BECKHOFF New Automation Technology

Ultra-compact: The versatile AX8000 multi-axis servo system

The AX8000 system completes the highly scalable Beckhoff Drive Technology portfolio

As a provider of scalable drive technology, Beckhoff offers a comprehensive hardware and software portfolio for all requirements, price ranges and areas of application: In addition to the comprehensive motion control solutions offered in TwinCAT automation software and a scalable motor series, a wide range of drives is

Compact Drive Technology

- Solutions up to 16 A directly within the standard I/O system
- Connection of stepper, servo, DC or AC motors
- IP 20 and IP 67-rated connection options
- Matching motors, gear units and pre-assembled cables
- Powerful, compact connections in EtherCAT Terminal and EtherCAT Box formats
- Especially compact in combination with One Cable Technology

AX8000 | Multi-axis servo system

- Modular servo drive system
- Power supply modules: 20 A DC, 40 A DC
- Combined power supply and axis modules: 80 A, 1 x 25 A, 1 x 40 A
- Single-axis modules: 1 x 8 A, 1 x 18 A
- Dual-axis module: 2 x 6 A
- Simple commissioning and installation
- Exceptionally compact footprint for multi-axis systems
- Spindle converter for machine tools
- Multi-feedback interface

AX5000 | Digital Compact Servo Drives

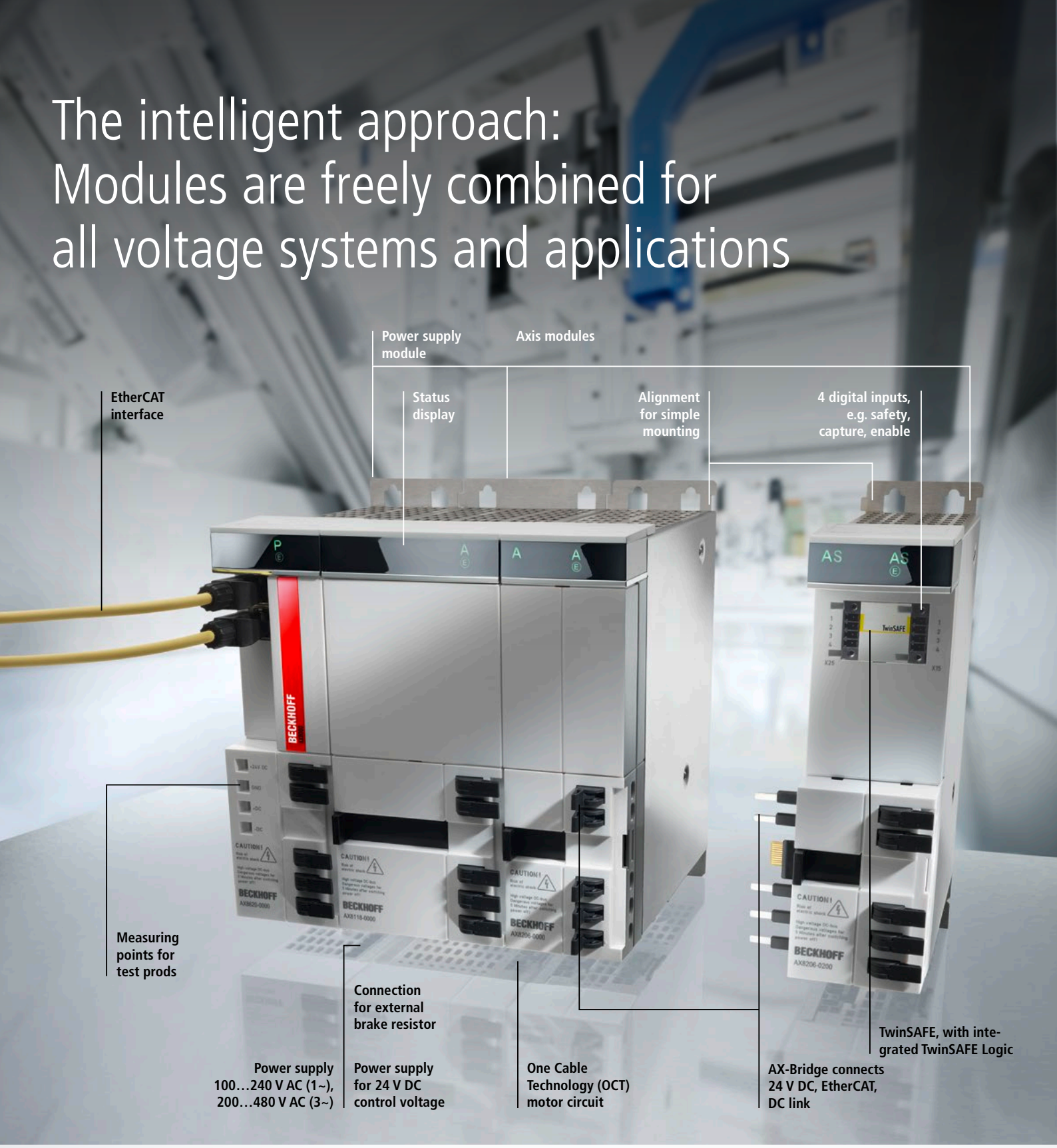
- Single-axis servo drives: 1.5 A up to 170 A
- Dual-axis servo drives: 2 x 1.5 A, 2 x 3 A, 2 x 6 A
- Support for third-party motors and various encoder systems
- Optimized functionality and impressive price-to-performance ratio

also available, from compact drive technology implemented directly at the I/O level, to the versatile AX5000 Servo Drive. The ultra-compact AX8000 servo system enhances the range: As a modular, multi-axis servo system, the AX8000 delivers high-performance drive technology with optimized space utilization for every control cabinet, offering precisely-scaled solutions for all motion tasks.

Highly scalable Beckhoff Drive Technology

- Drive solutions with an ideal price-to-performance ratio
- Modular AX8000 multi-axis servo system completes the drive controller portfolio.
- Scalable motor series
- Comprehensive motion control functionalities

The intelligent approach: Modules are freely combined for all voltage systems and applications



With the AX8000 multi-axis servo system, you benefit from maximum flexibility: Power supply, axis modules and other optional modules can be combined as needed for all areas of application. All requirements are covered – without the need for further components or any hidden costs. The power supply module features an integrated mains filter, as well as an internal brake resistor and a brake chopper. Two power supply modules with 20 or 40 A DC supply the connected axis modules with energy. Two combined power supply and axis modules with 80 A DC as well as a first new integrated axis module with 25 A or 40 A expand the portfolio in the higher output range. The single-axis modules are available in 60 mm width for motor currents up to 8 A. Automatic adaptation to the connected motor is assured by the special Beckhoff motor current measurement technology: This is the prerequisite for the ability to cover the whole range from 1 A to

AX8620-0000

AX8640-0000

AX86xx | Supply modules

AX8620 | Supply modules 20 A
- 100…240 V AC (1~), 7 A DC
- 200…480 V AC (3~), 20 A DC

AX8640 | Power supply modules 40 A
- 200…480 V AC (3~), 40 A DC

AX8525/AX8540

AX85xx | Combined power supply and axis modules
- 200…480 V AC (3~), 80 A DC

Integrated axis modules
- AX8525: 1 x 25 A
- AX8540: 1 x 40 A

AX8108

AX8118

AX8206

AX81xx, AX82xx | Singe- and dual-axis modules
- AX8108: 1 x 8 A
- AX8118: 1 x 18 A
- AX8206: 2 x 6 A

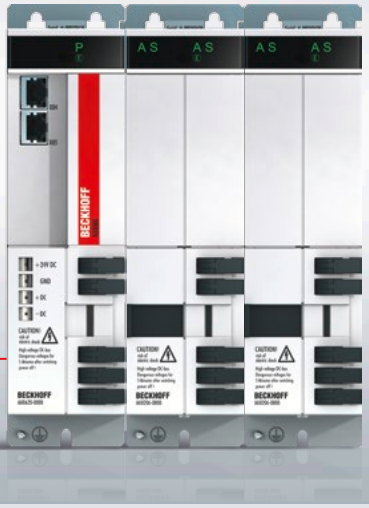
AX8810 | Capacitor module

AX881x | Option modules
- AX8810: capacitor/DC link expansion

8 A motor current with a single module. The same principle applies to the 90 mm-wide 18 A modules. The 60 mm wide dual-axis module with 2 x 6 A rated current particularly excels at saving space: The total current can be used flexibly, so that a 3 A motor can be operated at one channel and an 8 A motor on the other, for example. This leads to enhanced flexibility within the drive system.

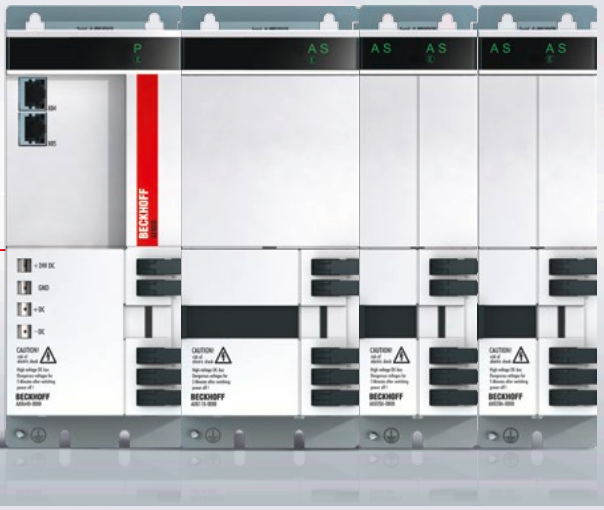
The AX8000 principle of modularity
- Increased flexibility
- Application-specific configuration
- Significantly reduced system size
- Toolless connection system
- Available for all voltages worldwide

Compact design brings any multi-axis configuration required into any control cabinet: AX8000



4-axis configuration

- Power supply module 10.7 kW
- 2 dual-axis modules
  - For connecting four 6 A motors
- 180 mm overall width



5-axis configuration

- Power supply module 21.4 kW
- 1 single-axis module 18 A
- 2 dual-axis modules, 4 x 6 A
- 300 mm overall width

6-axis CNC configuration

- Overall power supply of 42.8 kW
- Combined power supply and axis module 1 x 40 A as a spindle converter
- Single-axis module 1 x 18 A for x-axis
- Dual-axis module 2 x 6 A for y-axis and z-axis
- Dual-axis module 2 x 6 A for a-axis and c-axis
- Overall width of 570 mm

The AX8000 from Beckhoff is the future-ready response to current developments and trends in machine design: External control cabinets are increasingly replaced by machine-integrated solutions, which inevitably means that less space is available for the installation. With a depth of just 192 mm, the AX8000 servo system is ideal for such compact machine control cabinets. In order to make the handling of the control cabinet especially user-friendly during machine commissioning and installation, the connection technology of the AX8000 was completely revised and designed for tool-free assembly.

Space-saving installation in control cabinets

- Many different numbers of axes possible
- Maximum freedom in system design
- Direct installation on the machine
- Reduced installation time and costs

Fail-safe and fast installation: with One Cable Technology and AX-Bridge

Just as compelling as the compact design is the toolless, fast and simple installation of the AX8000 via the directly integrated AX-Bridge. A sliding mechanism links DC link, PE, EtherCAT and 24 V DC control voltage between the modules quickly and reliably by simply moving and latching the spring-loaded connection. One easy slide of

1 AX-Bridge quick connection system

- Fail-safe axis connections
- Simple connection of 24 V DC, DC link and EtherCAT
- Efficient and precise installation
- Fast, safe and screwless plug connection

2 OCT – One Cable Technology

- Reduced costs
- Reduced installation time
- Reduced space requirements

3 Bayonet connector for quick installation

- Fast and simple connection technology
- OCT encoder for standard and TwinSAFE applications

the AX-Bridge simplifies otherwise demanding installation situations in small control cabinets, such as those that are embedded in the machine base. The AX8000 uses a revised version of the tried and tested One Cable Technology (OCT) from Beckhoff: An optimized plug connector latches automatically to establish a secure connection that can be easily released again as required. At the same time, the plug connector secures the shield without an additional screw connection. On the motor side, OCT also provides a compelling solution with a sophisticated connection: the easy to handle, safe bayonet fitting for quick installation.

The AX8000 connection technology

- Directly integrated AX-Bridge for fast, toolless installation
- Fast, simple connections: AX-Bridge, bayonet fitting and space-saving One Cable Technology

Built-in safety: TwinSAFE with 17 drive-integrated safety functions

- Safety over EtherCAT (FSoE), compliant with IEC 61784-3-12
- Drive-integrated safety functions, compliant with IEC 61800-5-2 and ETG.6100 safety drive profile
- TwinSAFE Logic integrated
- Activation of safety functions via FSoE or digital inputs
- All drive-integrated safety functions comply with EN ISO 13849-1:2008 (Cat. 4 PL e) and IEC 61508:2010 Safety Integrity Level SIL 3.

The higher the performance level of a drive solution, the more critical the issue of safety becomes: Key risks for machine operators can potentially arise from the dynamics of any electronic drive technology. With the drive-integrated safety functions of the AX8000, industry and legal requirements can easily be taken into account early on in the design phase of the machine. With TwinSAFE, Beckhoff offers a reliable solution, which enables users to implement 17 integrated stop, velocity, position, acceleration, direction of rotation and brake safety functions with Performance Level e.

High performance: with fast current and position controller

- Fast current and position controller
- High-performance FPGA/ARM processor technology
- FPGA-based control algorithms
- Multi-channel current control technology
  - Sampling and response time 1 µs
  - Current controller cycle time 31.25 µs
  - Speed controller cycle time 62.5 µs
  - Position controller cycle time 62.5 µs
  - EtherCAT cycle time 62.5 µs minimum
- High-performance analysis tools

The AX8000 enables smoother motion control through increased sampling rates and, therefore, an optimized product quality. The current measurement takes place within 1 µs in an FPGA; the system is able to respond to changes virtually in real-time. Device protection for drives and motors is also assured in this way: If, for example, the motor encounters an obstruction, the drive will limit the current to the rated value within 1 µs. This prevents overload of motor and drive. Other valuable features include the high-performance analysis tools offered by TwinCAT: the TwinCAT 3 Motion Designer design tool, the TwinCAT 3 Drive Manager configuration tool, the TwinCAT 3 Scope software oscilloscope and the TwinCAT 3 Bode Plot Base tuning tool.

The flexible approach: freely-combined modules for all voltage systems and applications

DESIGN AWARD 2016

AX8000 | Multi-axis servo system

The AX8000 multi-axis servo system greatly simplifies the implementation of multi-channel drive solutions. The required number of single- or dual-axis modules are attached to the central supply module. The modules are connected without screws or tools using the built-in AX-Bridge quick connection system, which is based on spring-loaded terminals.

The functional system with the minimalist, high-quality appearance won the iF Design Award 2016.

Technical data	AX8000
Bus system	EtherCAT
Drive profile	CiA402 according to IEC 61800-7-201 (CoE)
Rated supply voltage	100…480 V AC, 50/60Hz
DC link voltage	140…848 V DC
Current control	1 µs update time, min. 31.25 µs cycle time
Design form	modular system with 60 mm, 90 mm or 360 mm wide elements
Protection rating	IP 20
Operating temperature	0…+55 °C (see documentation)
Approvals	CE, cULus

AX8620, AX8640 | Power supply modules AX8525, AX8540 | Combined power supply and axis modules

A power supply module generates the DC link voltage for the supply of the axis modules and the option modules from the mains voltage. It already contains a mains filter, for which the drive is tested and certified in accordance with EN 61800-3 for Category C3 use. Any regenerative energy produced, e.g. through strong braking of the motors, can be converted into heat either via the internal brake resistor or via the combination of built-in brake chopper and external brake resistor. Alternatively, the energy can be buffered in the AX8810 capacitor module.

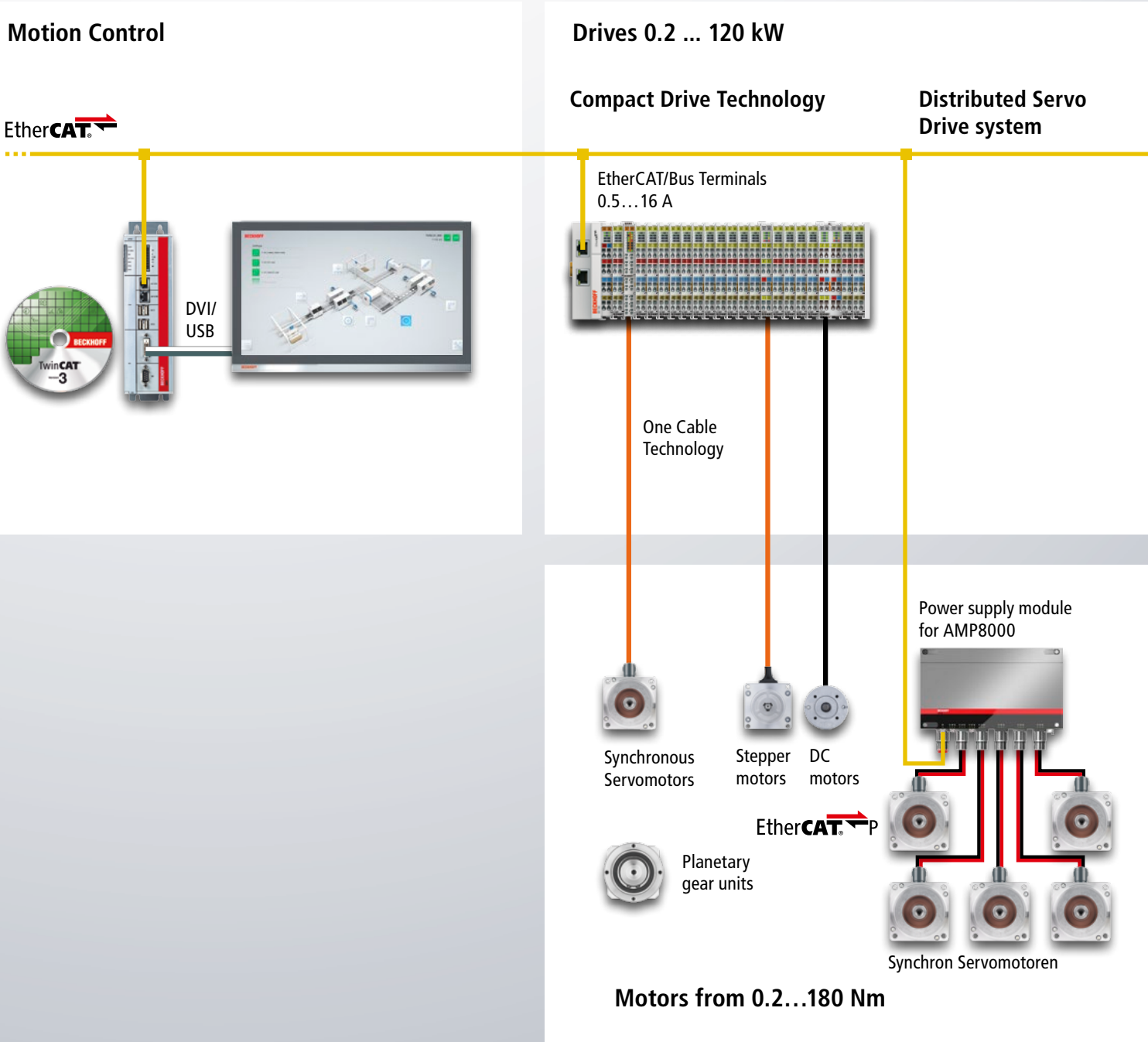
Technical data	AX8620-0000	AX8640-0000	AX8525-0000	AX8540-0000
Rated supply voltage	1 x 100…240 V AC 3 x 200…480 V AC	3 x 200…480 V AC	3 x 200…480 V AC	3 x 200…480 V AC
Rated input current at 40 °C	1~: 10 A | 3~: 17.5 A	3~: 35 A	3~: 70 A	3~: 70 A
Rated output current	1~: 7 A DC | 3~: 20 A DC	3~: 40 A DC	3~: 80 A DC	3~: 80 A DC
Rated output	1~: 2 kW | 3~: 10.7 kW	3~: 21.4 kW	3~: 42.8 kW	3~: 42.8 kW
DC link voltage	max. 848 V DC			
DC link capacitance	405 µF	625 µF	1520 µF	1520 µF
Integrated axis module			1 x 25 A	1 x 40 A
Further information	www.beckhoff.com/AX8620	www.beckhoff.com/AX8640	www.beckhoff.com/AX8525	www.beckhoff.com/AX8540

AX81xx, AX82xx | Axis modules

An axis module contains the DC link and the inverter for supplying the motor. Depending on the required number of axes, the axis modules are attached to the supply module to form the multi-axis servo system. Axis modules with different ratings can be combined in order to enable an optimized design of the individual axes. Supporting a wide supply voltage range from 140 to 848 V DC, the axis modules can be operated without limitation with any of the supply modules. The electrical connection is established without tools via the already integrated AX-Bridge.

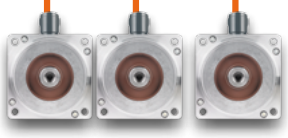
Technical data	AX8108-0000	AX8118-0000	AX8206-0000
Number of channels	1	1	2
Rated current	1 x 8 A	1 x 18 A	2 x 6 A
DC link voltage	max. 875 V DC		
DC link capacitance	135 µF	405 µF	135 µF
Minimum rated channel current at full current resolution	1 A	5 A	1 A
Peak output current	20 A	40 A	20 A | 20 A
Further information	www.beckhoff.com/AX81xx	www.beckhoff.com/AX81xx	www.beckhoff.com/AX82xx

In detail: Drive Technology and Motion Control from Beckhoff



Multi-axis servo drives

AX8000 Multi-axis servo system 1.0…40 A



Synchronous Servomotors

Planetary gear units

Single-/Multi-axis servo drives

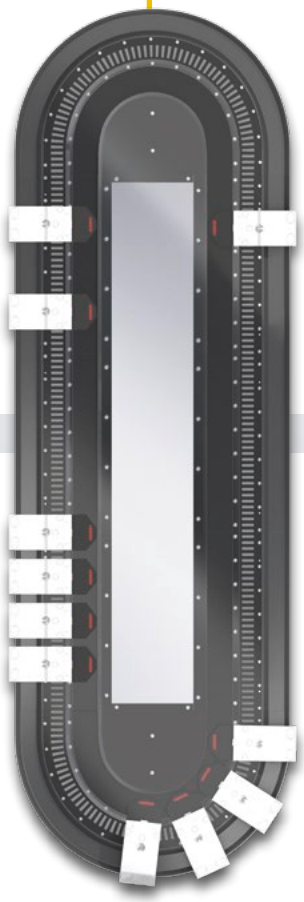
AX5000 Compact Servo Drives 1.5…170 A

Synchronous Servomotors

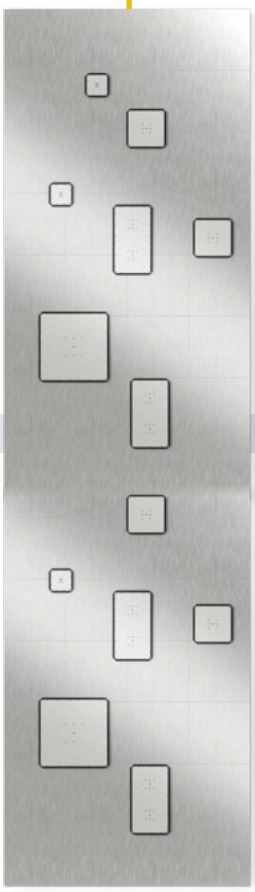
Planetary gear units

Linear motors

XTS | Linear transport system



XPlanar | Planar motor system



XPlanar®

In combination with the motion control solutions offered in TwinCAT automation software, Beckhoff Drive Technology offers complete drive systems, covering all single- and multi-axis positioning tasks with highly dynamic requirements. This is based on the maximized scalability of the drive technology, ranging from compact drives in the I/O system up to the AX8000 and the AX5000 Servo Drives, along with the wide range of TwinCAT functionalities. TwinCAT serves as the engineering platform as well as the runtime for all functions, including NC PTP, NC I, CNC, robotics, cam plates, "flying saw" or camshafts.

- Fully scalable motion control systems
- Integrated safety up to Performance Level PL e
- High-performance system communication via EtherCAT
- One Cable Technology for reduced hardware and commissioning costs
- Flexible transport systems XTS and XPlanar

DK3402-0621

The versatile multi-axis servo system:
AX8000. Detailed information is available at:

▸ **www.beckhoff.com/AX8000**

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