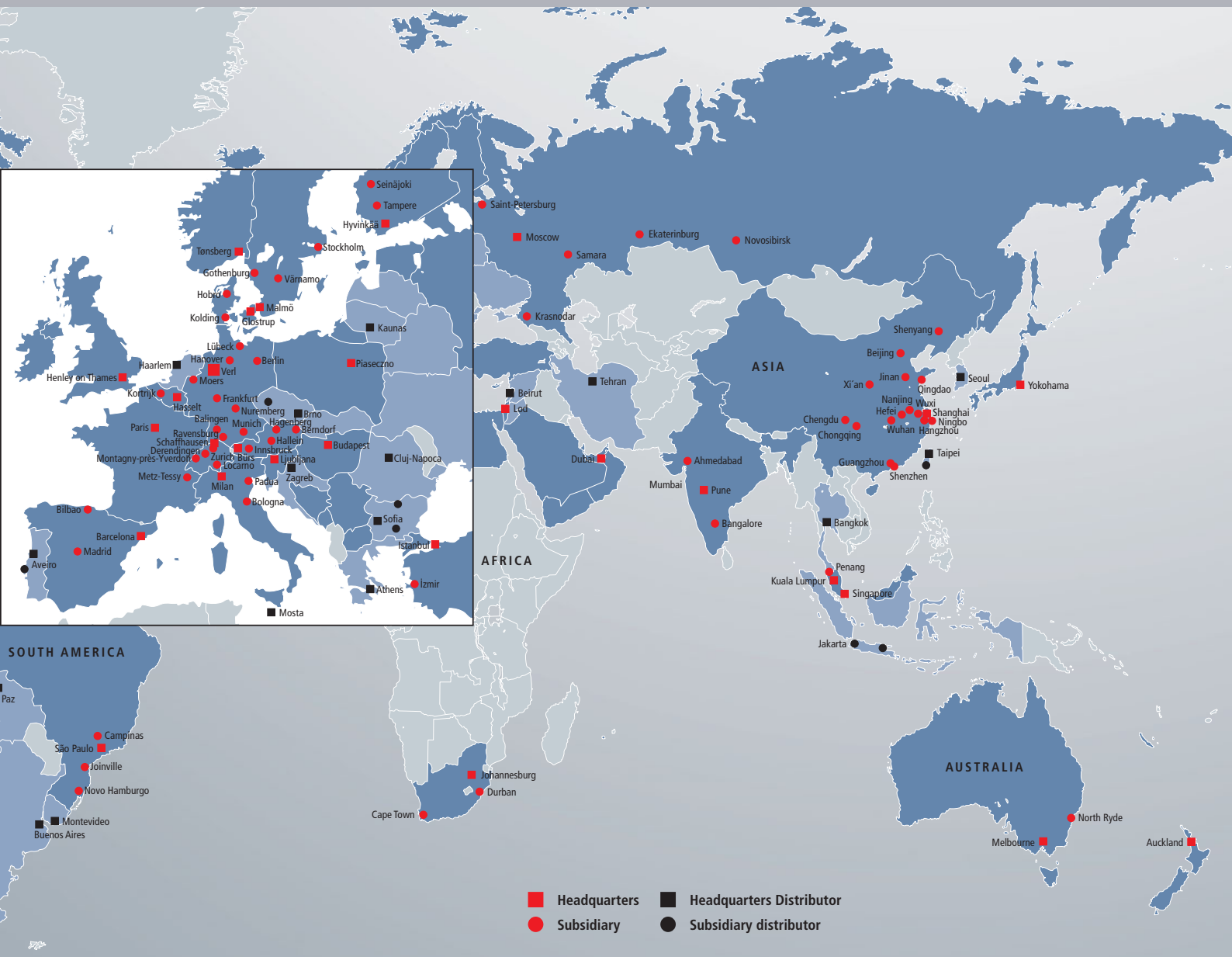

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