

# Expanded AX5000 drives complement overall system

→ In combination with the TwinCAT Motion Control software, Beckhoff Drive Technology represents an advanced and complete drive system. In addition to high-performance AX5000 EtherCAT drives, Beckhoff offers a complete integrated and coordinated system consisting of Servo Drives; Servo, Linear and Stepper Motors; gears; cable sets and accessories, complemented by customized support for drive configuration and commissioning.

In an interview with PC Control, Andreas Golf, Beckhoff Product Manager for Drive Technology, provides an overview of the current status and motion-related innovations.

## PC Control: What characterizes an advanced servo drive? What are the key features of the AX5000?

**Andreas Golf:** Compact single- and two-channel modules enable very efficient cabinet mounting. Since control cabinets are becoming smaller and smaller, the current/volume ratio is a crucial parameter. In the design of the AX5000 Servo Drive series, we took this into account by integrating additional components such as mains filters, ballast resistors or mains chokes in the device.

The devices must be suitable for application worldwide and cover a wide range of voltage specifications. The AX5000 meets this requirement: The basic unit can be operated with mains voltages between 1 x 100 V AC -10 % and 3 x 480 V AC +10 %.

The AX5000 benefits from optimal control quality and dynamic control characteristics. It has a very small current controller cycle time of 31.25 µs, which enables trouble-free operation of low-induction motors or ironless linear motors.

The AX5000 offers the maximum resolution even with poor matching of motor and controller current. Since the current controller always operates in the optimal resolution range, a 6 A controller can operate a 1 A motor, for example.

Short commissioning times and simple handling during service are crucial today. In view of the worldwide deployment of their machines, users cannot always be sure that qualified personnel are available locally. In conjunction with TwinCAT, the AX5000 takes pressure off commissioning staff through central parameter management. Parameterization does not require a variety of tools. Default motor value sets or – even more convenient – electronic name plates reduce the machine setup effort to a minimum. After replacement of hardware components, data are automatically downloaded to the drive so that the machine is immediately ready for use again.

## PC Control: The AX5000 was developed specifically for PC-based control technology. Which tasks does TwinCAT handle? Which does the drive handle?

**Andreas Golf:** The development objectives for the AX5000 included size reduction to a minimum without loss of convenience and control quality, and removal of needless, costly intelligence from the drive in order to make the device as uncomplicated as possible. This helps the user through greater transparency. Users don't have to worry about issues such as "What do I have to do next in the drive?" or "How should I prioritize the control system?" Everything is simply programmed centrally in TwinCAT. Drive tasks are limited to current and speed control and position interpolation. The profile computer is always at the top in the control system, where the parameters of the other drives are also managed.

The user doesn't have to pay for complex intelligence in the drive, a significant factor in applications with many axes. Such a system configuration has only become possible with EtherCAT as the communication backbone between the drive and control system. Complicated internode communication between the axes is no longer required; even highly complex cam plates or multi-axis path interpolation is solved centrally.

## PC Control: One advantage of the AX5000 series is the versatile multi-feedback interface. Which feedback systems are supported and which servomotors does Beckhoff offer in combination with the AX5000?

**Andreas Golf:** These days a servo drive must be able to handle all established feedback systems. The AX5000 supports BISS, EnDAT, Hiperface and resolver systems as standard. This is part of our multi-feedback and multi-motor concept and also applies to the AX5000. It is able to operate synchronous and asynchronous motors with and without feedback, iron core and ironless linear motors, and direct torque motors. The Beckhoff motor range includes three product lines: As rotational options, we offer the tried and tested AM2000 motors, the dynamic, pole-wound motors of the AM3000 series, and the pole-wound AM3500 high-inertia motors. Each range has different features for specific application areas: The AM2000 is recommended for standard applications, the AM3000 for highly dynamic applications, and the AM3500 as a "workhorse" with high inherent inertia



Andreas Golf,  
Beckhoff Product Manager  
for Drive Technology



for optimal mass adaptation. Our linear iron core motors are available in three different widths covering the range between 120 N and 6750 N. The ironless linear motors AL3800 are mainly used in the semiconductor industry and panel production. Due to the lack of cogging, users can achieve maximum positioning accuracy and synchronism.

**PC Control: With EtherCAT as system bus, the drives have access to a fast communication system. In what way does the overall motion system benefit from this?**

**Andreas Golf:** In the past, the serial fieldbus used to be the bottleneck of the overall system. As a result, more and more intelligence was shifted into the drives, thereby making the system significantly more expensive and complex – particularly for multi-axis applications. Through the introduction of EtherCAT, it is now possible to deal with all tasks, including current control, in the control system. The drive can be assigned set values very quickly, which greatly simplifies the system configuration. Many scalings become redundant, resulting furthermore in reduced computing power requirements in the drive. Even highly complex applications can be simplified significantly through central data and parameter management.

**PC Control: With the new product lines for 18 A and 25 A, the Servo Drive range was expanded further. What further developments are to be expected?**

**Andreas Golf:** With the AX5118 and AX5125 series, the AX5000 family already covers the majority of our applications, although some applications require even higher performance, which is why we are expanding the AX5000 series further with the development of controllers with current levels up to 100 A for the high end of the spectrum.

**PC Control: How is the AX5000 commissioned?**

**Andreas Golf:** The development objective for the AX5000 was fast, straightforward commissioning in order to minimize setup times for the customer. Today the required commissioning time is increasingly considered in conjunction with the device price. What use is a good, cost-effective device if commissioning takes twice as long? A matched system offers

the optimal solution. Our central data and parameter management was a major step forward; default value parameters, the electronic motor name plate and soon-to-be-introduced auto-tuning make commissioning even simpler.

**The AX5000 drive is optionally available with integrated safety functions. Which functions are supported?**

**Andreas Golf:** The restart lock of the AX5801 prevents unintentional restart of the motor according to category 3 of EN954-1. We are currently in the process of developing extended functionality that will cover safely reduced speed, safely reduced torque, safe direction of rotation and brake management – all expected to be available towards the end of 2008.

**PC Control: Electrical drive technology offers tremendous savings potential in terms of energy efficiency. How does the AX5000 contribute to energy efficiency?**

**Andreas Golf:** The individual devices offer significantly higher DC-Link capacity than usual. This means that far more energy can be stored loss-free in the condenser, which is then available for subsequent acceleration processes. In addition, all DC-Link devices can be connected, resulting in further savings potential.

A further device currently under development is a capacitor module that offers additional capacities that can simply be integrated between existing devices in order to be able to store even more energy loss-free. Furthermore, this enables to supply the drives and/or the PC with 24 V DC control voltage, which offers UPS functionality in the event of a current interruption.

As an alternative to energy exchange and buffering within the DC-Link, we will soon offer regenerative power supply units which will feed back excess energy from the DC-Link to the mains. Current regeneration is advantageous if larger loads are decelerated regularly. For smaller loads the DC-Link solution is more cost-effective.