

Openness reduces implementation effort and costs

# Motion Control for packaging machines

→ In the run-up to Interpack 2008, Kai Binder – chief editor of “SPS-Magazin” – talked to Beckhoff packaging experts Frank Würthner, Dr. Josef Popenfort and Dr. Wilfried Plaß about the potential for innovative PC-based automation technology in the packaging machine industry.



Kai Binder, chief editor of  
“SPS-Magazin”



**What made Beckhoff decide to have a presence at Interpack for the first time this year?**

**Frank Würthner:** A wide range of existing applications in the packaging industry indicate that automation technology from Beckhoff can significantly enhance the productivity and flexibility of packaging machines. PC-based control technology can control and monitor the complete process chain for individual packaging machines and complete packaging lines. All processes, from filling, forming, sealing, labeling, collecting and re-packing to palleting, can be controlled throughout with our Industrial PCs and TwinCAT automation software.

At Interpack, Beckhoff will demonstrate the potential of PC-based control technology for the packaging industry. The company will present itself to end customers as a leading edge and well-established supplier of complete control solutions that meet the challenges of this high growth market.

**What are the most urgent issues facing the packaging industry with regard to automation technology?**

**Frank Würthner:** The packaging machines of tomorrow should be flexible, productive and space-saving. They should keep products safe, fresh and hygienic, while at the same time meeting design criteria. This requires a wide range of packaging shapes, styles and materials, and in some cases even for the same product. In the future, packaging machines will have to become increasingly flexible and productive in order to be successful in the market. Another important issue for the packaging industry is traceability and, accordingly, consistent documentation of all process data. Open, PC-based control technology from Beckhoff, which supports convenient connection to databases and ERP systems, represents a comprehensive response to these requirements.



Frank Würthner, Beckhoff Market Manager, Packaging Industry



Dr. Josef Papenfort, Beckhoff Product Manager, TwinCAT



Dr. Wilfried Plaß, Beckhoff Software Development, Motion Control



Die Servoverstärker-Baureihe AX5000 ist für ein Optimum an Funktion und Wirtschaftlichkeit ausgelegt.

### What role does automation technology play for the development of packaging machines?

**Frank Würthner:** Advanced automation technology drives technological progress in packaging machines and significantly improves their competitiveness. The ultra-fast XFC (eXtreme Fast Control) technology from Beckhoff, for example, increases the output and, therefore, productivity of packaging machines. The automation components also benefit from compact and simple connections, which reduce space requirements and installation effort.

### Which control concepts are successful in this sector?

**Frank Würthner:** Central control technology offers substantial benefits compared with a decentralized approach. The fact that all programs and process data are available in a central CPU simplifies the engineering process and reduces commissioning and maintenance costs. A prerequisite

for a central approach is a high-performance fieldbus for I/O and Motion Control, such as EtherCAT. Naturally Beckhoff components can also be used for a distributed, decentralized approach. The trend to replace mechanical gearing and cam plates with electronic solutions leads to an increase in the number of servomotors in conjunction with digital servo drives. They are highly suitable for positioning tasks with particularly high demands in terms of dynamics and stability. Beckhoff recommends its AX5000 series Servo Drives. In view of the steadily rising number of servo motors in a machine, a central Motion Control solution with synchronization of all axes has clear advantages.

### What does "open automation system" actually mean and why is it important?

**Dr. Josef Papenfort:** In automation technology, "openness" refers to software and hardware interfaces. At the core is the open, scalable TwinCAT automation software from Beckhoff. It is a pure software PLC and Motion Control solution for PCs. PLC programming is based on the international IEC 61131-3 standard. Open communication interfaces support integration into existing visualization, control and database systems. Through the open interfaces and the different abstraction levels of the TwinCAT system, applications will run with almost any fieldbus, I/O components and drive technology from different manufacturers without further adaptation. The openness of the TwinCAT system supports machine manufacturers in their efforts to adapt their systems to varying requirements, without excessive implementation costs and time.

### Which components does Beckhoff offer for packaging machine manufacturers?

**Frank Würthner:** For the packaging machine sector the Beckhoff product range offers compact, high-performance IPCs with motherboards especially designed for industrial applications, Embedded PCs, a wide range of electronic I/O terminals, versatile Servo Drive Technology, cost-effective Stepper Motor technology, the high-speed EtherCAT fieldbus, TwinCAT automation software, and special panels. From these integrated, scalable,



and modular control components, the optimal solution can be configured for any task with regard to computing power, complexity and costs.

#### What does the Beckhoff PLC and Motion Control solution look like in practice?

**Dr. Wilfried Plaß:** TwinCAT integrates PLC and Motion Control functionalities. PLC libraries with function blocks based on the PLCopen Motion Control and the OMAC PackSoft standard (PackAL) facilitate programming. Standards such as the OMAC Packaging Guidelines offer a consistent interface for packaging machines worldwide. OMAC (Open Modular Architecture Controls) is a North American user association for the definition of open automation architectures. The TcPackAL PLC library offers software modules for different packaging tasks. TwinCAT ScopeView supports commissioning.

#### Can Beckhoff meet the special Motion Control requirements of a packaging machine such as format-dependent cam plates and online modification of cam plates?

**Dr. Wilfried Plaß:** The Motion Control functionality of TwinCAT satisfies these requirements with PLCopen-compliant function blocks. Cam plates can not only be controlled as point values with spline interpolation, but also section by section based on motion laws directly from the TwinCAT NC platform. Online modification is possible through changes in individual segment points, for example. These are executed in the next cycle or from an activation position. Complete cam plates can be exchanged for creating typical start, operating and stop curves. The "flying saw" can be used for synchronization of a slave (which may be in motion) with a master. The powerful TwinCAT CAM Design Tool is available for configuring the cam plates (according to VDI Guideline 2143).

#### EtherCAT is characterized by particularly fast communication. How does this benefit machine manufacturers and operators?

**Frank Würthner:** EtherCAT, the real-time capable Ethernet fieldbus with leading performance, flexible topology and particularly simple handling, is ideal for packaging machine applications. The fast communication between the I/O signals and the controller, with update and response times that are at least 10 times faster compared with the conventional field-

buses, offers machine manufacturers unimagined possibilities based on Motion Control with a large number of synchronized axes and reproducible accuracy in the nanosecond range. The redundancy enshrined in the EtherCAT fieldbus system offers added safety in the event of broken wires. Simple and reliable connection technology can significantly reduce the cabling effort costs. EtherCAT offers full Ethernet compatibility, maximum utilization of the Ethernet bandwidth, and outstanding real-time characteristics at a low cost. Legacy devices can easily be integrated through gateways to conventional fieldbuses such as PROFIBUS or CAN. This ensures compatibility and continuity with "traditional" systems. In addition, EtherCAT technology is characterized by a high degree of openness: The EtherCAT Technology Group (ETG) currently has more than 680 members. As a result, more and more devices from different manufacturers worldwide are available with EtherCAT interfaces.

#### Customers increasingly expect their automation suppliers to offer seamless integration of drive and control technology. How does Beckhoff meet these requirements?

**Dr. Josef Papenfort:** Beckhoff uses different approaches for this purpose: On the one hand, TwinCAT has always combined PLC, Motion Control design and run-time in a single software. On the other hand, EtherCAT as a fast fieldbus guarantees deterministic exchange of data both with I/Os and drives.

With XFC, the combination of a high-performance CPU, the PC; software such as TwinCAT; a high-performance fieldbus such as EtherCAT, and fast I/Os such as the XFC terminals, any programmer is able to realize very fast and highly precise control solutions for packaging machines simply and elegantly based on standard components. In addition, the AX5000 Servo Drive series offers maximum performance and dynamics. The AX5000 series is available in single- or multi-channel form and is optimized in terms of function and cost-effectiveness. The integrated, fast control technology with a current control cycle of up to 31.25 µs supports highly dynamic positioning tasks. EtherCAT as a high-performance communication system enables ideal interfacing with the central controller.