

AX5000 Servo Drives integrate
EtherCAT and TwinSAFE technology

Beckhoff Drive Technology for complete systems

→ The Beckhoff rapid new technology development continues unabated. In an interview with Ronald Heinze, chief editor of *openautomation*, managing director Hans Beckhoff talks about current trends, developments and highlights surrounding the SPS/IPC/DRIVES fair in Germany.

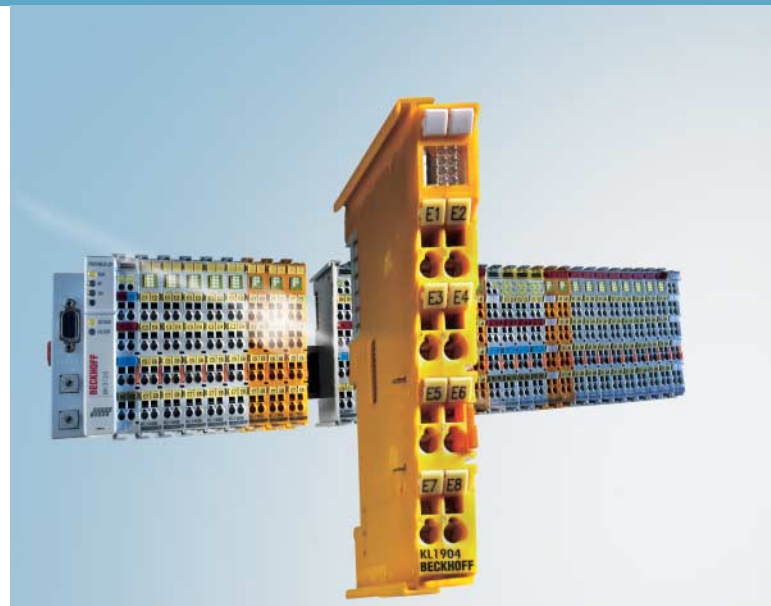
“Factor 10 every 10 years.” – Will Beckhoff meet its growth targets?

“Absolutely, although our target of ‘Factor 10 every 10 years’ is, of course, rather ambitious and brave,” said managing director Hans Beckhoff. “This year our global growth rate will be approximately 16%. Combined with 29% and 31% in 2003 and 2004 respectively, this means that our sales have doubled within three years.” On average, this has been the company’s growth rate over the last 20 years. “From a historical perspective, we can look confidently into the future,” said Hans Beckhoff. “We would obviously be delighted for this rate of development to continue, although we are being realistic to acknowledge that as the company becomes larger, growth figures may appear somewhat lower and ‘more normal’ increases would still represent very positive development.”

In order to achieve these growth targets, Beckhoff continues to expand export activities. In the long run, Beckhoff’s managing director expects a shift in sales ratios over the next few years: “Today, approximately 60% of sales are generated in Germany and about 40% abroad. By 2010 we expect this ratio to be reversed.” In order to hit this target, the company is continuously expanding its international distribution network and continues to establish new Beckhoff subsidiaries in strategically selected countries.

Set for further growth with EtherCAT

EtherCAT also continues its strong growth. The EtherCAT Technology Group (ETG) already has more than 230 members. “The EtherCAT specification has been published by IEC. EtherCAT has been approved as an ISO standard and is being standardized by the IEC as a communication system for both CANopen and IEC-61491 drive profiles,” said Hans Beckhoff, providing a summary of the successes. In addition, more than 100 manufacturers are already working on implementations. “Our company alone has sold more than 100 master and slave implementation kits, one third of which were masters,” said Hans Beckhoff. In addition, new technological developments will be presented at SPS/IPC/DRIVES, including a redundant solution for EtherCAT and Safety over EtherCAT. Safety-related communication, thus becomes part of the EtherCAT communication strategy. This also means that TwinSAFE, a Beckhoff invention, will soon be made available to the EtherCAT community.



The TwinSAFE Bus Terminals enable connection of all common safety sensors and actuators. They can be operated with a PROFIsafe-compatible safety controller or in standalone mode with the KL6904 TwinSAFE Logic Bus Terminal. The PROFIsafe or TwinSAFE protocol is used for safe communication.





Managing director Hans Beckhoff said: "Today, approximately 60% of sales are generated in Germany and about 40% abroad. By 2010, we expect this ratio to be reversed." In order to achieve this target, we are continuously expanding our international distribution network.

Nevertheless, the automotive industry decided to use PROFINET: They state that, for their purposes, the real-time capability of PROFINET RT (PROFINET IO), the flexible structure of PROFINET (line, star...), and unrestricted communication using Ethernet TCP/IP via PROFINET are sufficient. The decision to use PROFINET comes as no surprise to Beckhoff's managing director: "European, American and Japanese car manufacturers have a tradition of standardizing on their existing brands. However – just like in politics – the statements of motor vehicle manufacturers have to be considered fully and within their context. With the AIDA initiative declaration, four major motor vehicle manufacturers decided to use PROFINET IO for networking in body shop systems, provided this system offers technical and economic benefits. As far as we are aware, this rather softly worded recommendation does not apply to other sectors of the automotive industry." Providing examples, Hans Beckhoff mentions technology control systems for machine tools, presses or robotics. "These applications require higher performance than can be achieved with PROFINET IO. This is where technology scores over tradition. These are indeed areas where EtherCAT is readily accepted and used," said the automation expert.

EtherCAT delivers technologically: Numerous topology options offer benefits for system networking. "The EtherCAT ring structure is only mapped technologically in data communication. When it comes to the actual cabling – star, tree, strand and ring structure are all supported," said Hans Beckhoff. "Furthermore, hot connect and disconnect enable very flexible handling of dynamic system structures. One of the pre-eminent features of EtherCAT is that, in parallel with real-time operation, transparency for general IT protocols such as TCP/IP is retained."

Compact EtherCAT ASICs, compact I/O modules

EtherCAT Slave Controllers have been available as FPGA since November 2004 and are used in a wide range of EtherCAT field devices. Hans Beckhoff stresses that FPGA-based solutions are already very competitive from a technical and commercial point of view. After all, the hardware is less expensive than many competitor ASICs. "The first ASIC variant optimized for modular devices left the Beckhoff development division at the end of August and is currently being implemented by an ASIC supplier." According to the managing director, the developers were very keen to include several technical highlights, such as distributed

clocks. "This chip will be available by the end of February 2006," said the managing director. "The next version is expected about four weeks later." Both chips are smaller than the FPGA and have lower current input. In addition, netX chip processors from Hilscher with EtherCAT functionality are becoming available.

Focus on safety

A one-stop provider for automation also has to meet the safety requirements of machine and plant manufacturers. The Beckhoff strategy accepts this challenge: "Safety technology is an integral component of the TwinCAT system," said Hans Beckhoff. "Small and medium applications can be configured via the TwinCAT System Manager and loaded into the KL6904 Logic Terminal. For large safety applications we are developing the safety PLC, which will be freely programmable according to IEC 61131-3."

The benefits of the Beckhoff safety strategy are obvious: The machine uses a single, uniform automation system, without the need for a separate safety control system. "Simplified projecting, realization and maintenance – with all aspects fully integrated," said the managing director. Moreover, all safety-relevant signals can be accessed from the standard control system. According to Hans Beckhoff, all this results in "significant improvements in diagnostic depth and higher system availability."

It goes without saying that EtherCAT also enables safety communication. "The TwinSAFE protocol enables safe communication between safety devices without the aid of the EtherCAT data security layer," said Hans Beckhoff. The system meets the requirements of safety integration level 3 (EN 61508 SIL 3). "The protocol is designed to enable fieldbus-neutral tunnelling across other bus systems such as PROFIBUS or CANopen. Different data lengths and transfer rates are possible. The communication link between two safety devices is referred to as 'EtherCAT safety connection,' consisting of an initiator and a responder. Whether the initiator or the responder is located in an EtherCAT master or slave is irrelevant." This means that any EtherCAT device – master or slave – can establish one or more EtherCAT safety connections with other EtherCAT devices.



Hans Beckhoff comments on the combination of EtherCAT and TwinSAFE:
"The TwinSAFE protocol enables safe communication between safety devices without the need for the EtherCAT data security layer. The protocol is designed to enable fieldbus-neutral tunnelling across other bus systems such as PROFIBUS or CANopen."

The new AX5000 Servo Drives with EtherCAT and optional TwinSAFE technology enable connection of synchronous servo, asynchronous servo and linear motors. The drives in the performance range between 250 W and 10 kW are designed as one- or two-axis modules.

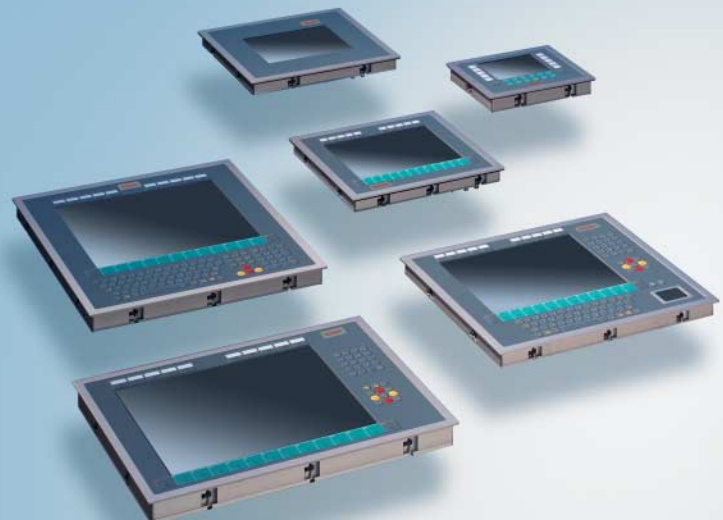
Drives: Simplicity as a basic principle

Motion Control is a central component of the Beckhoff control technology. The company has been offering PC-based software NCs since 1986. "The consistent openness of our control technology enables a wide range of peripheral and drive equipment to be connected," said Hans Beckhoff. For example, the company can create motion controllers based on almost any communication system. In addition to Beckhoff drive components, products from a large number of competitors can be controlled. "This will continue to be the case in future, although the new AX5000 product line will significantly strengthen our own Drive Technology," Hans Beckhoff said.

"The new Beckhoff AX5000 drive with intelligent connection system was developed completely in-house," said the managing director. "This drive will set new price/performance standards." It can be combined with different motor types such as Synchronous Servo, Asynchronous Servo and Linear Servomotors. "Of course, the drives also support EtherCAT communication and enable configuration of decentralized or centralized control architectures," Hans Beckhoff continued. Initially, the drives will cover a capacity range between 250 W and 10 kW. Further upward expansion is envisioned for the future. "Our new drives are optimized for PC-based automation," said the managing director. "We stand by our basic principle: keep it simple. These drives can be commissioned by our customers within a few minutes." Hans Beckhoff expects this development to have significant impact on further growth for the company.



Expansion of the Beckhoff Control Panel series: The new Panel PC series is very compact and offers plenty of CPU performance. Two performance classes are available: Pentium M for Windows XP and embedded operating systems and an ARM-based version for Windows CE applications.



Beckhoff Automation

Beckhoff also offers Compact Drive Technology: In the output range up to 250 W with extra-low voltage (< 48 V DC), this has been realized in the form of servo and stepper motor I/O terminals as part of the Bus Terminal system. According to Beckhoff, these ultra compact and simple-to-use drives will accelerate the trend towards electric Servo Drive Technology in machine construction.

Since safety technology is an integral component of Beckhoff automation technology, it is also integrated in AX5000 Drive Technology. With an optional safety module, the drives offer safety functions such as safe stop, safe restart lock, safely reduced velocity or safe absolute position. "Functions such as safely reduced torque or safe brake control will also become available," Hans Beckhoff continued. "Significant added value can only be achieved with safe and integrated automation including controls, I/O and drives, combined with a 'fieldbus-neutral' safety protocol such as EtherCAT safety."

New generation of computers

At the SPS/IPC/DRIVES fair, Beckhoff will also present new PCs: "The new CP series, short for Control Panel PCs, is extremely compact and is set to establish itself as an ideal machine control platform," said Hans Beckhoff. "These computers with high-density motherboards behind the panels will reflect a new level of price/service value. These EtherCAT-optimized PCs help demonstrate how EtherCAT will drive the future of automation," Beckhoff said. Two performance classes will be available: Pentium M for Windows XP, and embedded operating systems and an ARM-based version for pure Windows CE applications. Pure monitor versions are also available in the same housing type. The tried and tested aluminum version enables straightforward, application-specific adaptation of the operating panel based on a range of basic housing designs: Displays are available in sizes between 6.5" and 20", for example.

Beckhoff's rapid growth requires continuous development of the company infrastructure.

"Our company keeps repositioning itself with new departments and divisions," said managing director Hans Beckhoff. "At present, we are in the process of detaching the business areas of electrical installation and specialized trade as independent companies."

Elektro Beckhoff GmbH will be renamed Beckhoff Automation GmbH. The new company will continue all activities of the existing industrial electronics division. The electrical installation division will take on the traditional name of Elektro Beckhoff GmbH. Trade activities will be consolidated in a new company called Beckhoff Technik und Design GmbH. The successful family network will continue.

All Beckhoff Group companies are owned by the Beckhoff family: the three brothers Hans Beckhoff, Arno Beckhoff, Michael Beckhoff and their sister Marlies Hillen. All four also act as managing directors for the individual companies.